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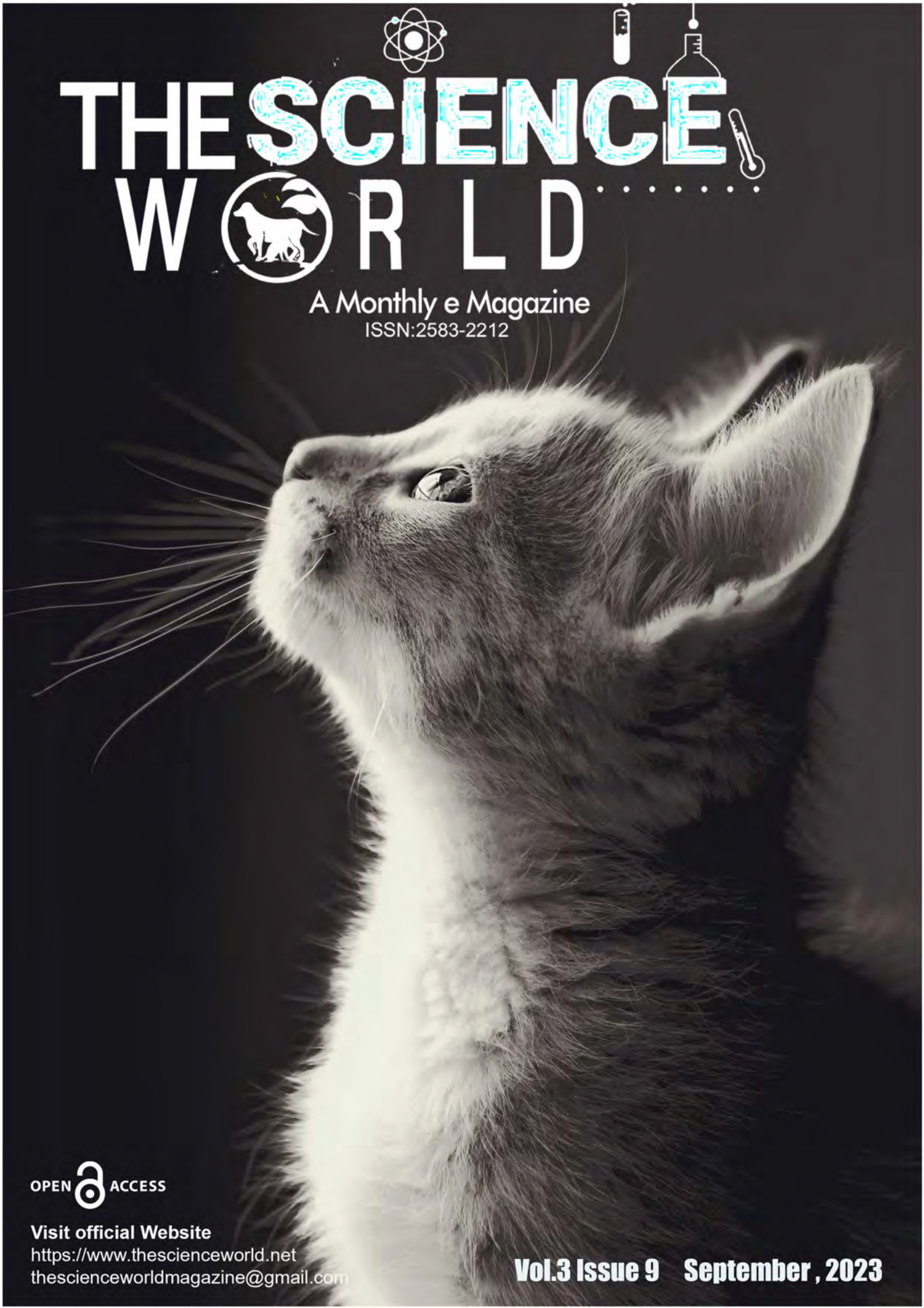
A Monthly e Magazine

ISSN:2583-2212



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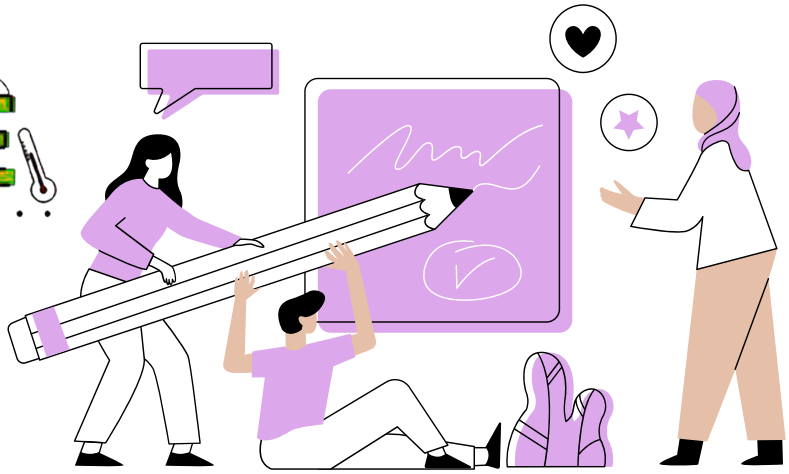

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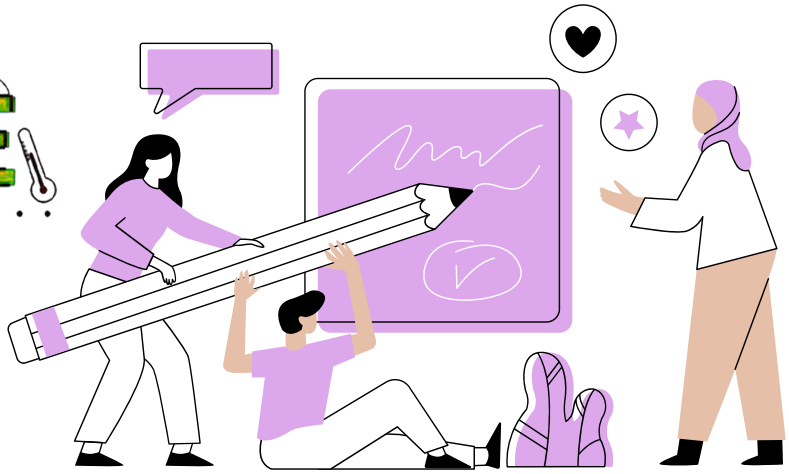

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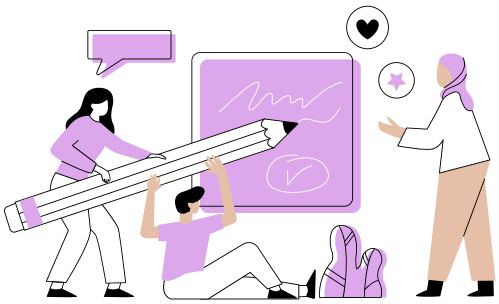

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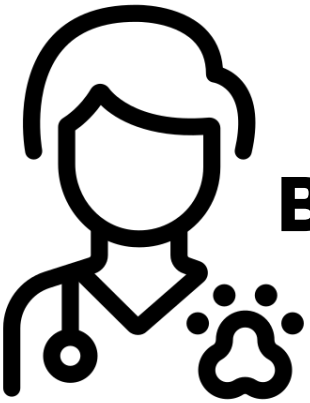

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"The Science World" emerges as a beacon of intellectual exchange within the realm of scientific discourse. This distinguished open-access e-magazine (ISSN: 2583-2212), inaugurated in May 2021, serves as a hallowed platform for the convergence of erudite minds, inviting researchers, scholars, and scientists of myriad disciplines to partake in a symphony of innovation and insight.

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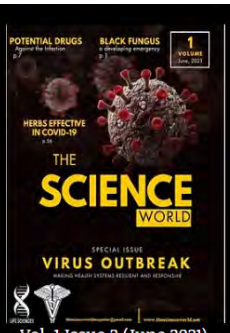
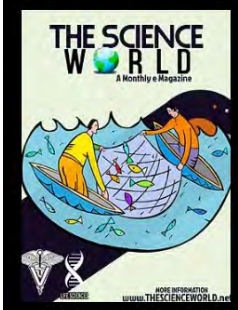


Vol. 1 Issue 2 (June,2021)

Vol. 1 Issue 3 (July,2021)



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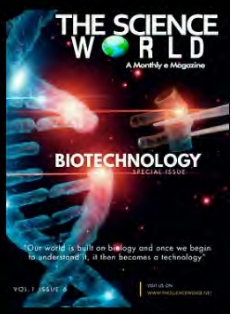
Vol. 1 Issue 5 (Sept,2021)



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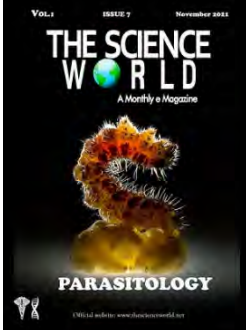
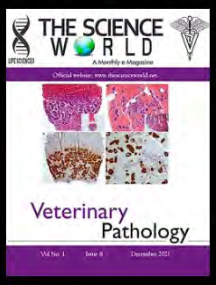
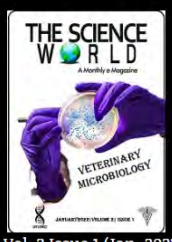


Vol. 1 Issue 7 (Nov, 2021)

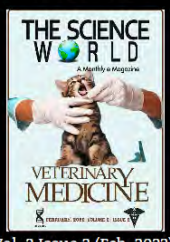


Vol. 1 Issue 8 (DEC, 2021)

2022

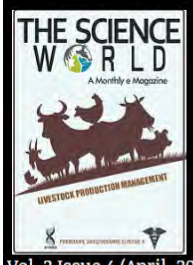


Vol. 2 Issue 1 (Jan, 2022)



Vol. 2 Issue 2 (Feb, 2022)

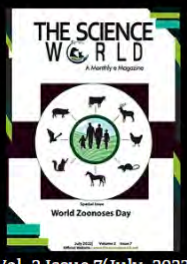
Vol. 2 Issue 3(Mrch, 2022)



Vol. 2 Issue 4 (April, 2022)

Vol. 2 Issue 5 (May, 2022)

Vol. 2 Issue 6(June, 2022)



Vol. 2 Issue 7(July, 2022)

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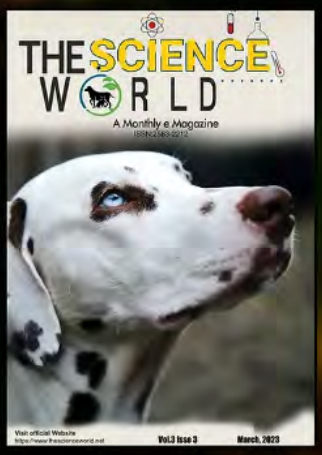

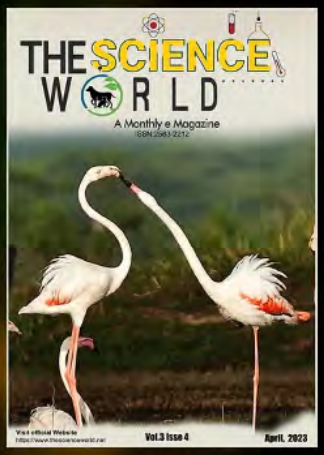

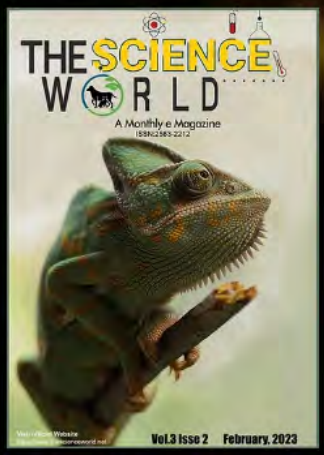

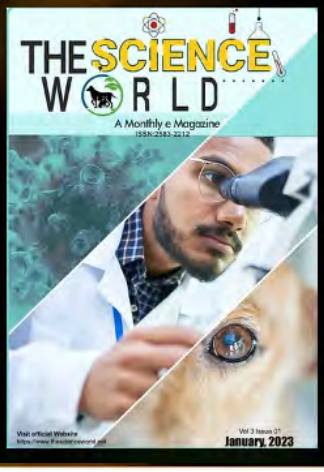

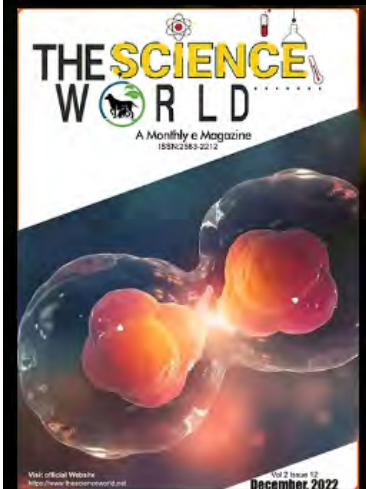

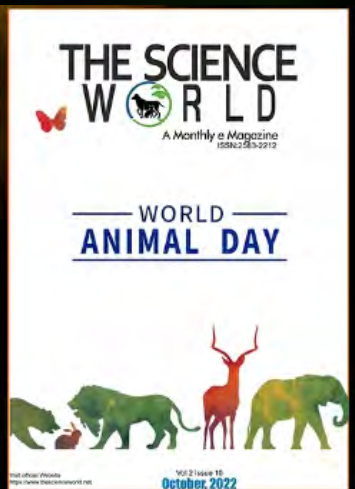

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Popular Article

Sept, 2023; 3(09), 2185-2187

Calf diarrhoea: Serious concern for calf mortality

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Calf diarrhea, also known as calf scours, is a common and concerning condition affecting young calves, particularly in the livestock industry. It is one of the major causes of death in dairy calves and attribute approximately 57% of calf mortality, resulting in economic losses across the world due to high morbidity, mortality and veterinary cost. It is characterized by frequent and watery bowel movements in calves less than three weeks old causing dehydration, decreased appetite and difficulty in standing. In severe cases, calves may suffer from ataxia, acidemia, bacteremia, arrhythmia and hypovolemia leading to death. It can be caused by a variety of factors, including viral, bacterial, and parasitic infections, as well as management and environmental factors.

The etiology of calf diarrhea can be broadly divided into infectious and non-infectious wherein infectious includes bacteria, viruses and protozoa. Non-infectious or predisposing factors includes inadequate nutrition of pregnant dams and colostrum, less immunoglobulin ingestion from calves gut and environmental factors like poor sanitation, overcrowding, poor quality milk/ milk replacers. Some of the infectious causes can be generally summarized below.

Escherichia coli (*E.coli*)

It is the most frequently implicated agents, causing calf scour and can be classified into six pathogroups based on virulence scheme: Enterotoxigenic E. coli (ETEC), Shiga toxin-producing E. coli (STEC), Enteropathogenic E. coli (EPEC), Entero-invasive E. coli (EIEC), Entero-aggressive E. coli (EAEC) and Enterohaemorrhagic E. coli (EHEC). ETEC is the most typical cause of diarrhea in newborn calf.

Clinical Signs

During the first four days after birth, newborn calves are particularly vulnerable to ETEC infection and experience watery diarrhea. It infects the gut epithelium and multiplies in the intestinal villi. Anorexia, elevated body temperature, increased heart rate, watery to semisolid faeces and dehydration are mainly observed. Calves from 4 days to 2 months old may manifest with diarrhea or primarily as dysentery and mucus in the feces

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Salmonella

Salmonellosis is commonly found in calves less than 3 weeks of age. Salmonella produces enterotoxin, causing inflammatory changes in intestine and bacteremia. Severe symptoms are observed in 10 days to 3-months old calves. The infected calf can act as a source of zoonosis through direct contact or food-borne routes. Most common strains are *S. dublin* and *S. typhimurium*

Clinical signs

Salmonella infection can cause a number of different clinical signs, from asymptomatic to symptomatic salmonellosis. *S. typhimurium* causes systemic disease and acute diarrheal disease more frequently than S. Dublin. Watery, mucoid diarrhoea accompanied by fibrin and blood is the hallmark of the clinical signs. Depending on the severity of the infection, calves can release the bacterium sporadically and for varying lengths of time.

Clostridium perfringens

They are gram-positive, spore-forming anaerobic bacterium causing a wide range of diseases in mammals and birds due to the ubiquitous nature of the bacterium in the environment. They can be subdivided into five types (A, B, C, D, and E) based on the production of toxins wherein Type C has been mostly reported in conjunction with calf diarrhea.

Clinical signs

Intestinal pain and diarrhoea are brought on by enterotoxin's actions on epithelial cells. Hemorrhagic enteritis with ulceration of the mucosa is observed and death may occur in a few hours, but in less severe cases, calf may survive for a few days and recovery is possible with treatment. Low levels of proteolytic enzymes (like trypsin) in the digestive system of newborn calves make them more susceptible to infection.

Cryptosporidium

They are protozoan parasite frequently associated with gastrointestinal tract diseases in humans and neonatal cattle. There are 24 species of Cryptosporidium among which *C. parvum* is a potential zoonotic agent and is considered to be main cause of calf diarrhea. Infection can be detected as early as 5 days of age with the greatest proportion of calves excreting organisms between 9-14 days. Oocyst-infested environments have the potential to infect both humans and animals instantaneously.

Clinical signs

Calves infected with *C. parvum* can be asymptomatic or develop severe diarrhoea with dehydration. Animals with compromised immune systems are more vulnerable to the disease. Infection damages the intestinal epithelial cells, leading to severe villous atrophy in infected animals and damaged to the intestinal epithelium causes prolonged malnutrition and reduced growth rates in affected calves due to malabsorption of digested foods.

Eimeria

Eimeria species causes coccidiosis in ruminants and poultry. The most prevalent species of Eimeria that causes coccidiosis in cattle are *E. bovis, E. zuernii* and *E. auburnensis*. *E. zuernii* causes

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winter coccidiosis in cattle which is highly pathogenic. Prepatent period is 16-17 days.

Clinical signs

Bloody mucoid diarrhea, epithelial mucosal lesion, dehydration, depression, tenesmus and occasional rectal prolapse are among the common clinical signs. Bloody mucoid diarrhea is often seen 1-3 days before 1st oocyst are shed and in acute cases, death of calf can occur within 5-7 days. The disease is most common in fall and least during summer time.

Bovine Viral Diarrhea (BVD)

Bovine Viral Diarrhea virus is an enveloped, single-stranded RNA virus. It can cause calf diarrhea in two major ways, persistent infection resulting in primary damage to enterocytes and susceptibility to co-infection or transient infection with replication in enterocytes and lesion formation contributing to diarrhea.

Clinical signs

Commonly observed symptoms include diarrhea, pyrexia, depression, anorexia, oral ulcerations and leukopenia leading to immunosuppression. Pregnant cows if exposed to a noncytopathic BVDV during 45-125 days of gestation deliver persistently infected (PI) calves since the fetus is not immunocompetent. Most PI calves are born weak and susceptible to other pathogens and experience poor growth.

Prevention & Control

Management of calf diarrhea can be done mainly at three levels i.e., peripartum calving management, calf immunity and environmental stress or contamination. Peripartum calving management includes adequate feeding and mineral supplements of pregnant cows during the last trimester to reduce calf morbidity and mortality rates. Under calf immunity building, neonatal calf should receive 2-3L (for beef calves) or 3-4 L (for dairy calves) of colostrum within the first 6 hrs after birth. Milk or freshly reconstituted milk should be fed at body temperature (38 degree Celsius). In environmental stress or contamination management, all feeding facilities and equipment's (milking bottles and water buckets) should be maintained with strict hygiene practices and calves should be dewormed at appropriate intervals. Moreover, extreme weather conditions such as low temperatures, rain, wind, and high levels of moisture act as stress factors to young calves and increase the susceptibility of calves to diarrhea therefore, by implementing a managed breeding programme, the calving season can be changed to coincide with more favorable environmental conditions.

In summary, calf diarrhea is a significant health issue in young calves, characterized by watery diarrhea and caused by various infectious agents and environmental factors. It can have severe health and economic consequences, making prevention and prompt treatment essential in the management of this condition in the livestock industry.

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Popular Article

Sept, 2023; 3(09), 2188-2193

Progressive Myopia - another bane of the COVID 19 pandemic?

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Human beings witnessed a global crisis in the form of the COVID19 pandemic, which affected both physical and mental well-being of individuals. The devastating nature of the SARS-CoV-2 virus shook the world and since the time the virus was recognized in late 2019 a dramatic upsurge in myopia, especially in young children, is one aspect that has slowly gained prominence (1). Children and adolescents were already at greater risk since modernization has affixed them firmly onto the digital devices to compete in their respective fields of interest. Holden, Long and respective teams reported a shift of the curve for myopia cases, and it has been estimated to affect approximately half of the population, making it around five billion people by 2050, out of which 9.8% are likely to have severe myopia (2,3). Severe myopic patients are again more prone to retinal detachment and it has been suggested that myopia with associated pathological conditions might lead to loss of vision (4). A study conducted by Enthoven and team showed an increase in the odds of myopia in 9-year-old children, showing an association between myopia and near work/computer use (5). Digital Eye Strain (DES) or computer vision syndrome is an emerging threat to the public health due to excessive use of gadgets as well as sustained near work or closer working distance from digital screens, as reported by Huang and colleagues (6). Bhattacharya and members reported that DES mainly occurs as a result of photochemical damage of cells due to the emission of harmful short high energy waves from such devices (7). Usage of computers and smart phones puts the person in question at a higher risk for progressive myopia than television use. Along with that, Liu and team has established that the duration of engagement with such digital screen is positively associated with myopia related symptoms (8). Home confinement amidst the pandemic minimized the risk of exposure to the deadly Corona virus,

but at the same time the draconian lockdown raised questions about public health hazards, among which 'quarantine myopia' is one topic which is certainly debatable. Earlier the studies of Qian, Lim and their fellow researchers had already revealed the high incidence rate of myopia in Asia since many years (9,10). A pre COVID period study showed that almost 80% Asian children had myopia whereas only 25% of the European children of the same age were myopic which was a clear evidence of high incidence rate in Asia (1). This crisis might have only got an up thrust during the COVID-19 lockdown due to an extraordinary leap in digital screen time of people. A UNESCO report stated that approximately 1.37 billion students (a whopping 80% of the world's student population) from over 130 countries have been affected by the e-learning approaches of education institutions during the COVID pandemic (11). China was the first country to see the emergence of the virus; hence the students in China followed by the other Asian countries were the first to experience the outbreak as well as the home confinement. Ever since the consequences of such actions are being recorded, myopia is one problem in which the incidence rate has risen further more than the pre-existing one. To be precise, both the prevalence and incidence have increased worldwide during the pandemic. An assessment carried out by Moore and team showed that 85% of 8 years old children spent 5.14 h/day on-screen during home confinement where the recommended average on-screen time limit is 2h/day in Canada (12). Curb in outdoor activities during lockdown deprived the children from effective classroom interaction. Recent studies carried out by Landreneau and colleagues showed that the prevalence of myopia exceeds approximately 28% globally (13) and numbers published by UNESCO reveal that digital learning during peak months of pandemic affected almost 1.5 billion young children from 192 different countries (14).

A case report published by Picotti and team stated that after confinement during 2020, 8-14 years old children were frequent visitors and among them 60% were girls. UNESCO declared that the mean annualized progression for the right eyes in 2019 was found to be 0·44±0·52 D which further increased to 0·58±0·53 D in 2020 during lockdown confinement (15). As reported by Singh, daily data usage of smart phones was double in myopic students as compared to non-myopic ones (16). In another study conducted by Wang and team, it was revealed that many other associated factors contributed to the accelerating progress of myopia such as time spent for outdoor activities, hereditary factors, regional differences and types of digital devices used during an outbreak (17). In a case report, Sumitha and team were of the opinion that approximately 79% of 917 students were found to be myopic between March-April 2020 in India (18). A substantial shift of myopic curve was observed by y−0.3 diopters [D] by Wang and team during school photo screenings in 2020 as compared to last previous years between 2015 and 2019 (1). Klaver and colleagues observed 9-13 years old children and found that the mean refractive index showed greater myopia in girls than the boys (19), as they spend more time on-screen or on social media with less physical activity. According to Sydney

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Adolescent Vascular and Eye Study, conducted by French and team, it was revealed that age factor also contributed to the occurrence of myopia because younger children were more sensitive to myopic triggering that develops from the environment. The study proposed that 6 years old myopic children spent 1.5 hours or more on a digital device than the children without myopia. However, the results were not same in case of 12-year-old children thus indicating towards the association of age factors (20).

It requires several protection protocols or recommendation guidelines to combat Myopia progression. Vision therapies have recently been adapted which play a significant role in minimizing these anomalies. Different interventions are there for myopia reduction *viz.* optimizing various environmental influences, topical applications as pharmacological intervention and lastly use of few optical devices such as multifocal spectacles or contact lenses with discrete dual focal designs (21). Allen, Vasudevan and researchers were also of the opinion that patients could try vision therapy tools like Hart Chart (22), lens flippers (23) and Brock string with beads of different colours. Gifford and colleagues also opined that documentation of ocular biometry could be beneficial to the practitioner during the evaluation process in implementing myopia control strategy (24). Visual hygiene could also be achieved by using larger gadget screens to minimize the visual fatigue, along with frequent blinking to minimize the dryness in the eyes (25). In the opinion of Naroo and team, contact lens could be another option against myopia progression (26).

Over the years, there has been emerging evidence about the association between the time of outdoor activities and the protection against the onset of myopia. Nemeth and colleagues reported that when children spent sufficient time in outdoor activities (more than 2 hours/day), the risk of myopia got reduced considerably, even when both their parents were myopic (27). Even the incidence of new cases of myopia over a period of one year got significantly reduced when the time spent outdoors was increased by an additional 80 minutes/day. The rate of progression of myopia got remarkably reduced in the children who spent this additional time outdoors, as compared to the children who did not (0.25 D to 0.38 D), as reported by Wu and team (28). Smith and other researchers hypothesized that brighter light outdoors stimulates the release of dopamine from the retina and inhibits axial elongation in animal models (29). Hence, wherever possible, involvement in outdoor activities like backyard farming or gardening or playing any kind of sport in the lawn, can greatly reduce the risk of developing myopia. As stated by Waleed and colleagues, the old-school trick of 20-20-20 (looking away every 20 minutes at an object 20 feet away for 20 seconds) (30) and certain eye exercises can be adopted by the teachers for the students, especially during long live study sessions. Forceful blinking of the eyes can also be encouraged. As reported by Wai, this exercise squeezes the meibomian glands which help with evaporative dry eye (1).

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There are a few initiatives already taken to spread awareness through either social media platform or campaigns regarding myopia in children and how it is detrimental for them. As stated by Lanca and his team, the Global Myopia Awareness Coalition started to raise the awareness against childhood myopia amongst the parents in 2019 (31). Considering the importance of sleep hygiene, parents can also monitor sleep cycle of their children by using few web-based apps that helps in restricting the screen time. Chia, Trier and their colleagues also reported that use of low-dose atropine and 7-methylxanthine has been found to be effective in slowing down the progression of myopia (32, 33).

The government health agencies can tie-up with the educational institutions in order to shape out a more holistic curriculum. As put forwarded by Singh, a challenging yet necessary technological development would be to develop applications or wearable devices that would measure the digital screen time, the eye-to-screen distance and pop-ups that would assure breaks to be taken by the user (16). Futuristic applications that can automatically cut of the usage of data after a certain period of time, especially for the kids, can be pondered upon to be developed. The COVID-19 pandemic was indeed an unrivalled wake-up call for the government, the educational institutions, health sector, the research and development units and the parents, to acknowledge the fact that myopia can indeed turn out to be the future monstrous epidemic in many countries, if careful strategies are not developed and applied upon in the educational institutions and also at work places, as soon as possible.

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Data- Driven Decision- Making in livestock Management

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Introduction

Rise in population and income development is resulting in the rise of the demand for a wider variety of foods globally. Human nutrition studies have revealed that people are moving towards more affluent food consumption habits (Wiedmann et al., 2020). Livestock management is one area that will gain a lot from this growth. This shift in demand from foods of plant origin to livestock products like meat, eggs, and milk, combined with the ever-growing population, must be addressed without causing any further load on environmental or exhausting the diminishing the global resources. In addition to this, agriculture's age old and conventional methods are also undergoing exceptional changes in this era of technical developments. Introducing the world of data-driven decision-making, a typical example of mankind seeking efficiency, that is transforming how farmers and ranchers manage their animal populations, ensuring both increased productivity and the welfare of the animals in their care. The livestock industries are showing keen interest in examining how data-driven decision making may be used to increase productivity (Koketsu and Iida, 2020). Decisions of the progressive farmers in the field of agriculture no longer only rely on common practises and intuition now a days, thanks to technology for the tools available to farmers today which enable them to collect, process, and interpret a wealth of data coming from every aspect of their livestock operations. A significant amount of real-time data is gathered by sensors designed to keep tabs on animal health, environmental factors, and feeding patterns which when analyzed, reveals intricate insights that have the potential to completely reshape the farming industry. This article will try to enlighten that how by utilizing the power of data we can promote a new era of accuracy and well-informed decisions in the business.

When decisions are made on livestock farms utilizing data-driven decision making, they are based on predictions created using the data gathered on the farm and across the supply chain. Data analytics

and machine learning (ML) approaches are being used to make accurate forecasts and support decision-making. According to Neethirajan (2020), ML models are now being used to forecast a variety of factors relevant to decision-making, such as sales and feed performance. The ability to predict the problems and opportunities to correct them beforehand has never been more real. from improving feed formulas to spotting illness early symptoms this data-driven revolution is a symbol of a change towards ethical and ecological farming, where animal welfare is supported by facts rather than presumptions. The potential benefits come with challenges, as with every revolutionary innovation.

In order to maintain a competitive edge in the agriculture industry as a whole and the, data collection and analytics are becoming increasingly important. For ML models to function properly, structured data must be available and easily accessible (Lee and Shin, 2020). In order to put better data analytics into practice, it is crucial to look into the full data analytics pipeline (Pääkkönen and Pakkala, 2015). However, as a flaw of this technology for the application of this into current agricultural workflows one needs to pay more attention to data security, and privacy issues as the computerized system can be hacked or manipulated.

Collecting and gathering livestock data

Livestock data collection includes a wide range of information, such as animal health records, eating patterns, environmental variables, and reproductive data. The progress in Overall technological aspect has favored the emergence of IoT and Cloud paradigms, resulting in the emergence of various technology-related concepts such as Precision Agriculture (measures and responds to the variability of agricultural data gathered by sensors), Smart Farming (applies information and data technologies to perform a more comprehensive analysis of the farming system, taking into account location, historical, real-time data, and other factors) (Wolfert et al., 2017) and IoT (the process of linking several heterogeneous things, such as machinery, cars, or buildings, with electronic devices, such as sensors and actuators, over various communication protocols in order to capture and retrieve data). Smart collars, temperature sensors, and RFID tags are examples of IoT devices that provide real-time monitoring of important parameters, allowing farmers to precisely observe animal behaviours and detect early signs of illness. These technologies generate a continual stream of data that aids in making timely, educated decisions.

Radio Frequency Identification (RFID) tags provide a technique for tracking and identifying individual animals. When RFID tags are attached to each animal, they allow for more precise tracking of movement patterns, behaviors, and health statuses. Gas sensors to measure potentially dangerous levels of gases in 493 the air inside barns. GPS and geolocation sensors are very useful for livestock that are free to roam in open grazing systems. Farmers may track the locations and movements of their livestock with these gadgets. Sensors are also used to track several elements of livestock behavior and

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physiology like hygrometer and air thermometers etc used in the barns. By capturing movements and behavioral patterns, activity monitors provide insights into animal health and reproduction cycles. Health monitors with sensors for heart rate, respiration rate, and body temperature have the advantage of detecting health issues early, allowing for prompt interventions and limiting illness spread among the herd. The integration of data collected by these sensors and gadgets goes beyond simply observation and into action. Information is delivered to centralized platforms for analysis and transformation into meaningful insights via data transmission and analytics. This technique enables farmers to make informed real-time decisions, leading in better resource allocation, optimised feeding strategies, and faster remedies for animal health issues.

(a) Radio Frequency Identification (RFID) tags in cattle

(b) GPS cattle Tracker

Benefits of Data-Driven Decisions in Livestock Management

The incorporation of data-driven decision-making in livestock management has ushered in a new era of accuracy and efficiency in agricultural practices in recent years. Farmers and livestock managers may optimize resources, increase animal health and wellbeing, and improve farm sustainability by leveraging the power of data analytics and technology.

1. Capital Optimization: Farmers may modify feeding schedules and adjust diets to fulfil the individual demands of each animal by analyzing past data. In (2018) Dunn and associates discovered that data-driven feeding techniques resulted in a 15% reduction in feed expenditures and a 10% increase in overall cattle output.
2. Prediction of Market Demand: Farmers can change their production plans to meet shifting demands by analyzing past data on customer preferences and market trends. This eliminates overproduction and food waste while assuring a consistent supply of high-quality products.
3. Environmental Sustainability: Farmers may construct more efficient housing conditions that reduce energy consumption and the environmental imprint of livestock operations by analyzing data on environmental elements such as temperature, humidity, and air quality.
4. Preventive Health Care: Data analytics aid in the early detection of health disorders and the execution of timely interventions in proactive health management. Smith et al. (2020), for

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example, revealed that real-time monitoring of dairy cow behavior using IoT devices resulted in a 25% reduction in veterinary expenditures due to early disease diagnosis

5. Improved Reproduction Methods: According to the findings of Garca-Ruiz et al. (2019), combining genetic data into breeding decisions resulted in a 12% increase in milk yield and a 9% improvement in reproductive rates in dairy cows. Farmers can use genetic data analysis to select animals with superior qualities for breeding, resulting in healthier progeny and enhanced herd genetics.

(c) Monitoring of Livestock Health

Challenges and Considerations

The incorporation of data-driven decisions in livestock management has various benefits, but it also introduces new obstacles and issues that must be addressed to ensure successful implementation and ethical practice. These difficulties transcend technical, ethical, and practical dimensions, need careful consideration and strategic planning. Compliance with data protection standards is critical for retaining consumer and stakeholder trust. Farmers and livestock management must take strong cybersecurity precautions to avoid data breaches and unauthorized access. Along with this, Poor data quality, whether caused by sensor failure or human mistake, can also lead to inaccurate conclusions and actions so to maintain the accuracy of obtained data it is critical to create data validation methods and perform frequent maintenance. Furthermore, in the challenges of these technology one can add the implementation cost of these sensors and devices which only the high earning farmers can afford, also the poor farmers lack knowledge and skills to implement these technologies. Adopting data-driven decisions necessitates a strong technology foundation not all farmers, particularly in rural areas, may have access to advanced technology or dependable internet connectivity. To promote equal adoption of these practices, it is critical to bridge the digital gap. At last farmers and stakeholders can reap the benefits of data-driven decisions while guaranteeing ethical, efficient, and sustainable livestock management practices by identifying these issues and taking a strategic approach.

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Conclusion

Globalization has facilitated agricultural trading worldwide. Adoption of data-driven decisions in livestock management stands out as a beacon of progress and potential in the shifting landscape of modern agriculture. Farmers and stockbreeders must upstage themselves by offering high-quality products, information about the origin of the product, and the processes it has gone through in the value chain till it reaches the retail site. To that purpose, the agri-food business must adopt technology like the Internet of Things and other smart agricultural technologies that provide monitoring and traceability. However, in the midst of these exciting developments, it is critical to recognize the problems and concerns that come with the adoption of data-driven decisions. A comprehensive approach is required to ensure data security and privacy, as well as to bridge technological divisions and address ethical problems. Collaboration among stakeholders, including farmers, researchers, and technology specialists, is critical in overcoming these obstacles and achieving a seamless integration of data and agriculture. Finally, the future holds enormous promise for data-driven decisions in cattle management. It is a road towards greater efficiency, animal welfare, and environmental sustainability. We go on a transforming journey as we embrace this trip with a spirit of innovation, accountability, and teamwork.

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Natural Dyes and its classifications

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India has a rich plant biodiversity which is ranked 11th as biggest biodiversity in the world. It has approximately 4,90,000 plant species and there is no doubt that the plant kingdom is a treasure-house of diverse natural products. There are several plants / plant parts that provide natural dyes which are used in the textile industry. In many of the world's developing countries, however, natural dyes can offer not only a rich and varied source of dyestuff, but also the possibility of income through sustainable harvest and sale of these dye plants. Many dyes are available from tree waste or can be easily grown in market gardens. Recently, interest in the use of natural dyes has been growing rapidly due to the result of stringent environmental standards imposed by environmental board and pollution control board of many countries in response to toxic and allergic reactions associated with synthetic dyes.

Classification of Natural Dyes

Padma S Vankar has proved that dyes are classified based on their structure, source, method of application, color, etc. Two types of classifications are described below.

(a) Based on Chemical Structures

(i) Indigo dyes

This is perhaps the most important group of natural dyes, obtained from *Indigoferatinctoria* (Fig. 2.1).

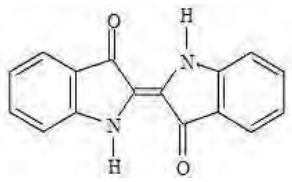

Fig. 2.1: Structure of indigo

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(ii) Anthraquinone dyes

Some of the most important red dyes are based on the anthraquinone structure (Fig. 2.2). They are obtained both from plants and insects. These dyes are characterized by good fastness to light. They form complexes with metal salts and the resultant metal-complex dyes have good wash fastness.

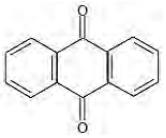

Fig. 2.2: Structure of anthraquinone

(iii) Alpha-hydroxy-naphthoquinones

The most prominent member of this class of dyes is lawsone or henna, obtained from *Lawsoniainermis* (Fig. 2.3). Another similar dye is juglone, obtained from the shells of unripe walnuts. These dyes are generally dispersing dyes and give shades of orange.

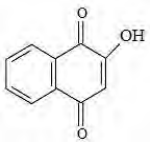

Fig. 2.3: Structure of alpha-hydroxy-naphthoquinone

(iv) Flavones

Flavones (Fig. 2.4) are colourless organic compounds. Most of the natural yellows are derivatives of hydroxyl and methoxy substituted flavones and isoflavones. Common example is weld (containing luteolin pigment) giving brilliant and fast colours on both wool and silk.

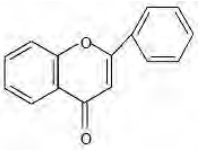

Fig. 2.4: Structure of flavone

(v) Dihydropyrans

Closely related in chemical structure to the flavones are substituted di-hydropyrans, *viz* (Fig. 2.5). haematin and its leuco form, haematoxylin. These are important natural dyes for dark shades on silk, wool and cotton. Logwood, Brazil wood and Sappan-wood are the common example.

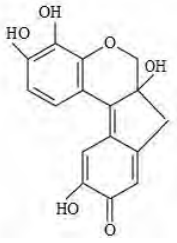

Fig. 2.5: Structure of dihydropyran

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(vi) Anthocyanidins

The naturally occurring member of this class includes carajurin, a direct orange dye for wool and cotton. It is obtained from the leaves of bignonia chica (Fig. 2.6).

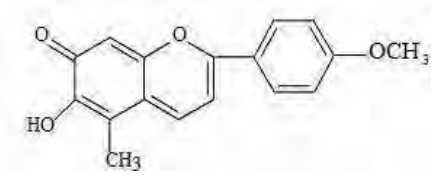

Fig. 2.6: Structure of anthocyanidin

(vii) Carotenoids

The class name carotene (Fig. 2.7) is derived from the orange pigment found in carrots. In this color is due to the presence of long conjugated double bonds. Example: Annatto and saffron.

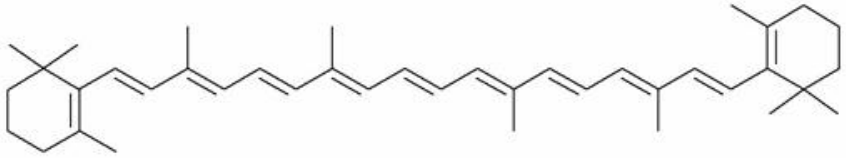

Fig. 2.7: Structure of carotene

(b) Based on color

Various natural dyes are present in all the colors of the visible spectrum. The natural color and hue of a dye can be altered by treating with metal salts. If the dye is of plant origin, the color may vary depending on the soil properties, part of the plant, season of harvesting, cultivation practices, etc.

(i) Blue dye

The only viable choice among the blue natural dyes is indigo. Natural indigo is obtained by fermenting the leaves of various species of *Indigofera*, running off the liquor to precipitate the dye. Woad (*Isatis tinctoria*) is another important source of indigo.

(ii) Red color

Most red dyes are found in roots or barks of plants or camouflaged in the bodies of dull grey insects. The sources of red color are limited. Cochineal is an important red dye and it is the brightest of all the available natural red dyes.

Examples

(i) Manjith and Kusumbar among the vegetable sources.

(ii) Lac and Kermiz among the animal sources.

(iii) Yellow color

Yellow is the most common color in the natural dyes. However, most of the yellow colorants are fugitive. Some of the important yellow dyes are obtained from Barberry (*Berberris aristata*), Tesu flowers (*Butea frondosa, monosperma*) and Kamala (*Mollotus philippensis*).

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Utilization Of Natural Dyes

Gulragani *et al.*, has shown that classification of natural dyes based on applications. These are:

(a) Substantive Dyes (or) Non-mordant Dyes

This is a first group of natural dyes, which produce a fast color on textile materials directly by boiling.

Example

Indigo, Orchil, Turmeric, etc.

(b) Adjective (or) Mordant Dyes

This is a second group of natural dyes, which needs an additional chemical (mordant) to make the permanent color, is termed as adjective or mordant dyes. In pure state these dyes are generally slightly colored and when used alone give poor dyeing.

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Popular Article

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An overview of common microbial diseases in sheep and goats

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1. Bluetongue (Catarrhal fever of sheep)

❖ Causes

- It is caused by Arthropod-borne orbi virus in the family of *Reoviridae*.
- Biting insect of the genus of the *Culicoides* transmits the virus during the rainy season while blood sucking.
- Mosquitoes and other ectoparasites like sheep ked or *Melophagus ovinus* (blood-feeding parasites of sheep) may transmit the disease mechanically.
- The disease is more prevalent in late summer and early autumn which makes conducive environment for the multiplication of the vectors.
- Transmission through the semen and placental routes is possible.
- The virus is resistant to decomposition, desiccation and antiseptic agents.

❖ Clinical symptoms

- Fever
- Depressed attitude and off feed
- Reddening and swelling of the nose and oral mucosa
- Profuse nasal and oral discharge
- Inflammation and ulceration of lips, gums, buccal mucosa and tongue
- Cyanotic (bluish) appearance of tongue
- Tilting of the neck towards one side (wry neck)
- Reddening and swelling of coronary band of the limbs, and lameness
- Congestion of conjunctival mucous membranes and matting of eyelids
- Foul smelling diarrhoea
- Dyspnoea, snoring and pneumonia may be observed
- Death due to respiratory failure.

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❖ **Prevention and Control**

- Isolate affected animals and provide adequate rest
- Affected animals should not be allowed for grazing and should be fed with porridge made of rice, ragi and kambu.
- Immediate consultation should be made from the nearest veterinary hospital regarding antibiotic administration or symptomatic treatment to be given to the affected animals.
- Ulcers in the mouth can be treated with saline water or dissolve 1g of Potassium permanganate in 1 liter of water and wash the mouth 2 to 3 times a day with this solution and apply glycerin on the ulcers.
- Vaccination of animals with regular intervals (first vaccination at 3 months of age and next vaccination once in a year).
- Grazing of the animals should be avoided in areas where there are lot of vectors
- Cattle may act as carriers. The viraemic stage remains in them for more than 5 weeks. So movements of cattle should be restricted.
- Importation of animals from the areas prevailing the disease should be avoided.
- Strict regulation is to be followed to prevent the entry of diseased animals from endemic zones.
- An attempt should be made to control the vectors (*Culicoides*) population with fly repellants and spraying of butox (1 ml in 3 liters of water) in the breeding places of the insects.
- Cloud of smoke with dried leaves/wood during 6-9 PM might help to keep off *Culicoides* from sheep sheds.

2. Peste-des-Petits Ruminants (PPR)

- Peste des petits Ruminants also known as 'Goat Plague' is a viral disease that affects goats and sheep which causes huge financial loss to the animal rearers/farmers and economic loss to the country.

❖ **Causes**

- The disease is caused by Morbillivirus of the *Paramyxoviridae* family.
- Natural transmission occurs primarily through direct contact with infected sheep and goat
- Transmission may take place through contaminated feed, water, bedding and other appliances.
- Secretions and excretions are a rich source of virus and the spread of the disease take place through their contamination. Faeces are the main spreading agent and through it the disease may occur in epidemic proportion.

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- The disease may spread in a flock through the introduction of newly purchased sick animals from the market.
- There is no carrier state in animals; the spread of the disease is possible through animals with subclinical infection.
- Ingestion of infected material is the main way of transmission but it may also take place through inhalation and contact with ocular secretions
- The disease is not transmitted through insect vectors
- Wild ruminants have been suspected to play a role in the spreading of this disease

❖ **Clinical symptoms**

- High rise of temperature (104 - 105oF).
- The animal will show a dull coat, dry muzzle and inappetence.
- There will be profuse serous nasal discharges accompanied by sneezing and coughing.
- The discharges may be crust-like, hard and matt the nasal and ocular surroundings
- Oral necrotic lesions were noticed in lips, buccal mucosa, gums, dental palate and tongue, with malodour (halitosis).
- Congestion of conjunctival mucous membranes and matting of eyelids
- Signs of pneumonia and animal may die due to respiratory distress.
- Diarrhoeic faeces may contain mucus and blood.
- Pregnant goat may abort.
- Most of the animals recover and death may occur in a few of them.

❖ **Prevention and Control**

- Sick animals should be segregated and treated with proper intravenous salines and antibiotic injections.
- Affected animals should not be allowed for grazing and should be fed porridge made of rice, ragi and kambu
- Regular and proper vaccination of animals (First vaccination at 3 months of age and next vaccination once a year)
- Strict sanitation and hygienic measures are to be adopted in a flock. It is susceptible to most disinfectants, e.g. phenol, sodium hydroxide (2%).
- Restrictions should be made for the introduction of new animals in a flock, especially in areas where the disease is prevalent.
- Quarantine measures should be strictly followed in imported sheep and goats before introduction.

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3. **Sheep pox**
    - It is an acute to chronic viral disease of sheep and goats characterized by generalized pox lesions throughout the skin and mucous membranes. All breeds of sheep and goats irrespective of age and sex are affected.
    - It is possible to infect goats with sheep pox virus and sheep with goat pox virus.
    - Sheeps are naturally susceptible to sheep pox. Younger sheeps are more susceptible than old ones. The disease occurrence period is April- June.

❖ **Causes**

- It is caused by a member of the genus Capri pox virus, the pox viridae family.
- Cutaneous lesions (crust, nodules) resulting in aerosols, saliva, faeces and nasal secretions from sick animals for 1-2 months and dried scabs at ambient temperature may be the source for the spread of the virus.
- The usual mode of transmission is from direct contact with the infected animal. Indirect transmission by contaminated litter, fodder, water and attendants may spread the virus through mechanical ways.
- The virus may gain entrance through wounds and abrasions.
- The virus may present in skin papules. While the affected animals rub their body on other animals, the virus is passed directly to susceptible animals
- The biting insects (mechanical vectors) may inoculate the virus intradermally or subcutaneously.
- Aerosol or droplet infection is quite possible.
- Dogs, cats, etc. may mechanically transport the virus to other places.
- The virus may pass from the infected mother to the foetus through the placenta.

❖ **Clinical symptoms**

- Skin papules appear in 2-5 days following temperature and first appear on the hairless parts of the skin.
- Soon after the development of papules rhinitis, conjunctivitis may be observed.
- Papules like pock lesions appear in all the parts of the body, e.g., lips, cheeks, snout, nostril, face, ear, feet, thigh, abdomen, eyelid, neck, teat and udder
- The eyelids are swollen and they may completely cover the eyeball
- Mucopurulent discharges from the eyes and nose
- Animals become weak, disoriented and eventually unable to stand.
- The mucous membrane of the eyes, nose, lips, vulva and prepuce becomes necrotic
- Animals die due to the development of labored breathing as a result of broncho-pneumonia

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- Animals that survive develop scabs and shed over 3-6 weeks, leaving a raw granulating area.

❖ **Prevention and Control**

- Isolation of infected herds and sick animals for at least 45 days after recovery
- Proper antibiotic and NSAID injections
- Quarantine before introduction into herds.
- Animal traffic from the infected areas is to be prevented.
- Proper disposal of cadavers and products
- Regular Sheep pox vaccination of animals (first vaccination at 3 months of age and next vaccination once in a year (Feb-March, adult 5 ml, S/C, Kids 2.5 ml S/C)
- Strict sanitary measures are to be adopted. Use disinfectants like ether (20%), chloroform and formalin (1%) and phenol (2%) to prevent the transmission of disease.

4. Orf

❖ **Causes**

- Orf disease also known as contagious ecthyma or contagious pustular dermatitis or scabby mouth is a zoonotic disease caused by the *parapoxvirus, Orfviridae*.
- It is a highly infectious pox virus disease of sheep and goats manifested by the occurrence of pustular and scabby lesions on the lips, muzzle and udder.

❖ **Clinical symptoms**

- The appearance of nodular eruptions on the oral commissures, lips, mouth and nostrils, and the lesions are followed by papules, vesicles, pustules and ulcers in 3 to 4 days.
- Profuse salivation, lacrimation accompanied by nasal discharge.
- Extensive lesions on the feet lead to lameness.
- In young lambs, the initial lesion may develop on the gum below the incisor teeth.
- Ewes nursing infected lambs may develop lesions on the udder.
- Mastitis may result in ewes with lesions on the udder.

❖ **Prevention and Control**

- Affected animals should be segregated from the rest of the flock.
- Strict hygienic and sanitary measures are to be adopted.
- Proper antibiotic and anti-inflammatory injections.
- Lambs should be vaccinated when one month old. For better results, a second vaccination 2-3 months later is suggested. Vaccinated animals should be segregated from unprotected stock until the scabs have fallen off.

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5. Tetanus

- It is a non-contagious, infectious disease of mammals characterized by spasmodic contraction of skeletal muscles.
- Sheep and goats are more susceptible than cattle.

❖ **Causes**

- The disease is caused by bacteria known as Clostridium tetani which is remain in the intestine of herbivorous animals as normal habitat.
- Cl. tetani organism is sensitive to heat and cannot survive in the presence of oxygen, and this organism produces spores, these spores are extremely resistant to heat and the usual antiseptics and can persist in the soil even for years.
- Cl. Tetani spores require anaerobic conditions at the wound site for germination and liberate potent toxins.
- Spores may continue to persist in a dormant manner in tissues for many months until favorable conditions develop for their germination.
- The organisms are very much resistant and therefore remain in the environment especially in the street dust, garden soil and animal-manured soil in large numbers for a considerable period.
- Organisms may continue to live in the faeces for a long period and thus remain a potential source of infection to man and animals.
- The organisms gain entry through deep punctured wounds contaminated with bacterial spores. Trauma and damage of the tissues caused by dog bites, injection, vaccination, or chemical agents such as calcium salt, lactic acid, or by infection with other bacteria may help in the initiation of the disease process.
- Organisms may gain access during parturition and manual handling of the genitalia with contaminants, retention of placenta and prolapse, castration by open method, shearing, docking and vaccination may augment the transmission if, not attended properly.
- Neonatal animals may get the infection through contaminated umbilicus.
- Deep wounds in the feet during grazing, ploughing or transport, wound of the oral mucosa, dental caries, wound due to surgical interference, wounds by a penetrating object e.g. nails, etc., and contamination by dirt may influence the disease transmission.

❖ **Clinical symptoms**

- Apathy to feed, restricted movement, muscular stiffness, difficulty in walking, lack of coordination and unusual walking are the initial signs of the disease.
- Stiffness of muscles of the limbs with extended back and neck arched, reporting sudden death.

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- Stiff gait spasm of mouth muscles results in the mouth becoming held tight, difficult to separate the jaws, "lock-jaw" condition.
- Prolapse of the third eyelid, head drawn on one side or backward, pump handle position of the tail, erection of the ears, immobility of the ears and characteristic "saw horse stance" are the features.
- The rigidity of the facial muscles gives an anxious expression.
- There is a restriction of mastication and dribbling of saliva from the mouth.
- Suppression of rumination and bloat are the important attributes
- Animal remains hypersensitive and overreaction to sudden noise or physical contact and reflex irritability is noted from the start of the symptom.
- Death usually occurs in 3-4 days.

❖ **Prevention and Control**

- Proper vaccination at day old should be used. Giving two doses of vaccine at least four weeks apart. An annual booster dose is recommended
- Tetanus toxoid vaccine at the time of exposure of body tissues to the environment prevents the disease occurrence.
- Providing passive immunity to the lambs by giving ewes a booster vaccination, a few weeks before lambing commences
- Care of any local wound and make sure the wound is not contaminated by dirt.
- Cleanliness and proper hygienic measures are to be adopted at the time of parturition and following parturition.
- The animal should not be allowed to graze near barbed wire fencing.
- Open method of castration should be discouraged at the village level.
- Proper care should be taken to handle the retention of placenta and prolapsed cases.
- Sterile surgical instruments are to be used at the time of operation.
- The wound should be drained with deep incision. The animal should be kept away from metallic and sharp objects.
- Hygiene is essential while undertaking any husbandry or surgical procedure.
- All out precautions should be taken during castration.
- Waterers and feed troughs should be kept clean and free of contaminants from faeces.
- Good grazing management to control pasture or grassland-borne helminthic infections.
- The use of clean or safe pastures (not grazed for 6 to 12 months) will help to control helminth problems.
- Rotational grazing of livestock species should be followed to minimize or limit the infection from pasture.

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- All new arrivals to the farm should be isolated for at least 30 days and dewormed.
- Young animals should be housed separately from adult animals to prevent disease spread.
- Infected animals should be removed from the flock or herd and housed separately.
- Treatment should be followed by chemoprophylaxis to prevent reinfection.

6. Anthrax

❖ **Causes**

- Anthrax is an infectious bacterial disease of animals, caused by the spore-forming bacteria Bacillus anthracis. It can affect humans and a wide range of animals.

❖ **Symptoms**

- Sudden death within 48 hrs of illness of animal.
- Following death, there is an oozing of blood from the natural orifices.
- Bloat may develop.
- Oedema may predominantly notice under the neck, brisket region, thorax, abdomen and flank.

❖ **Prevention and Control**

- The dead animal's body should not be opened.
- Care should be taken to destroy the dead body by deep burial with quick lime.
- Periodical and regular vaccination should be done.
- Strict quarantine measures in anthrax-prone areas.
- Preventing the introduction of infected animals into disease-free areas.
- Persons handling the anthrax-infected animals should adopt adequate sanitary measures.
- The adjacent areas of the dead and infected animals should be thoroughly disinfected with 3% peracetic acid or 10% caustic soda or 10% formalin.
- The fodder from infected pastures should be destroyed and not to be given to the other animals.

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Popular Article

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Therapeutic Management of Hypovitaminosis-A in a Turtle

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Abstract

A red ear slider turtle of one year old was presented to the Veterinary Clinical Complex (VCC), College of Veterinary Science, Rajendranagar, Hyderabad with a history of swollen and oedematous eyelids, anorexia, lethargy and stunted growth, that was being provided with commercial feed. Clinical examination of the turtle revealed conjunctivitis along with blepharitis and blepharedema. The case was tentatively diagnosed as Hypovitaminosis-A and treated with injectable vitamin-A, oral Vetrivit turtle multivitamin and turtle eye drops, and complete recovery of the turtle was noticed after a period of 30 days.

Keywords: Blepharitis, Blepharedema, Hypovitaminosis-A, Turtle.

Introduction

Vitamin A is essential for the maintenance and production of epithelial cells and is also intimately related to vision. The clinical condition of Hypovitaminosis-A in reptiles results from a low β-carotene diet (Chitty and Raftery, 2013). In turtles, yolk sac is not fully resorbed until the age of six months and satisfies the Vitamin-A requirements of hatchlings until resorption. Chelonians predominately feed on foods low in Vitamin-A, such as iceberg lettuce, cucumbers or meat products. Dark leafy greens like spinach, turnip, mustard greens, broccoli, yellow or orange fruits and vegetables such as squash, peppers and carrots are rich in β-carotene which acts as a precursor of Vitamin A (Mitchell and Tully, 2009). Herbivores are efficient in converting beta carotene to Vitamin A whereas carnivores and many aquatic turtles and box turtles (*Terrapene spp.*) are less capable of converting beta carotene to Vitamin A making them more susceptible to deficiency. Inappropriate diet and husbandry practices are the risk factors to cause Hypovitaminosis-A in chelonians (Mayer and Donnelly, 2013). The most common clinical abnormality associated with Hypovitaminosis-A is squamous metaplasia, resulting in degeneration of epithelial surfaces such as conjunctiva, gingiva,

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pancreatic ducts, renal tubules, skin and lung alveoli. Squamous metaplasia can manifest itself in several different ways because of multiple epithelial body surfaces (Holladay *et al.,* 2001). Blepharospasm, blepharedema, blepharitis, conjunctivitis, blindness, rhinitis, lower respiratory tract disease including nasal discharge, depression, dyspnoea, open-mouth breathing and cutaneous abnormalities may be observed. Acute deficiency in semi-aquatic chelonians generally presents as ocular changes, whereas chronic deficiency in terrestrial chelonians is typically associated with respiratory, hepatic, renal and pancreatic epithelial abnormalities (Mitchell and Tully, 2009). Affected turtles should be provided with proper treatment with parenteral or oral Vitamin-A. Initiate Vitamin-A therapy for aquatic turtles @ 200-300 IU/ kg body weight, and in box turtles @ 1000-2000 IU/kg body weight, weekly once for 4-6 total doses. Change the diet to provide more preformed Vitamin-A and β-carotene for herbivorous reptiles (Mcarthur *et al.,* 2004). General recommendations for domestic species that can provide a starting point for dietary supplementation are 2.5-15 IU/gram diet on dry matter basis.

History and Clinical Observations

A one-year-old red ear slider turtle was presented to the Veterinary Clinical Complex, College of Veterinary Science, Rajendranagar, Hyderabad with a history of swollen and oedematous eyelids, loss of appetite and weight, dullness and poor growth, that was on commercial feed. On clinical examination, conjunctivitis along with blepharitis and blepharedema was evident (Fig. 1 and 2).

Diagnosis and Treatment

Based on history and clinical examination, the turtle was tentatively diagnosed as a case of hypovitaminosis-A. Treatment with Inj. Vitamin A @ 1000 IU, subcutaneously weekly once for two consecutive administrations, Vetrivit turtle multivitamin @ 6 drops twice a day per orally for 1 month and turtle eye drops were instilled @ 1 drop twice a day in both eyes. After 14 days of treatment, the turtle showed clinical improvement *i.e.,* swelling and edema of the eyelids had subsided, but complete recovery was noticed only after 30 days of therapy (Fig. 3 to 4).

Fig.1 and 2: Blepharitis and Blepharedema in turtle before treatment

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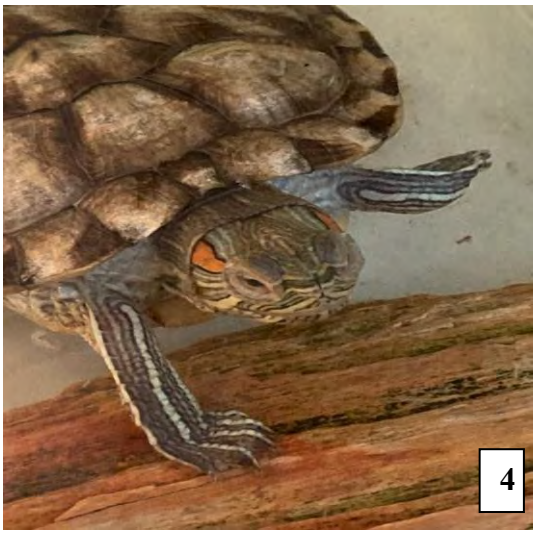

Fig. 3 and 4: Clinical improvement of turtle after treatment

Discussion

In our case, the turtle was being fed with commercial feed which is a poor source of Vitamin A. Mitchell and Tully (2009), reported hypovitaminosis-A as a clinical condition of reptiles resulting from a diet low or lacking in beta carotene and preformed Vitamin A in carnivores and omnivores reptiles. Multivitamin supplements utilized often lack preformed Vitamin-A. Herbivores can efficiently convert beta carotene to Vitamin A whereas carnivores and many turtles and box turtles are less efficient in doing so (Mayer and Donnelly, 2013). In the current case, clinical signs of conjunctivitis along with blepharitis and blepharedema were in accordance with the observations of Mitchell and Tully (2009) who noticed similar clinical signs such as unilateral or bilateral palpebral oedema, blepharitis and conjunctivitis with reduced or loss of vision in turtles suffering from hypovitaminosis A. Chronic blepharedema cases may show bilateral or unilateral white to yellow semi-solid or solid cellular debris filling the conjunctival sac. Post-hibernation blindness in tortoises is mostly due to retinal damage from Vitamin A deficiency. Hypovitaminosis A can be diagnosed from dietary history, clinical signs, measuring Vitamin A levels or histopathology of tissue samples showing squamous metaplasia of epithelial surfaces. Deficiency of Vitamin A can be corrected by oral supplementation with Vitamin A or by offering small amounts of liver once per week (Mukti, 2020). Injectable Vitamin A should be used very cautiously, as a single injection can cause hypervitaminosis A. Oral dosing with natural sources of β-carotene or preformed Vitamin A is a safe and preferred method of supplementation. Mitchell and Tully (2009) found that 1500-2000 IU Vitamin A is a safe parenteral dose for treating deficient animals. Oral dosing may be safer than parenteral treatment in avoiding vitamin A intoxication. Single parenteral injection followed by dietary correction and oral supplementation as recommended by Varshney *et al.* (2016). The current case was treated with Inj. Vitamin A @ 1000 IU, subcutaneously, weekly once for two consecutive

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administrations and simultaneous oral supplementation of Vitamin A. Recommended dietary supplementation for domestic species of turtle's ranges between 2.5-15 IU/gram diet on a dry matter basis. Vetrivit turtle multivitamin is a balanced supplement to meet the vitamin requirements for turtles and terrapins. It contains a vitamin complex in a micro-emulsion form which keeps all vitamins water stable. It fights off vitamin deficiency and encourages healthy growth. Emulsified or oil-based forms have a greater ability to be stored by the reptile liver and are likely a better choice for acute treatment. Hypovitaminosis A can be prevented in herbivorous and omnivorous reptile species by including foods with high beta carotene levels such as dark green leafy vegetables, oranges, sweet potatoes, carrots, squash, melon and papaya etc. (Mayer and Donnelly, 2013).

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Popular Article

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Tick-Borne Haemoprotozoan Infections in Bovines and Their Control Strategies

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Abstract

Multi-species tick infestations are common in cattle (especially in crossbred) and buffaloes. Ticks transmit diseases such as theileriosis, babesiosis and anaplasmosis, they also cause extensive damage to livestock health. These tick-borne haemoparasitic diseases constitute a major constraint to livestock production and have a considerable impact resulting in huge economic losses in affected countries.

Introduction

India contributes a major part of the World's livestock by sharing approximately 193.46 million cattle and 109.85 million buffaloes in organized and unorganized sectors (as per 20th livestock census). These animals are suffering from tick infestation almost throughout the year. Species of *Theileria, Babesia*, and *Anaplasma* are tick-borne parasites that are prevalent throughout the world, particularly prevalent in the tropics and subtropics and are associated with diseases of Theileriosis, Babesiosis, and Anaplasmosis, respectively, that pose a significant health threat to livestock production in many countries (Dantas *et al.,* 2012).

Haemoparasites have generally been shown to cause destruction of red blood cells resulting in anaemia, jaundice, anorexia, weight loss and infertility (Akande *et al.,* 2010). The direct losses caused by the parasites are attributed to acute illness and death, premature slaughter and rejection of some body parts at meat inspection. Indirect losses include the reduction of productive potential such as decreased growth rate, weight loss in young growing animals and late maturity of slaughter stock. Farmers may not appreciate the effects of these haemoparasites on their animals, perhaps due to the subclinical nature of presentation and chronic nature of the affected animals. *Babesia, Theileria* and *Anaplasma* are tick-borne haemoparasites that globally impact animal health and economy in view of mortality, reduced milk, meat and hide production and lower animal draft power (Radostits *et al.,* 2000). Hence, control of vectors, immunoprophylaxis, early diagnosis and treatment are necessary to

prevent mortality and associated production losses.

Pathogenesis and Clinical Signs

Bovine babesiosis is caused by the intraerythrocytic haemoprotozoa of *B. bigemina*, *B. bovis, B. divergens* and *B. major* which are transmitted by Ixodid ticks *Rhipicephalus (Boophilus) microplus* (Bose *et al.,* 1995). Incubation period varies according to the *babesia spp* affecting cattle and buffaloes. Pathogenesis is mainly due to parasitaemia, which causes high fever up to 45.5 ℃, destruction of large number of erythrocytes due to autoimmune mechanism, blood loss, cerebral anoxia, accumulation of toxic byproducts, release of kinin and intravascular coagulation. Symptoms include anorexia, weakness, cessation of rumination, depression, salivation, dryness of muzzle, lacrimation, reduced milk yield, diarrhoea, brick red conjunctiva which later turns to anaemic. In advanced stages, severe anaemia, haemoglobinuria, jaundice and death may be noticed. In chronic infections, animals may be weak and emaciated for weeks (Bhatia *et al.,* 2010).

Bovine theileriosis is a tick-borne disease caused by *Theileria annulata* and *Theileria parva,* which are pleomorphic forms and occur in lymphocytes, histiocytes and erythrocytes of vertebrate hosts. They cause a fatal disease in dairy animals and transstadial transmission occurs by *Hyalomma spp, Rhipicephalus spp*. Exotic, cross-bred animals and indigenous calves are more susceptible to infection and suffer more. Indigenous cattle do not show clinical signs, remain as carrier and act as source of infection to other susceptible animals. The incubation period varies from 9-25 days. The disease is characterized by lymphadenopathy, splenomegaly, fever (40-41.5 ℃), anaemia, inappetence, laboured breathing, serous nasal discharges, coughing, rough hair coat, weakness and loss of body weight (Maharana *et al.,* 2016). Bilirubinuria, jaundice followed by weakness and death may be noticed in later stages. Nervous signs are reported in cerebral form of theileriosis.

Another tick-borne haemoprotozoan disease, anaplasmosis also called gall sickness is a vector-borne disease of cattle and buffaloes, that is caused by an obligate intraerythrocytic rickettsial microorganism, *Anaplasma marginale and Anaplasma centrale, that are mostly transmitted by Rhipicephalus (Boophilus) microplus, Dermacentor, Hyalomma, Ixodes. Argas* and *ornithodorous* also act as vectors. Characteristic features of the disease include progressive haemolytic anaemia associated with fever, anorexia, jaundice, decreased milk production, abortions, hyperexcitability and in peracute cases death occurs within 24hrs in adult dairy cows.

Postmortem Findings

In babesiosis, lesions include emaciations, yellowish discoloration of subcutis, swelling and congestion of internal organs, enlargement of spleen, live, distended gall bladder, enlarged and congested lymph nodes and kidneys, and urinary bladder containing coffee-colored urine. Emaciated carcass, pale mucous membranes, enlarged superficial lymph nodes, spleen and liver, distended gall bladder with thick bile, congested and petechial haemorrhages on kidney and lungs, punched necrotic

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ulcers in abomasum are pathognomonic to theileriosis.

Diagnosis

Based on history, clinical manifestations, demonstration of piroplasms in stained blood smears, Koch's blue bodies in lymphocytes in lymph node biopsy smears (theileriosis), necropsy findings and prevalence of ticks in endemic areas. Molecular techniques and serological tests like complement fixation, indirect fluorescent antibody, indirect haemagglutination tests and capillary haemagglutination tests, etc. may be used.

Treatment And Control

Chemoprophylaxis, immunoprophylaxis and chemotherapy along with supportive therapy are important control measures. For babesiosis, Dimenazene aceturate is given @ 3-5 mg/kg bw through i/m route for two consecutive days. Imidocarb dipropionate is given @ 1.2 mg/kg bw as a single dose through s/c route. 1% trypan blue solution (50-100 ml) given strictly through i/v route is the oldest remedy for babesiosis.

In India, the commercial vaccine Rakshavac-T @ 3 ml, subcutaneous injection, once a year is recommended in crossbred and exotic cattle aged 2 months and above against theileriosis. Buparvaquone @ 2.5 mg/kg bw through i/m route is highly effective for treating theileriosis. Oxytetracycline @ 15 mg/kg bw through i/m route to be given 4-6 times daily. Parvaquone @ 20 mg/kg bw through i/v route as a single dose is highly effective. Halofuginone can be given@ 1-2 mg/kg bw orally once.

Tetracycline @ 6-10 mg/kg bw, given as single i/m injection is effective in anaplasmosis, usually three such daily injections are given. Supportive treatment includes blood transfusion, multivitamin supplements, and fluid therapy. Control of ticks and proper treatment of positive cases in segregation help in the effective control of diseases.

Conclusion

Ticks, which transmit parasites such as *Hyalomma* and *Rhipicephalus* spp. are a major concern for dairy farmers during the rainy and summer seasons. The most important tick-borne haemoparasites in cattle and buffaloes are *Babesia, Theileria* and *Anaplasma*. These haemoparasites account for substantial losses in terms of decreased working capacity, growth, and productivity of animals. Repeated use of chemical acaricides for tick management resulted in the establishment of acaricide-resistant tick populations, insecticide residues in livestock products and environmental pollution. Significant economic loss due to tick infestation in crossbred, indigenous cattle and buffaloes was estimated. Hence, prophylactic measures, early diagnosis based on history, clinical manifestations, blood smear examination, haematology, serum biochemical analysis and early treatment can prevent high mortality rates and production losses.

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Popular Article

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Cultivation Practices of Kalanamak Rice Noth East Plan Zone

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Abstract

Kalanamak rice (Oryza sativa L.) is a traditional aromatic rice variety known for its unique grain characteristics, aroma, and culinary preferences. This study focuses on the cultivation practices of Kalanamak rice within the North East Plain Zone, considering its significance in terms of cultural heritage, biodiversity conservation, and sustainable agriculture. The abstract provides a concise overview of the study's objectives, methods, key findings, and implications. The study found that Kalanamak rice cultivation in the North East Plain Zone is deeply embedded in the cultural practices of local communities.

Key words: Agronomic practices, Sowing, Irrigation, Pest and disease management, Kalanamak rice cultivation.

Introduction

The heritage rice (*Oryza sativa* L.) known as Kalanamak is the pinnacle of the best aromatic rice produced and consumed in the north eastern region of Uttar Pradesh. Since the beginning of time, people have been cultivating it **(Chaudhary and Tran, 2001; Chaudhary, 2002; Chaudhary and Mishra, 2010).** About 3000 years ago, Kalanamak is thought to have been the chosen kind for offerings made to Lord Buddha. High yielding varieties (HYV), which have been neglected by rice research organisations over decades of under cultivation and farmers' improper seed management, have doubled down on their economic assault. Short grain Kalanamak is categorized as a medium slender variety. These have exceptionally high head rice recovery (70%) rates. These have great grain elongation and cook up gently. The most iron and zinc are mixed in the maximum amount in Kalanamak types. This is why the only rice variety from north India to be included in the Nutri Farm project of the Indian Ministry of Agriculture was Kalanamak. Government of Uttar Pradesh had included Kalanamak in the Nutri Farm project also. Kalanamak is the most nutritious of all rice in terms of protein, Iron, Zinc, Vitamin-A (beta carotene) while being sugar free. The catchphrase

"Basmati for your eyes and Kalanamak for your palate" is well-known in eastern Uttar Pradesh. For fine rice, the government sets a Minimum Support Price (MSP) of about Rs. 1750/q. But Kalanamak rice only brings in between Rs. 3500 and Rs. 4500 per quarter. As a result, the revenue of Kalanamak Farmers has tripled.

Time of cultivation

In order to maintain the quality of its grain, Kalanamak should only be grown during the *Kharif* season. The latter week of July is the best time to seed Kalanamak. The seedlings are prepared for transplantation when they have reached the age of roughly 30 days. The Prayagraj condition final week of July to the first week of August is the best period to transplant. Never perform a transplant before the final week of July. This advice is supported by the observation that grain only reaches its highest quality and most aromatic state at temperatures between 25 and 300 C.

Seed rate

About 30 kilograms seed is enough to cultivate one hectare of land due to small grain size and lower 1000 grain weight.

Nursery management

The final week of June through the first week of July is ideal for nursery sowing. For seeding, a nursery area of 1000 square metres, or 0.1 hectare, is adequate. To prepare the seedbed for a field measuring one hectare, plough and bund 1,000 square metres of land. Apply FYM and fertiliser after that, according to the results of the soil test. After thoroughly incorporating the FYM into the soil, add water to the bed, puddle it, and level it such that 2 cm of water stagnate in the seedbed. Put the seeds in water for 12 hours and then prepare a seedbed. After the water is drained, the seed is piled on the ground or put in jute bags. With the heat created by soaking seeds, the seeds sprout within 24 hours if heaped on the floor and covered with damp jute bags. The sprouting seeds are then broadcast on the seedbed that have already been prepared.


Fig. Preparation of nursery field, Application of FYM

Preparation of field

When nursery is ready to transplanting in main field. Before transplanting the nursery

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seedlings to main field, it should be free from weeds. For the purpose of green manure, *Sesbania* (Dhaincha) or *Crotalaria juncea* (sunn hemp) should be sown in the mid may to first week of June. Once these crops have grown for about 45-60 days, these should be ploughed in the field using mould board plough. In case Mung was grown the pod should be handpicked before ploughing in the field. It may be noted the field must be full with 20 cm water to allow proper rotting. This will allow a proper decomposition within week. Such green manuring provides at least 80 kg N/ha. In case FYM 10 tons of FYM or compost should be applied before ploughing. In the fertilizer dose of 30 kg Nitrogen, 30 kg phosphorus and 30 kg potash should be used per hectare. If the soil has history Zinc deficiency, 25 kg Zinc sulphate should be applied per ha before transplanting. Final land preparation should do after fill in the field with 4 to 5 cm of water and puddling with any appropriate tractor or bullock drawn puddler or equipment.

Fig: Preparation of bund, puddling and Transplant in main field

Transplanting

Once seedlings have attained an age of 20-30 days, these are ready for transplanting. A spacing of 20 cm row to 15 cm plant to plant is recommended.

Fertilizer management

There are so many methods and combination to supply major nutrients to the plants. Full fertilizer requirement of Kalanamak may be provided totally by inorganic fertilizers such as Urea, Ammonium Sulphate, DAP and Super Phosphate but grain quality will be affected though not the yield. In case of only inorganic manures are used, 30 kilogram of Nitrogen, 30 kilogram of Phosphorus and 30 kilograms of Potash *i.e.,* half dose of nitrogen and full dose of Phosphorus and Potash must be applied before transplanting. 15 kilograms of nitrogen should be top dressed one month after transplanting. The remaining 15 kilograms of nitrogen should be applied at the time of panicle initiation which may be around mid to last week of September.

Weed control

Since transplanting of Kalanamak is done late, by that time most of the weeds in the rice field germinated already. After that, Kalanamak does not require weeding since it is a tall type that covers

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the soil surface, preventing weed growth. Herbicides, on the other hand, should be used with caution and deliberation if necessary.

Pest and disease management

Kalanamak is cultivated at relatively lower fertility levels. It also possesses a moderate level of resistance to key pests and diseases. But it may be get infested with stem borer and gandhi bug. Against stem borer no simple remedy can be recommended. But to control gandhi bug BHC or Malathion dusts may be used during heading to milk stage.

Harvesting, threshing and storage

Usually crop mature 30 days after full heading. Date of harvesting may be decided once the leaves have almost dried. Husk being black in color does not convert golden or straw color, thus leaves are better indicator of maturity. Threshing should be done immediately after harvesting. Grain should be sun dried to a moisture level of about 12% before it is stored.

Grain quality

Kalanamak Kiran has medium cylinder grain with black husk and white rice. It is highly aromatic and soft cooking type with low amylose content. Kalanamak Kiran has also high protein, Zinc and Iron. The significant point is that it has low Glycemic Index (53.1%) which is suitable even for diabetic people. This heritage rice is full of nutrotive values. **(Chaudhary, 2016 and Chaudhary *et al.*, 2012).**

Tripling the Income

According to the government, the current minimum support price for rice is Rs. 1835/q. The current Kalanamak Kiran selling price ranges from Rs. 3500 to Rs. 4000/q. Farmers can double their revenue and triple the price of product that has received a Kalanamak organic certification because to this pricing difference. **(Mishra and Chaudhary, 2012; Chaudhary, 2013).**

Summary

The best aromatic rice being grown in North-Eastern U.P. is kalanamak kiran. The central variety recommendation and notification committee of the Indian government published Kalanamak Kiran in 2019. It is extremely high in protein, zinc, and iron. It is suitable for intake for diabetics due to its Glycemic Index of 53.1. In conclusion, Kalanamak Kiran can stabilise it from extinction to distinction and has the finest mix of grain quality and production. **(Chaudhary *et al.*, 2012).** Therefore, farmers can not only double but triple their income. It seed are available with PRDF in Gorakpur.

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Popular Article

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Dermatophytosis in Cats

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Introduction

Dermatophytosis is an infection of skin, hair, or claws caused by a type of fungus known as dermatophyte (ringworm). In cats, about 98% of ringworm cases are caused by the fungus *Microsporum canis*. The fungus spreads easily and also cause zoonotic infections. Dermatophytes are keratin-loving organisms that invade skin and hair shafts, leading to clinical signs of folliculitis. Rapid diagnosis and treatment can prevent spread of disease and propagation within the environment, which is especially important in multi-cat households, catteries and shelters. (Frymus et al., 2013)

Etiology

The most important pathogens of veterinary importance are:

- *Microsporum canis* (80% of the cases in cats)
- *Trichophyton mentagrophytes, T. verrucosum, and T. erinacei*
- *M. gypseum*

Pathogenesis

Most fungi are opportunistic pathogens that invade the body if there is failure of the host's innate immune defense system. This can be defined as the non-specific, naturally present component of the immune system which is not dependent on prior antigen sensitization – e.g., the physical skin barrier, temperature, pH, and antimicrobial peptides (Frymus *et al*., 2013).

Once in contact with the skin, the spores create germ tubes to penetrate the stratum corneum and hair follicles, excreting toxins or allergens where the vascular components are capable of responding to toxins through an inflammatory reaction. Exudation from invaded epithelial layers produce dry crust which are characteristic of the disease

The spores (micosporum) released from the skin, hair, and claws of infected cats into the environment form the infectious stage of the lifecycle. These infective spores develop when fungal hyphae fragments, and directly or indirectly (via clippers, brushes, bedding, etc.) make contact with a new host. Infected cats shed infectious spores before signs appear. The spores remain viable in the environment for 12-18 months.

Clinical Signs and Symptoms

- Clinical signs of infection develop 2-4 weeks after exposure.
- Kittens are most likely to be infected.
- The appearance of ringworm varies in cats. Lesions often develop on the face, ears and muzzle and then progress to the paws and tail
- Folliculitis is the hallmark of infection.
- Clinical signs can include any combination of alopecia, scaling, crusting, erythema, papules, hyperpigmentation, and variable pruritus.
- Persian cats can develop nodular lesions (Pseudomycetomas).
- Cats also develop exudative paronychia (Paronychia is an infection of the tissue adjacent to a nail, most often a fingernail.)
- Infected claws will become prone to fracture

Diagnosis

- Clients may be able to provide information confirming multiple in-contact with animals or people with suspicious skin lesions. While this information certainly increases the suspicion of dermatophytosis.
- The gold standard test for detection of fungus is culture of sample collected from hairs and scales on Sabouraud dextrose agar.
- MacKenzie's hair brush technique: With this technique, a new toothbrush is removed from its package and is rubbed gently over the suspected area, including the skin and hair margins of alopecic or scaly lesions. Then gently embed the toothbrush bristles into the fungal culture media.
- Wood's lamp Examination: A Wood's lamp emits ultraviolet light of a 320 to 400 nm wavelength. During infection with M canis an apple-green color fluoresce under Wood's lamp illumination is produced but the ability to fluoresce develops after the first week of infection and can persist at the tip of the hairs after resolution of the infection. This can be a quick and easy test to see if M canis infection is likely, however Only around 50% of cases of M canis infection show fluorescence. (Wolf et al)
- A dermo scope can be used to find abnormal hairs for direct examination. This is a handheld noninvasive tool used to examine the skin that can locate hairs for culture.

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- Skin scrapings, plucked suspected hairs can be collected for examination under microscope, Fungal hyphae can often be seen along with spores surrounding infected hairs.
- In recent years, use of polymerase chain reaction (PCR) to diagnose dermatophytosis has drawn attention but PCR alone is not a confirmatory test since it simply measures the presence of Fungal DNA, so paired positive PCR results along with culture are required for confirmation of living organisms.

Differential Diagnosis

- The prime differential diagnosis in cats is superficial folliculitis, which occurs secondary to Staphylococcus spp. and Demodex spp. Infections.
- allergic dermatitis and eosinophilic granuloma complex.
- Less common considerations would include psychogenic alopecia, anagen/telogen defluxion, pemphigus foliaceus, , thymoma-associated exfoliative dermatitis, and cutaneous lymphoma.
- Nodular forms of the disease may appear similar to other opportunistic bacterial (e.g., Mycobacteria spp., Nocardia spp.) or fungal (e.g., phaeohyphomycosis, hyalohyphomycosis, zygomycosis) infections, neoplasia, or sterile nodular panniculitis.

Treatment

- Dermatophytosis is a self-curing disease in most animals
- Clipping of hairs has been a necessary part of dermatophytosis treatment; however, clipping is currently being reconsidered because whole-body clipping is stressful and the common microtrauma of the skin can worsen the infection. Thus, whether to clip should be decided on a case-by-case basis; clipping is not necessary for short-coated animals.
- Treatment may be topical, systemic or both, but isolation of the affected animal during treatment is generally recommended. (Moriello et al.,2021)

Topical Therapy

Topical therapy is the most important way of minimizing disease transmission and environmental contamination. Infection is transmitted via contact with infective materials on the hair coat making it critical to disinfect the hair coat.

Topical therapy involves

- A whole-body rinse with lime sulfur (1:16), which should be done twice a week.
- Shampoo containing 2% chlorhexidine and 2% miconazole is effective
- focal topical therapy can be used for lesions in hard-to-treat locations such as the ears and face. A 1%–2% vaginal miconazole cream can safely be used on the face. For the ears, otic products that contain clotrimazole or miconazole/chlorhexidine or ketoconazole/chlorhexidine combinations are available.
- Whitfield's ointment- 3:6 salicyclic acid and Benzoic acid is also effective.

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Systemic Therapy

- Cats can be treated with itraconazole (5 mg/kg, PO, once daily on a week on/week off schedule). Most infections are resolved after 3 or 4 cycles. Itraconazole is considered fungistatic at low doses and fungicidal at high doses.
- Alternatives like terbinafine (10–30mg/kg) and griseofulvin (10–30mg/kg) can also be given depending upon the availability.

Points to keep in mind while choosing drugs for the therapy:

- Ketoconazole should not be used in cats because it causes anorexia.
- Fluconazole should not be used because this is the least effective drug for dermatophytes.
- Griseofulvin is no longer recommended because itraconazole and terbinafine are superior drugs.

Prognosis

- Dermatophytosis carries a good prognosis for cure; however, treatment can be frustrating in multi-animal households where environmental contamination is prevalent. It is important to look for underlying causes of infection and initiate treatment if the disease is ongoing (e.g., allergies, stress, immunocompromise, etc.).
- Although Clinical cure does not always equate to mycological cure. Thus, hair regrowth and the clinical appearance of the patient may not be sufficient criteria for decisions about duration of treatment. It is currently recommended that monitoring therapy and establishing whether a patient is completely cured should be based on a combination of resolution of clinical signs and a negative fungal culture. Extent of infection can be monitored by performing weekly cultures.

Public Health Significance

Dermatophytosis is a zoonotic disease and we as veterinarians have a responsibility to inform clients of this risk. Following things should be cleared to the clients once the infection is confirmed.

- Dermatophytosis is a low-level zoonotic disease as it is treatable and not life threatening.
- Dermatophytosis is a common skin disease in humans, commonly referred to as ‘toe nail fungus’ or ‘athlete’s foot fungus’.
- Transmission from animals to people is via direct contact with lesions.
- In animals, dermatophytosis is treatable and curable thus, euthanasia is not necessary.

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Prevention

Prevention includes environmental elimination of the fungal spores. Spores do not multiply in the environment as they are normal dormant life stage of dermatophytes and other microorganisms which can easily be eliminated from the environment. Removal of organic material and hair followed by washing of the surface (bed sheets, sofas, cat beds, etc) with a detergent until visibly clear is the most important step for environmental cleaning/disinfection. Thorough cleaning once or twice a week is adequate.

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Popular Article

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Telomerase Biology in Animal Cancers

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Cancer is a terrifying word in the mind of human beings. Over the past three decades, tremendous progress has been made in our understanding of cancer. The development of molecular biology has given researchers more motivation to understand the nuanced and intricate molecular processes involved in carcinogenesis, opening up the possibility of creating novel diagnostic and treatment approaches. By devoted study and the persistent efforts of oncologists around the world, many of the complexities of this particular disease are still being ironed out.

Telomeres are specialized nucleoprotein structures at the ends of eukaryotic chromosomes that are crucial for stable chromosome maintenance. These telomeres comprised up of multiple kilobases of repeating, simple sequences (TTAGGG), as well as accompanying proteins that attach to these repeating sequences. The repeat sequences of telomeres are conserved among the species. Telomeres capping the chromosome termini are essential to avoid abnormal recombination and end-to-end fusions, safeguard chromosomes against exonucleolytic (DNA) degradation, and preserve nuclear integrity. Telomeres may also play a role in the control of genes at distant loci.

It has been demonstrated that telomeres shorten with each cell division *in vitro* and with increasing age *in vivo*. Telomere shortening might serve as a mitotic clock that counts the number of divisions a cell can undergo. This telomere shortening is thought to be caused by a lack of activity of an enzyme called telomerase. This telomerase activity is frequently detected in cancer cells from a wide range of human and animal tumors. Cancer cells, on the other hand, have shorter but more stable telomeres than normal cells. This suggests that telomeres have been gradually shortening with each cancer cell division until a certain point, at which point either some mechanism led to the commencement of their maintenance or the cells died. In the latter case, cancer cells would experience

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terminal growth arrest, tumor stasis, and regression called cellular senescence.

Telomerase has emerged as a near universal marker of malignancy and has thus become an obvious diagnostic and therapeutic target because it is commonly expressed in a wide variety of cancers. The frequent presence of telomerase activity in a range of normal cells and tissues may put a cap on the use of telomerase as a cancer diagnostic. The majority of normal mammalian brain cells are post-mitotic, and there is no telomerase expression. As a result, telomerase activity in brain tumors is a useful diagnostic sign. However, the brain tissue appears to be unique in this regard. Fortunately, it is also discovered that benign neoplastic tumors lack telomerase activity. Although the extent to which telomerase expression is particular to the malignant state and the period of cancer growth during which it is activated is critical, for using telomerase as a diagnostic tool. The presence of telomerase in epithelial stem cells has produced conflicting outcomes in conditions such colonic adenomas, esophageal, cervix, and pre-menopausal endometrium, cervix, colon, and tissues harboring activated lymphocytes.

Detection techniques for telomerase and telomere:

Telomerase and telomere	Detection techniques
Telomerase activity	TRAP assay
Telomerase gene expression	Northern blot Nuclease protection assay RT-PCR In situ hybridization immunohistochemistry
Telomere length	Southern blot In situ hybridization Flow cytometry
Senescence-like phenotype	SA b-galactosidase activity P16 expression P21 expression

In veterinary oncology, the use of telomerase activity assays such the TRAP (telomere repeat amplification protocol) and TRAP-ELIDA assays is still in its infancy. Even the confirmatory study showing the presence of TTAGGG repeat sequences in bovine embryo chromosomes and telomerase activity in embryonic developing stage was published in 1999, which is astonishing. The research on the use of telomerase as a diagnostic marker for animal neoplasms, however, just began to appear in 1996. The majority of telomerase research in animals are carried out in canine cancers using the TRAP assay. It is noteworthy that this marker demonstrated significantly higher sensitivity (88% - 95%) in animal tumors than in human tumors. A study reported that telomerase activity was shown to be less

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specific (83%) than cytological examination (100%). Considering the piece-meal but promising reports, one should be optimistic that telomerase as a diagnostic marker in veterinary oncology holds promise for the future.

Telomerase activity in animal cancer diagnosis:

Tumors	Species
Malignant melanomers	Dog, pig, horse, opossum and man
Canine venereal tumours, canine mammary tumors, canine perianal tumors, equine wart, bovine bladder cancer	Dog, cattle and horse
Malignant and benign tumors	Dog
Mammary tumors, skin and oral cavity tumors, vascular tumors, Sertoli cell tumors	Dog
Benign and malignant mixed tumors, adenocarcinoma	Dog

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PPR disease in small Ruminants: An Emerging Viral Disease

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Abstract

A serious threat to the world's livestock populations has emerged from the extremely contagious viral disease known as *Peste des Petits Ruminants* (PPR), which affects small ruminants. The current state of PPR as a newly developing viral illness in small ruminants is discussed in this abstract, with particular emphasis on how it affects animal health, human livelihoods, and global food security. The scientific and veterinary societies are paying more and more attention to it because of its quick spread throughout continents, especially in Africa, Asia, and the Middle East. Most of the farming communities through-out the world rely on small ruminants for their livelihood sustenance as well as nutritional security. Diseases affecting small ruminants like PPR have a direct effect on global food security owing to economic loss pertaining to kid mortality, un-warranted veterinary expenses and reduced body weight gain. Although there has been significant progress in controlling PPR, obstacles still remain in the form of vaccine coverage issues, a lack of resources in endemic areas, and potential vaccine escape mutations. In order to stop the emergence and spread of PPR in small ruminants and ultimately ensure the welfare of both animals and people in affected areas, it is crucial that governments, international organizations, and the scientific and veterinary communities continue their research and collaborate.

Introduction

The viral disease *Peste des Petits Ruminants* (PPR), also known as sheep and goat plague, has become a serious concern for livestock owners and veterinary professionals all over the world. PPR has consequences for ruminant populations that cross international borders, making it a serious worldwide threat. India, a country where the livestock industry forms a crucial economic pillar, is now included in the dangerous threat's menacing reach.

Overview regarding prevalence in the global as well as India context

PPR began in Côte d'Ivoire in the early 1940s and has since spread its evil influence throughout more than 70 nations in Africa, the Middle East, Asia, and Europe. The Morbillivirus genus contains the etiological agent of PPR, which has genetic connections with the human measles virus. PPR hangs

over India's huge cattle industry, one of the biggest on the planet. Numerous Indian states have acknowledged its pernicious presence, which has sparked a crisis that not only threatens the lives of numerous farmers but also calls into question the country's food security.

Clinical Signs

PPR's clinical symptoms are undoubtedly concerning. Animals with the condition frequently display signs like pyrexia, nasal discharge, chronic coughing, and severe respiratory distress. Conjunctivitis, copious diarrhea, and severe oral sores are some of the cruel side effects, the illness brutally inflicts upon its helpless victims as it advances. PPR's attack goes beyond the aforementioned illnesses; it also cripples milk production and sets off a chain reaction of reproductive abnormalities. PPR's lethality can appear in the most heinous cases with a remorseless mortality rate that soars as high as 90%, transforming it into an unyielding enemy for small ruminant populations. The involvement of both digestive as well as respiratory system in this disease is much prounced, justifying its popular name as pneumo-enteritis complex.

Pathology

Gross Lesions

1. **Oral Lesions**: PPR frequently starts with lesions in the oral cavity, such as erosions, ulcers, and necrosis on the gums, tongue, and inner surface of the lips.
2. **Respiratory Lesions**: Animals with the condition may experience nasal discharge, congestion, and passageway erosions. Lungs can develop pneumonia, edema, and congestion. Antero-ventral consolidation of lung is more prounced.
3. **Digestive System**: There are also lesions in the digestive system that can cause inflammation and ulceration in the stomach and intestines. Animals exposed to the problem might get sick.
4. **Lymph Nodes**: Mesenteric lymph nodes, in particular, are frequently found to be enlarged and edematous. These lymph nodes could look enlarged and have bleeding.
5. **Eyes**: It's possible to see ocular lesions like conjunctivitis and corneal opacity, which can cause ocular discharge and occasionally blindness.
6. **Skin Conditions**: PPR-affected animals may develop skin conditions like hyperemia (redness), erosions, and necrosis. The skin can also develop crusts and scabs.
7. **Other Organs**: The liver and spleen may also exhibit lesions in severe cases.

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Microscopic Lesions

1. **Lesions of the Oral and Nasal Tracts:** Microscopic examination of lesions of the oral and nasal tracts typically reveals epithelial cell necrosis, ulceration, and the presence of syncytial cells (large multinucleated cells) brought on by viral infection.
2. **Respiratory Lesions:** Infected cells may have viral inclusion bodies present as well as lymphocytic infiltration, alveolar damage, and interstitial pneumonia in the lungs.
3. **Gastrointestinal Tract:** The mucosal lining of the stomach and intestines exhibits villous atrophy, inflammatory cell infiltration, and necrosis.
4. **Lymph Nodes:** Lymphoid depletion and necrosis, primarily affecting the follicular regions, can be seen in the lymph nodes.
5. **Eyes:** Conjunctivitis, keratitis, and corneal opacity with infiltration of inflammatory cells may be found upon histological examination of ocular tissues.
6. **Skin:** Epidermal hyperplasia, keratinocyte necrosis, and the presence of viral inclusion bodies are characteristics of skin lesions.

Conclusion

Peste des Petits Ruminants is a global threat to the small ruminant sector, including India, and crosses national boundaries. A harsh reality is the disastrous toll it takes on small ruminant productivity and health. Despite the fact that vaccinations have become the miracle cure, obstacles still stand in the way of obtaining universal immunization coverage, especially in the most remote regions of the globe. A strong collaboration between governments, veterinarians, and livestock keepers is necessary to combat PPR. Promoting strong biosecurity standards, beginning broad vaccination efforts, and raising public awareness of the disease's seriousness are all crucial first steps in reducing PPR's devastating effects. In addition to preserving the health and vigor of small ruminants, the implementation of these measures strengthens rural livelihoods and safeguards the foundation of food security in the face of this tenacious viral foe. In the global arena, collaboration is essential for mobilizing resources and expertise to manage and eventually eradicate PPR. The achievement of such a worthy goal lays the path for small ruminant populations and the people who depend on them to have a better and healthier future. We can only expect to halt the spread of this new viral plague and guarantee a prosperous future for our animals through unflinching devotion with an aim of doubling the farmer's income by 2030.

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Gain in Dairy Economy hangs around Age at First Calving (AFC) and Calving Interval (CI)

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Dairy farming which is practiced in India from time immemorial plays a significant part in Indian ruraleconomy. The input of dairy farming is revolving around the economic traits of cattle and buffalo, whichmajorly includes age at first calving and calving interval. Due to negative correlation between milk yieldand fertility, selection for high milk yield in dairy animals eventually lead to low reproductive performance (decline in fertility). The profitability will remain as a far approach in the absence of regularbreeding and calving at the appropriate time.

The quality of the stock management is determined majorly by the AFC and CI, so they are called the key indicators of quality of stock management. Reproduction is an important consideration in the economics of dairy farming. Reproductive efficiency which means the greater number of calves during lifetime, so that life time production is increased, is measured using AFC and CI. Healthy calf each year, which is the goal of dairy farming, can only be achieved by incorporation of managemental practices thatcontrol AFC and CI.

Age at first calving

It is the age of the female animal when it calves for the first time or a period that female calf needs to reach puberty and to reproduce for first time. The desirable age at first calving for Indian cattle breeds is 3 years, cross breed cattle is 2 years and for buffaloes it is 3½ years. It varies from breed to breed- AFC of Holstein Friesian and Jersy is 22 months while that of Brown Swiss and Ayrshire is 23 months.Optimum AFC is 22 -25 months in cattle.

Factors affecting AFC

Role of nutrition in controlling AFC is vital. Cows with good body condition attain puberty earlier lowering first calving age. Provision for good feed with proper proportion of mineral mixture, concentrateand forage and adequate water help to attain desired body weight and maturity at early age. Genetic potential of the animal is the other factor which determines AFC, so there in variation

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between breeds pertaining to AFC. Age at first mating and number of services per conception have positive associationwith AFC. Effect of season is noticed where calves born in south west monsoon were youngest at first calving while the calves born in summer were oldest. AFC is extended by the incidence of diseases.

Effects of varying AFC

Milk yield

Prolonged AFC will have high production at first lactation but there will be decrease life time production due to a smaller number of calvings. There is also reduction in milk persistency due to prolonged AFC. Early first calving is associated with decreased first lactation yield and milk fat percentage. Age at first calving has positive genetic correlation with days to attain peak yield but AFC has negative correlation with milk yield per day of lactation. Reduction in AFC can be achieved by selection based onmilk yield per day of lactation which also led to increase of milk yield per day of lactation. Fertility: More fertility is reported in heifers that conceive early and give birth at younger age and they may also have shorter caving interval. The positive and intermediate genetic correlation between AFC and CI indicate that CI is increased by increase in AFC with consequent increase in service period. Higher risk of dystocia is associated with both smaller heifers and old heifers. Dystocia with early AFC is attributed to decreased pelvic size. Increased risk of dystocia with delayed AFC is due to increasein calf birth weight.

Longeitivity

Extended AFC are commonly related to reproductive problems, which is the reason for greater culling risk for animals with more AFC. Longer the lifetime of cows means the return over feed cost is greater and smaller the percentage of cows needed for replacement every year.

Economic returns

Reducing AFC reduces feed cost and lead to early return on investment which in turn reduces the replacement expenses. Higher economic returns can be obtained when AFC is in optimum interval.

In evaluation of sire experiments, the progeny tests of sampling bulls are carried out earlier by loweringAFC. As decreasing AFC, reduces generation interval which has positive effect on genetic progress and a greater number of calves per cow can be obtained. If the age at first calving is below optimum, calves areborn weak and are also prone to infections. In similarity with other economic traits, AFC also has low heritability and is influenced by environment factors.

Calving Interval

It is the period between two successive calving's. It is the best index to measure reproductive efficiencyof cattle herd. One calf a year is more profitable in cattle, while it is one calf for every 15 months in buffaloes. Caving interval can be divided into 3 periods:

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i) Gestation period - the period between successful conception to calving

ii) Postpartum anestrus- period date of calving to estrus

iii) Service period- date calving to next successful conception. Heritability OF calving interval is low indicating thatthey do not have good response to selection.

Causes of variation in CI

Nutrition

Estrus and ovarian activity depend on the availability of nutrients. Proper nutrition after calving reduces the service period and thus shortens CI. The good nutrition availability leads to earlier establishment of estrus activity.

Season

The total requirement for maintenance, growth, lactation of cows calving in dry season is met by improved nutritional conditions in the subsequent rainy season, so they have less CI than calves bornat wet season.

Time of mating

The ovum released from the graafian follicle in cow is capable of fertilization only for aperiod 5- 10 hours. So, for effective fertilization, the time of mating in relation to ovulation is important.If not inseminated at proper time, there is no fertilization which leads to lengthening of CI by 21 days foreach late insemination.

Percent of fertilization

CI is increased if fertilization of ova fails due to too early or late service or insemination so that sperms and eggs do not meet at proper time, no fertilization occurs. The other causesof failure of fertilization are low viability of semen, ovulation failure, uterine infections.

Genetics

Even best feed and management cannot meet performance beyond the genetic limit of animal. CI of Gir is 18 months and Brown Swiss 20.3 months. Longer calving interval of Brown Swiss indicates lack of adaptation to humid environment. Sex of the calf born also influences the interval of calvingwhere the cows with female calf have shorter calving interval than cow with male calf. Days open: To achieve optimum calving interval of 12 months in cattle, the days open should not exceed80-85 days and ovarian activity should be re-established soon after calving. It also requires high conception rates.

In the absence of diseases that affect reproduction the calving interval will be reduced. Faster uterine involution shortens CI as it helps to bring back the ovulation activity and makes animal ready for next conception. Suckling delays uterine involution which in turn extends CI.

Factors influenced by CI

Total number of calving's is reduced if the calving interval is more, which in turn leads to

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reduction in total milk production of life time. Loss of production due to prolonged calving intervals leads to economic losses. Breeding efficiency will be greatly improved by lowering the calving interval. Breedingof females at lower age and rebreeding at earliest chance after each pregnancy results in increased lifetimeefficiency. A major role is also played by calving interval in profitability of farm by reducing the additional cost on the system if a cow calves for every 365 days. Longer calving interval leads to decreasein life time profit. The cause for economic losses due to prolonged calving interval lies in the fact that itincludes increased insemination cost, reduced return from calves born and high replacement costs.

Managemental practices to improve Calving Interval

Accurate breeding records of dates of heat, service and parturition should be maintained. Female animalmust be carefully observed for heat symptoms. If the cattle do not exhibit heat symptoms even after 30 months get examined by a vet. Cows need to bred or inseminated cows near the end of heat period. Estrussynchronization with different hormonal protocols and fixed time artificial insemination can practice reduces calving interval. When the animal is not conceived even after 3 services, getting the animal examined by a veterinarian. After 60 days of insemination, get animal checked for pregnancy. Effective measures should be implementation for controlling parasites and prevention of diseases. Timely vaccination of animals against diseases has to be done. Animals should be selected against infertility. Buying replacement stock from healthy herds only and testing them before introducing into herd. Balanced nutrition and adequate waterneed to be supplied. General programs of sanitation should be followed. There should be provision of comfortable environmentto exploit the full genetic potential of the animals. Stress conditions should be minimized to the maximumextent. Veterinarian assistance should be taken in management of infertility problems.

Conclusion

AFC and CI are the key parameters to measure in dairy cattle. Ideal AFC and CI help to optimize long term milk yield, fertility and longevity within herd. Optimum AFC and CI reduces the period in which heifer is only a capital drain on farm resources which in turn reduces rearing costs. Highest economic returns can be achieved by implementing proper managemental strategies to improve AFC and CI, as they influence the major source of income to farm i.e., the milk production per year and life time milk production. High and multidimensional benefits of AFC can be obtained by reducing AFC to the extentthat it is not harm reproduction efficiency with proper modification of rearing programs. Potentialityto lower risk of dystocia, to get higher lactation performance, shorten length of calving interval lies in controlling AFC.A major role is played by AFC and CI in lowering the cost of rearing replacements in a dairy herd.

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Guinea Pig: Nutritional Requirements, Feed Habits, Food Patterns, Digestive Structure, Functions and Feeding

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The domestic guinea pig (also commonly called the cavy after its scientific name) is a species ofrodent belonging to the family caviidae and the genus cavia. Despite their common name, these animals are not pigs nor do they come from guinea. They originated in Andes (present day Peru,Argentina, and Brazil). They are used in research mainly for production of sera, vaccines and other biological products. They are used as models for human disease conditions such as juvenile diabetes, tuberculosis, scurvy, and pregnancy complications. They are important for diagnostic reasons due to its high susceptibility to infectious diseases like diphtheria, leptospirosis and brucellosis.

Table 1. General characteristics of Guinea pig

Characteristic	Guinea pig
Scientific name	Cavia porcellus
Birth weight	85-90g
Litter size	3-4
Adult male	Boar
Adult female	sow
Mature wt	800-1200g (male) 700-900g (female)
Gestation period	59-72 days
Weaning age	14-21 days
Feed intake by adult animal	30-60g/day

BEHAVIOR

Resistance to Environmental and Dietary Change: Guinea pigs are indeed sensitive to changes in their environment and diet. It's crucial to establish a proper diet early in their life and maintain

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consistency. Sudden changes can lead to stress, depression, and a refusal to eat.

Social Nature: Guinea pigs are social animals and often prefer the company of other guinea pigs. When housing them together, it's essential to monitor their interactions for signs of aggression to ensure their well-being. If they are kept alone, they will need extra playtime and attention from their human companions to prevent loneliness and boredom.

Fear Response: Guinea pigs have a unique fear response, which involves freezing or making an explosive attempt to escape when frightened. This behavior is different from the typical "fight or flight" response seen in many other animals.

Coprophagia: While it might seem unusual, coprophagia (eating their own feces) is a normal and necessary behavior for guinea pigs. This process allows them to obtain valuable nutrients that can only be absorbed through the digestive system's two-pass method

DIGESTIVE PHYSIOLOGY

- They have a simple stomach lined with glandular epithelium.
- It has large semicircular caecum with numerous lateral pouches
- In caecum, synthesis of B vitamins and indispensable amino acids occur by
- microorganisms and recycling of intestinal contents by coprophagy.
- Intestine contains predominantly gram-positive bacteria

The guinea pig is widely recognized in the realm of nutrition due to its unique requirement for dietary vitamin C. This distinctive characteristic has rendered guinea pigs valuable subjects for research in areas such as collagen biosynthesis, wound healing, and bone growth. Additionally, young guinea pigs have a relatively heightened dietary need for arginine and folic acid. In its natural habitat, the guinea pig is a herbivore, primarily consuming plant-based foods. Its molar teeth are particularly adapted for grinding, much like other rodent species. Notably, the incisors of guinea pigs continue to grow continuously throughout their lives, similar to rats, mice, and rabbits.

The guinea pig possesses a simple stomach, completely lined with glandular epithelium. Furthermore, it boasts a sizable, semicircular caecum equipped with numerous lateral pouches, akin to that of rabbits. This caecum plays a vital role in various digestive functions, including the synthesis of B vitamins and indispensable amino acids by microbial organisms, as well as the recycling of intestinal contents through coprophagy.

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Table 2. Recommended Greens and Vegetables

Kale	Kale	Kale
Parsley	Parsley	Parsley
Collard Greens	Collard Greens	Collard Greens
Broccoli heads and leaves	Broccoli heads and leaves	Broccoli heads and leaves
Beet greens	Beet greens	Beet greens
Spinach	Spinach	Spinach

Table 3. Recommended Treat Foods (Fed in moderation):

Strawberries	Strawberries	Strawberries
Raspberries	Raspberries	Raspberries
Orange	Orange	Orange
Honeydew melon	Honeydew melon	Honeydew melon

Nutrient Requirements

Variation in requirements can occur as a consequence of several factors such as developmentalstage, reproductive activity, age, gender, strain etc.

Energy requirements

The guinea pig can utilize fibrous feed stuffs more efficiently than mice and rats. The guinea pig is a hindgut fermenter and can derive energy from fermentation of fibrous material in caecum. The maintenance energy requirement of guinea pig is 136 kcal ME/$BW^{.75}$/day. Sucrose, glucose, lactose and starch have been used as primary energy sources in purified diets for guinea pigs.

Protein requirements

Diets that provide 18-20% protein result in satisfactory reproduction. 30% of protein requirement should come from animal protein sources like skimmed milk powder, fishmeal etc. The clinical signs of protein deficiency are similar to kwashiorkor syndrome including reduced activity, mild hair loss and extensive oedema of face and forelimbs. Thus, guinea pigs are suitable models for the study of human protein calorie malnutrition.

Essential fatty acids: - Essential fatty acids required as linoleic acid, 4 g/ kg of dry diet is added. Deficiency of essential fatty acids results in retardation of growth, dermatitis and poor growth of fur.

Vitamins in guinea pig`s diet

Vitamin A: - Beta carotene is used by guinea pig as a source of vitamin A but it`s efficiency is only 40% that of preformed vitamin A. Diets containing 6.6 mg retinol / kg diet maintained optimal health and slightly positive vitamin A balance in guinea pigs . Vitamin A deficiency leads to poor growth, weight loss and corneal opacity.

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Vitamin C: - They require dietary source of vitamin C due to lack of enzyme L- gulonolactone oxidase. As per BIS specification, vitamin C requirement is 200 mg / kg compounded feed. Early signs of vitamin C deficiency in guinea pigs include reduced feed intake, weight loss, anemia and widespread hemorrhages. (Vitamin C deficiency cause impaired clotting mechanism)

Vitamin D: - not much effect if the ratio of Ca: P is satisfactory.

Vitamin E: - It is required for reproduction. It is desirable to supplement vitamin E 0.15 mg / animal per day.

FEEDING OF GUINEA PIG

Young ones are born with full coat of hair with their eyes open. Within few hours, they will be running around, nibbling leafy materials. Newborn animals can consume semisolid and solid food immediately although weaning is followed around 3 weeks of age. Guinea pig normally gains 5 -7 g/day during rapid growth period when allowed to eat *adlibitum*. Growth slows after 2 months and maturity is reached about 5 months. Weight gain can continue until 12-15 months of age.

FEEDING RATE

Growing animal: - 20-30g

Adult: - 30-50 g

Pregnant and lactating: -40-60 g

Table 4. BIS SPECIFICATION FOR COMPOUNDED FEEDS FOR GUINEA PIG

Parameter	Quantity
Moisture (max)	10%
Crude Protein (min)	22%
Ether Extract (min)	4%
Crude Fibre (max)	9-14%
Total Ash (max)	9%
AIA (max)	1%
Calcium (min)	1.2%
Phosphorous (min)	0.6%
Vitamin C (mg/kg diet)	200mg

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Recent Advancements in Commercial Poultry Breeding

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Advancements in genetics have enabled simultaneous improvements in multiple traits, and ongoing investments aim to enhance measurement accuracy to further improve breeding outcomes. Breeding companies play a vital role in managing genetic resources to produce animals with predictable performance and high health standards. This implies a commitment to producing poultry that meet specific criteria for performance and health. To avoid inbreeding and ensure the long-term sustainability of breeding programs, it is crucial to maintain sufficient population sizes. This helps preserve genetic variation, which is essential for making genetic improvements over time.

Over the last twenty years, there have been significant developments in the field of genetics, particularly in the ability of breeding programs to bring about coordinated improvements in multiple traits simultaneously. This means that selective breeding can lead to animals with better skeletal quality, heart and lung function, growth, feed efficiency, and reduced incidences of skeletal defects and ascites all at once. Breeding companies are investing heavily in improving the accuracy and relevance of the measurements they use in their programs. This increased precision in data collection allows for more efficient and accurate selection of animals based on their genetic traits, which, in turn, leads to progress in various desired traits.

Welfare Traits:

Poultry breeding companies recognize their responsibility to ensure the welfare of the animals they breed. This involves not only focusing on traits that enhance productivity but also on traits that contribute to the well-being of the birds. For example, in the case of layers, group selection methodologies have been implemented to address issues related to the livability of birds when housed together in populations. By reducing aggression within groups, breeders have been able to simultaneously improve both the welfare and productivity of layers. This approach underscores the

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importance of balancing productivity goals with the welfare of the animals.

Robustness:

Poultry production encompasses a wide range of environments and challenges, including variations in environmental conditions, nutritional requirements, and disease pressures. To ensure the success of their breeding programs, companies are now selecting for robustness in their poultry breeds. Robustness refers to the ability of birds to perform consistently well across diverse environments and under various stressors. A crucial aspect of this is selecting for disease resistance, as disease challenges are a primary concern in poultry production. Additionally, changes in production systems, such as transitioning from traditional cages to non-cage systems, necessitate that birds continue to perform predictably under these new conditions.

Genomics:

Advancements in genomics have had a profound impact on poultry breeding. The sequencing of the chicken genome has provided breeders with a wealth of genetic information. This includes the identification of over three million single nucleotide polymorphisms (SNPs) across the genome. This genomic data has enabled breeders to establish associations between specific genetic markers and desirable traits. As a result, selection for multiple traits has become more accurate. However, it's important to note that genomics is not intended to replace traditional selection methods but rather to enhance them. Genomic information allows breeders to better understand the genetic variation within populations and make more precise selection decisions.

Ethics:

Breeding companies in the poultry industry hold a significant role in ensuring ethical practices. They influence various aspects of the industry, including food safety, animal health, animal welfare, and food supply security. Ethical considerations extend to the sustainable management and conservation of genetic resources. As breeding companies continue to expand their product offerings to meet different production systems and consumer demands, they must operate within an ethical framework. This includes giving due attention to animal health, welfare, and the efficient utilization of resources. The ultimate goal is to achieve balanced and rapid genetic progress while upholding ethical standards.

Molecular Tools:

Modern molecular tools have provided powerful means to preserve the genetic diversity of endangered poultry breeds. These tools, including DNA profiling techniques and DNA fingerprinting using VNTR sequences, allow for the efficient evaluation of genetic worth and the maintenance of endangered breeds without further erosion of genetic variability. By utilizing DNA fingerprinting, breeders can determine genetic relatedness between individuals and breeds. This information aids in estimating population parameters such as average heterozygosity and the coefficient of genetic

differentiation. These tools empower breeders to design custom breeding programs for the conservation of endangered poultry breeds based on scientific principles.

Broiler and Layer Improvements:

In the poultry industry, significant advancements have been made in improving both broiler and layer characteristics. Modern broilers have demonstrated remarkable growth rates, with the ability to reach market weight in a fraction of the time compared to vintage broilers. These improvements are largely attributed to genetic enhancements, which have contributed to faster growth, higher carcass yield, and improved feed efficiency. However, these positive changes have come with challenges, including an increased incidence of skeletal problems, elevated mortality due to physiological changes, and issues related to reproductive fitness. For modern broilers, the management of excess fatness, which can affect reproductive fitness, involves feed restriction programs.

In contrast, modern layers have shown substantial improvements in egg production, egg mass, egg weight, and feed efficiency over the years. Despite these advancements, certain aspects like eggshell strength and albumen quality have remained relatively stable. The selection focus in layer breeding primarily revolves around fitness traits, which has helped avoid some of the issues seen in broilers. However, the pace of change in layer genetics has generally been slower than in broilers.

Conclusion

Poultry breeding is a complex field that requires a delicate balance between improving productivity, ensuring animal welfare, and upholding ethical standards. Advancements in genetics and breeding practices have transformed the poultry industry, enabling breeders to achieve holistic improvements in multiple traits while ensuring the welfare of the birds. Ethical considerations, robustness, and the integration of genomics and molecular tools contribute to responsible and sustainable poultry breeding practices. These advancements are crucial for meeting the demands of modern poultry production while upholding ethical standards and ensuring the well-being of the animals.

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Success Story
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A Success Story of Sri Krishna Priya Nursery: Journey from Passion to Profession

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Abstract

Nursery raising is one of the fastest growing businesses in agriculture and allied sector. Keeping in view the demand for ornamental plants, and flowers, the sector today offers immense opportunities for self-employment. The present success story focuses on the story of Mr. Ramkishore singh, who is engaged in nursery raising enterprise. The nursery offers a wide variety of eco-friendly organic plants and fruits.

Keywords: Nursery raising, fruit, ornamental plant, business

Introduction

Nursery raising as a profitable business has developed rapidly in the recent years. A nursery is an area in which seedlings are grown to be transplanted in other area. During the last few years there has been a high demand of horticultural crops specially the fruits and ornamental crops in urban as well as rural area. As a result of which the business of nursery raising became a lucrative one for others as these lead to the increase in demand of high-quality planting materials. This increased

Figure 1: Mr. Ramkishore Singh at his Nursery

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demand for ornamental and fruit plants motivated Mr. Ramkishore Singh to transform his hobby into business. He has started his own business of nursery raising in the year of 2011.

The Nursery Business

Mr Singh, 63 years old man, belongs to Binda village, which is situated in the Musahri subdivision of Muzaffarpur district. He lived in the village with his family. He is graduated from the subject of History but his interest is more towards gardening. His grandfather and whole family were engaged in farming. His grandfather had an orchard in the area of 7 acres. Since his childhood, gardening was his hobby. He was grown up by seeing the maintenance of orchard and learning by seeing is one of the important methods of extending our skill. He has started gardening and flowering when he was only 15 years old. Gradually what started as a hobby became his passion and the passion became his profession 'a source of earning'.

Figure 2: Various types of Cactus Plants

In the year of 2011, he started his hobby of nursery raising as a business. He started 'Sri Krishna Priya Nursery' at Rohua, Bela, Muzaffarpur. This nursery supplies ornamental plants, flowers and fruit plants. It includes mainly the various variety of mangoes including sugar free mangoes i.e. a kind of mango variety which is low in glucose and ideal for diabetic patients, show plants and seedlings of seasonal plants and flowers. This year he introduced a new variety of mango in his nursery i.e., Red Royal Mango. The nursery also has a wide variety of cactus plants.

A successful enterprise:

Mr. Singh uses vermicompost as an organic fertilizer for the flowers and other plants. He believes that utilization of vermicompost will improve the quality of the seed and plants as well and hence will be more environment friendly. He uses the dung from the cattle to produce vermicompost. At present he is having 5 cattles. He also sales the vermicompost. He also had developed polyhouse for the purpose of flowers and fruits cultivation. In every month on 6th and 7th he puts seeds/ planting materials for plantation of flowers. The business records approx. ₹100000 sales from nursery from March to August. During this season on an average, he requires 6 labors the cost of which came around ₹400 per laborer approximately 10000 is his miscellaneous expenditure during this season. Hence the earning during this period comes around ₹40000 per months from the nursery business. During the peak season i.e., generally from September to February the sale from nursery business comes around ₹200000 to ₹250000 approximately, the labor during the peak season increases from 10-15 approx. The average turnover that he earns from the flower business is 50000-60000 approximately. Mr Singh

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has also received prize for his sugar free mango in 2021 in the '*aam pradarshini' held in patna.*

Figure 3: A View of Sri Krishna Priya Nursery

Conclusion

Nursery Raising is a business that could be started by anyone having proper knowledge of plants. It is one of the profitable enterprises and could fetch decent income provided the tasks related to plantation and other related activities are timely executed. Proper management of nursery is the prerequisite for the success of the enterprise. Mr. Singh has achieved the success with the knowledge of proper management of plants.

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Authors' own compilation

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Nutritional strategies to prevent urolithiasis in canines

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Abstract

Urolithiasis is a common problem in canines where nutrition acts as a significant predisposing factor. The nutritional factors mainly influence urinary constituents and pH, which affect stone nucleation and growth. Non-operative treatment modalities are required to prevent and reduce the risk of recurrent urolithiasis. Medical management is primarily centered on the diet. Careful monitoring throughout is needed. Nutritional management is the best preventive strategy against urolithiasis.

Keywords: Urolithiasis, Nutrition, Canine.

Introduction

The urinary system is designed to eliminate body wastes in liquid form and normal urine is in a state of metastable over saturation (*i.e.* no spontaneous precipitation). Urolithiasis presents a state of unstable over saturation where spontaneous precipitation exists and minerals precipitate, crystals do not dissolve and they add together allowing the growth of urolith (also called urinary stones or calculi). It is a condition of urinary tract in which insoluble mineral and salt concretions develop and aggregate around a nidus of proteinaceous material mainly within the bladder or urethra (Belknap and Pugh, 2002), but can occur anywhere in the urinary tract. Abnormal microscopic precipitates in urine are known as crystalluria whereas macroscopic concretions are called uroliths. Commonly formed stones are struvite, calcium oxalate, calcium phosphate, calcium carbonate and silica. Uric acid, cystine, hippuric acid and tyrosine crystals may also be found. The presence of specific type of crystal depends on the diet and transitory physical and chemical conditions that exist in urine at that time.

Nutritional Management

Struvite Uroliths (Magnesium Ammonium Phosphate)

Struvite uroliths are one of the most common uroliths in dogs. Struvite calculi, especially in dogs, are often associated with infection with urease producing organisms (*Staphylococcus, Proteus*).

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Urease is an enzyme that breaks down urea with the release of ammonium and bicarbonate ions into the urine.

Nutritional aimed at dietary management of struvite uroliths include:

- Dissolution of uroliths within the bladder.
- Preventing formation of reoccurring uroliths or crystals.
- Promotion of an acidic urinary pH.
- Increasing water intake and encouraging frequent urination.

Restricted levels of protein are required (1.47 grams protein/100 kcal ME) for the management of struvite uroliths (Osborne *et al.,* 2000), but a high biological value is needed. The urine acidifying substance in diets designed for struvite dissolution is DL-Methionine, used at a dose rate of 0.5 g/kg of diet (Osborne *et al.,* 2000). The majority of calories obtained from the diet need to be acquired from a non-protein source. Thus, proportionately the carbohydrate and fat levels of ME are increased in these diets. Feeding diets with higher fat content to dogs with hyperlipidemia, pancreatitis or even at-risk groups (such as Schnauzers and Spaniels) is contraindicated.

Decreased amounts of phosphorous (24 mg phosphorus/100 kcal ME) and magnesium (3.3 mg magnesium/100 kcal ME) are present in diets designed to aid urinary tract issues, as these are constituents of struvite urolith (Osborne *et al.,* 2000). Sodium levels are often increased in these diets, in order to increase water intake (23.3 mg sodium/100 kcal ME). The antioxidants, Vitamin E and β-carotene are often supplemented, as they help to reduce oxidative damage and help to combat urolithiasis. As an oxalate precursor, Vitamin C should not be supplemented when feeding diets designed for struvite dissolution.

Calcium Oxalate Uroliths

Calcium oxalates are the second most common uroliths in dogs and most common in cats.

Nutritional aims of dietary management include:

- Promoting an alkaline urinary pH.
- Reducing the amounts of calcium, sodium and oxalates in diet.
- Increasing water consumption and frequency of urination.

For these uroliths to form, the urine must be supersaturated with calcium. Factors that may affect supersaturation of calcium include hypercalcaemia (although serum calcium is often normal) and possibly a diet containing high protein, high calcium and low Vitamin B_6. A decrease in intestinal *Oxalobacter formigenes* bacteria, which metabolise oxalates, has been found in dogs that form oxalate-containing uroliths compared to those that do not (Gnanandarajah *et al.,* 2012). The solubility of calcium oxalate crystals is less directly influenced by urine pH within the physiologic range than struvite stones, but acidosis may increase the amount of calcium released from the bones to buffer the acid, resulting in hypercalciuria. Preventing recurrence includes treatment of any underlying cause of

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hypercalcaemia, concurrent disease (such as hyperadrenocorticism) and increasing water intake to encourage the formation of less concentrated urine. Decreased urine concentration can also be aided by adjusting the diet (and possibly with thiazide diuretics, if necessary). Diuresis (resulting in decreased urine concentration) decreases the risk of calcium oxalate urolithiasis in dogs. The levels of calcium in diet should be restricted, but not reduced, as with levels of sodium. Restricted calcium levels are approximately 0.68% DMB.

Recommended dietary modifications include lower protein diet with levels of 1.6-2.2 g/100 kcal ME have been suggested (Senior, 1989) with adequate, but not excessive, phosphorus, magnesium and potassium. Some researchers have found an increase in dietary sodium, resulting in diuresis, decreases the relative supersaturation of calcium, even though it increases the total excretion. Sodium increases calcium excretion into the urine and a dietary level of 0.1-0.2% sodium DMB or 45-55 mg sodium/100 kcal ME is recommended (Senior, 1989).

Uric Acid/ Urate Uroliths

Urate calculi are formed due to increased excretion of urates or uric acid in urine. Dalmatian dogs and bulldogs have a higher frequency of urate stone formation than other breeds. In normal animals, purines convert to hypoxanthine, which converts to xanthine, then into uric acid, which then converts to allantoin - a soluble end product excreted in urine. In Dalmatians, uric acid is not converted to allantoin, resulting urine that is oversaturated with uric acid and therefore contains higher levels of urates than other breeds (Sorenson and Ling, 1993). Dalmatians also have a lower percentage of renal tubular reabsorption than other breeds, resulting in increased urate excretion. Other risk factors include increased renal excretion of ammonium, low urinary pH and urinary tract infections with urease-producing bacteria - for example, *Staphylococcus, Proteus, Escherichia coli* and *Mycoplasma*, which may increase ammonium ions.

Nutritional aims of dietary management of urate urolithiasis include:

- Restricting protein level.
- Increasing the source of non-protein calories.
- Promoting an alkaline urinary pH.

The diet designed to aid in the management of urate urolithiasis can have overall restricted levels of proteins (1.6-2.2 g protein/100 kcal ME) (Senior, 1989), especially those proteins that contain larger amounts of nucleic acids, as they contain purines, e.g. protein from muscle or organ tissues. Milk proteins (casein) and eggs provide a suitable source, as they contain a lower amount of purines, but also have a high biological value, which is required when a restriction on protein levels is required in the diet.

Allopurinol is a xanthine oxidase inhibitor, which reduces the rate of urate excretion into the urine. It decreases the production of uric acid by inhibiting the conversion of hypoxanthine to xanthine and

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xanthine to uric acid. Allopurinol needs to be added to the diet when dissolution of urate uroliths is required, although checking the dietary manufacturer's guidelines is recommended. A dose rate of 15 mg/kg *per os* (PO) twice daily (BID) should be utilised, although dose rate is dependent on the individual (Osborne *et al.,* 2000).

Cystine Urolithiasis

Cystine uroliths are uncommon in both cats and dogs, but arise due to a metabolic defect where the reabsorption of filtered cystine in the proximal tube is impaired (Bovee, 1984). Once in the urine cystine is very insoluble, especially in acidic urine.

Nutritional aims in the management of cystine uroliths include:

- Promoting an alkaline urinary pH.
- Reducing the amount of cystine produced by body.
- Increasing water consumption and frequency of urination.

A low protein diet is required (9-11% protein DM), as this will aid in the reduction of total daily excretion of cystine. Low sodium levels are also required as sodium excretion can enhance cystine excretion. Low sodium in combination with low protein levels tends to increase the urine volume, which further decreases the urinary concentration of cystine (Lulich *et al.,* 2016). In order to create an alkaline urine pH, supplementation with Potassium citrate (50-100 mg/kg b. wt. PO BID) is required.

Silicate Uroliths

Silicate uroliths are more commonly seen in male dogs (96%) than females (4%) (Osborne *et al.,* 2000), most likely due to females being able to pass smaller uroliths before they can induce clinical signs. Foods that contain large amounts of plant-derived materials are thought to be a predisposing factor for silicate uroliths, another factor being the consumption of soil, as silica in the soil passes through to the plants and is readily absorbed via the intestines.

Dietary management of dogs suffering from silicate uroliths is through prevention. Change of diet to one that does not contain large amounts of plant derived materials and increases the volume of urine produced are the main factors.

Conclusion

Dogs that have suffered from any form of urolithiasis need to have regular urinalysis while on the diet, including pH and having microscopy performed. Client education can be key in prevention in at-risk breeds and those that are over their ideal body condition score. This includes increasing water intake as much as possible in all groups and the frequency of urination.

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Biodiversity and Wildlife Conservation Efforts in India

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Abstract

India, renowned for its astounding biodiversity, faces a complex and multifaceted challenge in the form of wildlife conservation. From the lofty Himalayan peaks to the lush tropical rainforests and arid deserts, India boasts diverse biogeographical regions where unique ecosystems and iconic species thrive. The conservation endeavor in India encompasses a myriad of strategies, policies, and on-ground initiatives. Central to this effort is the establishment of protected areas, including national parks, wildlife sanctuaries, and conservation reserves, where wildlife and their habitats are safeguarded. Key projects such as Project Tiger, Project Elephant, and Project Rhino specifically target the conservation of flagship species. Community engagement, research, and international collaborations play pivotal roles. This article highlights the comprehensive framework for wildlife protection that India has developed, acknowledging the persistent threats posed by habitat loss, poaching, climate change, and human-wildlife conflict. It also provides an overview of the various conservation projects initiated by the Indian government, ranging from Project Dolphin to vulture conservation efforts, showcasing the nation's commitment to preserving its natural heritage.

Keywords: Biodiversity Acts, Biosphere Reserves, National Parks, Project Tiger, Wildlife organizations

Introduction

Wildlife conservation in India is a complex and multifaceted endeavor driven by the urgent need to protect and preserve the nation's rich biodiversity. As one of the world's most biologically diverse countries, India is home to a staggering array of flora and fauna, including iconic species like the Bengal tiger, Asian elephant, Indian rhinoceros, and numerous avian and amphibian species. The conservation of this diverse wildlife is not only a matter of ecological significance but also crucial for maintaining the delicate balance of ecosystems, preserving cultural and historical ties to nature, and ensuring the well-being of future generations.

From the icy deserts of Ladakh and Spiti to the hot deserts of Thar, temperate woods in the Himalayas to the lush green tropical rain forests of the lowlands, ***India is rich in biogeographical***

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regions. Large freshwater bodies in India include the Wular and Manasbal lakes in Kashmir, Chilka lake in Orissa, and Kolleru lake in Andhra Pradesh, as well as the Deccan's rough and rich coastline and coral reefs.

Protected areas:

Ecological/biogeographical zones where wildlife is conserved are known as ***Protected Areas***, wherein poaching is avoided, and their habitats and natural resources are preserved and to maintain biological variety, they have been circumscribed.

Protected areas in India:

According to National Wildlife Database Centre, Wildlife Institute of India, there are 998 protected areas including 106 National Parks, 567 Wildlife Sanctuaries, 105 Conservation Reserves and 220 Community Reserves. In addition, there are 53 Tiger Reserves, 18 Biosphere Reserves and 33 Elephant Reserves.

Table 1: Protected Areas of India (As on December, 2022)

Protected areas (PA)s	No.	Total Area (km^2)	Coverage % of Country
National Parks	106	44,402.95	1.35
Wildlife Sanctuaries	567	1,22,564.86	3.73
Conservation Reserves	105	5,206.55	0.16
Community Reserves	220	1,455.16	0.04
Protected Areas (PAs)	**998**	**1,73,629.52**	**5.28**

National Parks (NP) are strictly protected zones designed to benefit wildlife. They are set aside for the enhancement of wildlife. Cultivation, grazing, forestry operations, and habitat alteration are all prohibited in these areas. In *Sanctuaries (WLS), o*nly the fauna (animals) is protected and wood cutting and private ownership rights, forest product collection, timber harvesting, private property ownership, soil tilling, and other activities are permitted, but interference with the well-being of animals is prohibited. The State Government declares a sanctuary under Section 18(1) of the Wildlife (Protection) Act, 1972, and a national park under Section 35(1) of the Act. The boundaries of a sanctuary are defined at the time of declaration. The boundaries of a national park are well-defined and precise.

Biosphere Reserves*:* The concept of Biosphere Reserves was developed by the UNESCO Man and Biosphere Programme (MAB). Multiple land uses are authorized in the biosphere reserve, which is divided into zones. (i) Human activity is prohibited in the Core Zone. All forestry and harvesting operations are illegal, as is access. It is only permitted to conduct population studies and scientific inquiries. (ii) Human activity is restricted in this Buffer Zone. There is no shooting authorized here, however, professional graziers are not permitted to set up cattle pens. Tourists are permitted to camp. (iii) Manipulation Zone where a wide range of human activities are tolerated, but the ecosystem is not

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to be damaged. (iv) A Restoration Zone is a deteriorated area that is being restored to its natural state. In India, 14 places have been designated as Biosphere Reserves. Nilgiri Biosphere Reserve includes parts of Karnataka, Kerala and Tamil Nadu. It was declared in 1986.

Safari Park is an enclosed park where wild animals are kept in the open, uncaged, to provide natural environment for public viewing. *Zoo* is a section of the park dedicated to displaying wild creatures maintained in cages and artificial habitats. Animals' freedom is limited in this environment. *Zoological Garden is a* place in or near a city where a huge number of mammals, birds, reptiles, fishes, and other animals are displayed in a limited area in small enclosures or cages. It is utilized for public recreation and education. In *Zoological Park,* animals are relatively free and displayed in their natural habitat, with obstacles and restraints hidden from view. *Sanctum Sanctorum* is a sanctuary within a sanctuary, or the inner area of a natural sanctuary or national park, where no forest management or operation is permitted. Even tourists are not permitted to prevent any form of wildlife disturbance.

Conservation of Wildlife

All human activities and efforts aimed at saving wild creatures from extinction are referred to as wildlife conservation. It entails both the conservation and scientific management of wild animals and their surroundings. Some species have gone extinct due to natural reasons, but man's activities pose the biggest threat to biodiversity. Wildlife protection is inextricably linked to the health and improvement of forests. Protection, preservation, and perpetuation of rare plant and animal species in their natural habitats are all part of wildlife conservation.

The conservation of living resources has three distinct goals:

1. To keep vital ecological processes and life-supporting systems running smoothly.
2. To protect species variety.
3. Use of species and ecosystems in a sustainable manner to support rural communities and major industries.

Important methods for the conservation of wildlife in India

Protect wildlife, various sorts of wildlife conservation approaches can be used. Some of the major approaches for wildlife conservation in India include Management of habitat, Establishment of protected area, Awareness to people and Removing superstition from society and by enacting Wildlife conservation laws

Types of Wildlife conservation

Wildlife conservation can be categorized into two interesting phrases namely “in situ conservation” and “ex-situ conservation”. *In situ conservation* protects the imperil animal or plant on site in its natural habitat. Programs like National Parks, Biological Reserves comes under In Situ Conservation and *Ex situ conservation* meaning off-site conservation of wild animals and plants by removing and relocating some part of a population to protected habitat.

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Here are some important steps taken by the Government of India to protect biodiversity in India:

Indian Government came up with the ***Wildlife Protection Act in 1972***, and created several protected Areas like National Parks, Sanctuaries, Conservation Reserves and Community Reserves for protecting wildlife. There's law in place now that punishes those involved in illegal acts such as hunting, poaching.

Table 2. Laws and Acts Passed by Indian Government to Protect Wildlife

Sl. No.	Important Environment and Biodiversity Acts Passed by Indian Government
1	Fisheries Act, 1897
2	Indian Forests Act, 1927
3	Mining And Mineral Development Regulation Act, 1957
4	Prevention of Cruelty to Animals, 1960
5	Wildlife Protection Act, 1972
6	Water (Prevention and Control of Pollution) Act, 1974
7	Forest Conservation Act, 1980
8	Air (Prevention and Control of Pollution) Act, 1981
9	Environment Protection Act, 1986
10	Biological Diversity Act, 2002
11	Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Rights) Act, 2006

Wetland (Conservation and Management) Rules 2010 have been drafted to protect wetlands in India. ***Wildlife Crime Control Bureau*** was established to curb the illegal trade of wildlife and that of endangered species. ***Special organizations*** like Wildlife Institute of India, Bombay Natural History society and Salim Ali Centre for Ornithology and Natural History were setup to conduct research on conservation of wildlife.

Table 3. Wildlife organizations in India championing the cause of wildlife conservation

Sl. No.	Wildlife organizations
1	Wildlife Protection Society of India (WPSI) - New Delhi
2	Wildlife SOS - New Delhi
3	World Wide Fund for Nature (WWF) – New Delhi
4	Aaranyak And Hargila Army - Guwahati
5	Wildlife Trust of India (WTI) - Noida, Uttar Pradesh
6	Wildlife Conservation Society (WCS) – Bengaluru, Karnataka, India
7	Rhino Conservation of India – Assam
8	Sahyadri Nisarga Mitra - Maharashtra

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Important Conservation Projects in India

Project Tiger: This project was launched by the Government of India in 1973, with an initiative for protection and management of the reducing population of the tiger. The Bengal tigers were reducing drastically in their numbers and their habitats too as a result of increasing human activities and advancements. Therefore, in order to protect their habitat and their numbers, project initiative was taken. The project was administered by the National Tiger Conservation Authority.

Project Elephant: Project elephant was launched by the Indian government in 1992 to conserve the number of elephants, maintenance of their habitat, reduce human-animal conflicts, as well as reduce hunting and poaching. *Haathi Mere Saathi* scheme was also launched by the Ministry of Environment, Forest and Climate Change in partnership with wildlife trust of India. *Monitoring of Illegal Killing of Elephants (MIKE) Programme:* Mandated by COP resolution of CITES, MIKE program started in South Asia in the year 2003 to control illegal hunting and killing of elephants.

Crocodile Conservation Project: This project was launched in 1975, at different state levels. The objective of the project was to prevent the habitat destruction of the crocodiles and thus helping to increase their numbers. The hunting and killing of the crocodiles should be monitored. As a result of this initiative, the numbers have been increased from 100 to 1000 till 2012.

UNDP Sea Turtle Conservation Project: It was launched by Ministry of Environment, Forest and Climate Change in collaboration with UNDP in 1999. The Olive Ridley Turtle visits India during Winter. The implementing agency of this project is the Wildlife Institute of India. It is in the Vulnerable in IUCN list.

Project Dolphin: Ministry of Environment, Forest and Climate Change has notified Ganges River Dolphin as National Aquatic animal. It was listed in Schedule I of Wildlife Protection Act 1972. Major threat is river water pollution, poaching and siltation.

Project snow leopard: The Project Snow Leopard is an Indian initiative for strengthening wildlife conservation. in the Himalayan high altitudes. It aims to promote a knowledge-based and adaptive conservation framework that fully involves the local communities, who share the snow leopard's range, in conservation efforts.

Project Hangul: The project for the conservation and protection of Kashmir Stag came to be known as project Hangul and its population increased to 340 by the year 1980. The Rs. 1.677 crore five-year project included artificial breeding of the highly endangered Stag along with other measures for its protection and conservation

Project One Horned Rhino: Assam Forest department and Bodo council are implementing Indian rhino vision 2020 for increasing rhino population to 3000 by 2020 and to distribute them over 7 protected areas for conservation. *Indian rhino vision 2020* implemented by the department of

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environment and forests, Assam. The programme will be supported by WWF — India, the international rhino foundation (IRF), and a number of local NGOs. Translocations are the backbone of the IRV 2020 program.

Vulture Conservation in India: India has nine species of vultures in the world. The population of three species i.e., White-backed Vulture, Slender-billed Vulture and Long- billed Vulture in the wild has declined drastically over the past decade. The decline of Gyps genus in India has been put at 97% by 2005. Due to this evidence, all three vulture species were listed by IUCN, the World Conservation Union, in 2000 as "Critically Endangered". The workshop to prepare an Asian Vulture Recovery Plan held at Parwanoo in Himachal Pradesh, India in February 2004 recommended the establishment of captive holding and captive breeding facilities for three species of Gyps vultures at six different places in South Asia, besides implementing a ban on veterinary use of Diclofenac. These centres would serve as source for reintroduction of the birds after removal of the cause of mortality from the environment.

Indo-Russian Cooperation on Migratory Birds: MoEF has also signed a protocol with Russian counterpart, for conservation of migratory bird species between the two countries. It has been agreed to develop joint projects of mutual interest on migration and nesting behaviour of Siberian Cranes and common cranes and also to exchange scientific and official information on issues relating to wetland management, conservation of avi-fauna etc.

Other Projects: After the success of animal projects, the government has now initiated several new projects for conservation of other endangered animals like, The Himalayan Musk Deer Ecology and Conservation Project, Project Lion and endangered Birds / Pheasant Projects

India Adopts Sawen: The acronym of SAWEN is *South Asia Wildlife Enforcement Network*. It is an intergovernmental wildlife enforcement support body. It is launched in Paro, Bhutan in 2011. It was established for mutual collaboration for harmonizing as well as enforcing the wildlife protection. The SAWEN constitutes Afghanistan, India, Pakistan, Nepal, Bhutan, Bangladesh, Sri Lanka and the Maldives.

Captive Breeding Program: Captive breeding can be described as the selection of wild species and bred in the artificial condition under experts. It may represent the last chance to preserve a species in the wild.

Conclusion

Wildlife conservation in India is a testament to the nation's unwavering dedication to safeguarding its diverse and precious natural heritage. Through a multifaceted approach that includes protected areas, legislative measures, community involvement, and international collaborations, India has made significant progress in mitigating threats to its wildlife. However, the journey is ongoing, and the challenges persist. Continued vigilance, education, and sustainable practices are crucial to ensure the long-term survival of India's remarkable biodiversity, thereby securing a better future for

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both its wildlife and generations to come.

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Overview of Canine Monocytic Ehrlichiosis

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Abstract

Canine monocytic ehrlichiosis is a serious tick-transmitted, globally distributed disease of dogs that is caused by *Ehrlichia canis*. It primarily affects platelets, monocytes, and granulocytes. Acute infections in dogs respond favourably to therapy, however chronic disease results in bone marrow failure and death. The disease can be diagnosed based on clinical manifestations, haematology, microscopy, indirect immunofluorescence test (IFAT), enzyme-linked immunosorbent assay (ELISA) and polymerase chain reaction (PCR). For canine ehrlichiosis, Tetracycline or Doxycycline are usually recommended for a period of 3-4 weeks. Tick prophylaxis is key in preventing canine ehrlichiosis and is best achieved using ectoparasitic drugs that repel and kill ticks before they attach.

Keywords: Canine monocytic ehrlichiosis, Thrombocytopenia, Doxycycline.

INTRODUCTION

Canine monocytic ehrlichiosis also known as Canine haemorrhagic fever, Canine rickettsiosis, Canine typhus, Tracker dog disease and Tropical canine pancytopenia is a tick-transmitted fatal rickettsial disease of domestic dogs and wild canids, caused by an obligate intracellular bacterium, *Ehrlichia canis*. It has tropism for monocytes and macrophages (Azmi *et al.,* 2013). The organisms are transmitted by *Rhipicephalus sanguineus* (brown dog tick) rapidly within 3 hours of tick attachment to dog and can also be transmitted through transfusion of infected blood (Ettinger and Feldman, 2000). These pleomorphic organisms may occur as intracytoplasmic inclusions in circulating monocytes, either singly or in compact colonies called 'morula'. Canine monocytic ehrlichiosis is worldwide in distribution, with a higher frequency in tropical and subtropical regions. The disease affects multiple organs and systems and occurs in acute, sub-acute and chronic phases. Ehrlichiosis is characterized by signs of fever, anorexia, weight loss, lethargy, epistaxis, haemorrhages, edema of hind limbs and scrotum, anaemia and lymphadenopathy. Haematological alterations include thrombocytopenia, leukopenia and hyper-gammaglobulinemia. In canine

ehrlichiosis, there is no predilection of age or sex; however, Siberian Huskies and German Shepherds are more likely to develop severe clinical manifestations. Environmental factors like high temperature and low humidity favour the growth of vectors, so dogs living in such circumstances are at greater risk of disease. Definitive diagnosis involves the demonstration of morulae on cytology and blood smears, detection of antibodies through an indirect immunofluorescence test (IFAT), and DNA amplification by polymerase chain reaction (PCR).

PATHOGENESIS

Infection occurs through salivary secretions of the tick at the site of attachment during ingestion of a blood meal or through blood transfusions. Transmission by *Rhipicephalus sanguineus* is trans-stadial. *Ehrlichia* is thought to occur in three intracellular forms. The initial bodies are small spherical structures that are believed to develop into larger multiple membrane-bound units known as morulae. The morulae are inclusions within the cytoplasm of the leukocyte, they dissociate into small granules called elementary in about 2-4 weeks. The incubation period ranges from 8–20 days. In acute infections, the organism invades and multiplies within circulating mononuclear cells and the mononuclear phagocytes within the liver, spleen, and lymph nodes. The infected cells are then transported in circulation to the rest of the body, particularly to the lungs, kidneys, eyes and meninges. Cells infected with *Ehrlichia* adhere to the vascular endothelium and induce vasculitis which leads to Disseminated intravascular coagulopathy (Bhatia *et al.,* 2010). At this stage, severe clinical manifestations like high fever, anaemia and thrombocytopenia, can be observed. Dogs suffering from persistent infection develop a more lethal form of chronic disease, where the pathogen attacks the bone marrow and destroys the immune system. As a result, other opportunistic infectious agents further aggravate the situation. Severe thrombocytopenia leads to massive hemorrhages and death.

CLINICAL FINDINGS

Canine monocytic ehrlichiosis is characterized by three stages, acute, subclinical and chronic each varying in symptoms depending on the immune system of the dog and existence of co-infections with other tick-borne diseases.

Acute phase

This phase lasts for 3-5 weeks and is characterized by clinical signs of fever, anorexia, lethargy, depression, splenomegaly, lymphadenopathy, severe anaemia and thrombocytopenia. Conjunctivitis, pale mucous membranes, epistaxis, haematemesis, melena, petechial and ecchymotic haemorrhages on oral gums and ventral abdomen due to thrombocytopenia, edema of hind limbs and scrotum, ascites due to hypoproteinemia, lameness, and some neurological symptoms may be noticed. Dogs that are severely affected may die. Many dogs will be able to recover from the infection. If not, they enter the subclinical phase.

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Subclinical phase

The dogs successfully eliminate the *Ehrlichia* organisms from the body. However, some dogs develop persistent subclinical infections, act as asymptomatic carriers and become an important source of infection for months and years. In this phase, the animal apparently looks normal and healthy and does not present any clinically visible signs but upon haematological testing, mild thrombocytopenia can be detected. The infection may progress to the serious stage of infection, the chronic phase.

Chronic phase

The chronic phase can be either mild or severe. Weight loss, pale mucus membranes and gums due to anaemia, depression, lymphadenopathy, lameness, neurological signs, petechiae, bleeding due to thrombocytopenia, edema in the hind legs, and fever may be seen. In some cases, arthritis or 'glomerulonephritis' may develop. Recurrent clinical and haematological signs include thrombocytopenia, anemia, and pancytopaenia. In severe cases, the response to antibiotic therapy is poor and dogs often die from massive haemorrhage, severe debilitation or secondary infections.

PATHOLOGICAL FINDINGS

Haematological abnormalities are variable and overlapping, that include thrombocytopenia, hypergammaglobulinemia, hypoalbuminemia, and hyperglobulinemia. In chronic form, aplastic pancytopenia, granular lymphocytosis, mild elevation in liver enzymes and renal azotemia were found (Rungsipipat *et al.,* 2009). Gross pathological findings commonly include pale mucous membranes, lymphadenopathy, splenomegaly, ascites and congestion, petechial and ecchymotic haemorrhages in the liver, lungs, spleen, heart, lymph nodes and kidneys. Histopathology reveals plasmocytic–lymphocytic cellular infiltration in the liver, lungs, spleen and kidney (De Castro *et al.,* 2004).

DIAGNOSIS

Based on the history of tick exposure and physical examination of dog. Detection of *Ehrlichia canis* morulae within monocytes or lymphocytes in blood smear prepared from blood collected from the ear tip of the dog. Examination of buffy coat smear or lymph node cytology. The limitation of microscopy is that, it is extremely insensitive in the chronic and subclinical phases and unable to differentiate *Ehrlichia* species. Serological assays like indirect immunofluorescence test (IFAT) and enzyme-linked immunosorbent assay (ELISA) are used for the detection of antibodies. Molecular diagnosis like PCR amplifies the DNA of the pathogen and provides strong and clear evidence about the active ongoing disease.

TREATMENT

Tetracyclines or Doxycyclines are most used antibiotics usually for a period of 3-4 weeks. Tetracycline @ 22 mg/kg bw, three times a day for 21 days, or Doxycycline @ 10 mg/kg bw, per orally, once daily for four weeks is more efficacious and considered as the drug of choice. Supportive therapy with blood transfusion, polyionic isotonic fluids and Vitamin B-complex may hasten the

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recovery.

Dogs in the acute phase of the disease show dramatic improvement in haematological and clinical responses after 24-48 hours of therapy. Whereas, dogs in the chronic stage may not respond to treatment and have a poor prognosis. Hence, diagnosis of canine in the early stage of infection is important to ensure early treatment and a good prognosis.

PREVENTIVE STRATEGIES FOR CANINE MONOCYTIC EHRLICHIOSIS

In dogs, even after the complete recovery from natural infection after treatment, they do not develop long lasting immunity to *E. canis* infection and there are still chances of re-infection. Hence, prevention is possible by proper control of tick population and treating the infected dogs in early phase. Control of vectors by spraying suitable acaricides at regular intervals, by careful removal of ticks manually or by monitoring of environmental factors related to tick growth, are fundamental control procedures in handling ehrlichiosis. Topically acting synthetic pyrethroids (e.g. flumethrin) act as repellents (and kill) thus preventing tick attachment are proven to protect dogs against transmission of *E. canis.* In areas with heavy tick infestation, collars containing actives like amitraz can be used. In regions where the disease is endemic, prophylactic use of Doxycycline especially during summer and spring (tick season) can lower the risk of infection (Davoust *et al.,* 2005). Dogs traveling from endemic areas must be screened for canine monocytic ehrlichiosis before entering.

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Navigating India's Building Byelaws: Past, Present, and Future Perspectives

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Abstract

This comprehensive article delves into the intricacies of building byelaws in India, shedding light on their definition, historical context, and crucial importance in the rapidly urbanizing nation. It explores the scope and applicability of these regulations, categorizing them by residential, commercial, and industrial buildings, while also elucidating the roles of regulatory authorities such as the National Building Code of India (NBC) and local municipalities. The approval process, compliance challenges, and recent reforms are elucidated, offering valuable insights into the complexities of adhering to building byelaws. It also emphasizes the importance of compliance, best practices, and community engagement. Looking toward the future, the article discusses potential reforms, technological advancements, and the role of building byelaws in shaping sustainable and smart cities. In conclusion, it underscores the critical role building byelaws play in India's urban development and calls for collaborative efforts among stakeholders to ensure their effective implementation.

Introduction

India's urban landscape is undergoing rapid transformation, with buildings springing up everywhere. To ensure orderly growth and to safeguard the interests of both builders and the public, India has established comprehensive building byelaws. Building byelaws are a set of rules and regulations that govern the construction and use of buildings within a city or region. They address various aspects, including zoning, construction standards, safety measures, and environmental considerations (TCPO, 2016).

Building byelaws are of paramount importance in India, a country experiencing unprecedented urbanization. These regulations help maintain the integrity of urban planning, ensure safety, and promote sustainable development. They guide architects, engineers, and builders in constructing structures that are compliant with national and local standards, ultimately enhancing the quality of life for citizens.

Understanding and complying with building byelaws are essential for anyone involved in construction projects, from architects and engineers to property developers and homeowners. Failure to adhere to these regulations can lead to legal complications, delays, and even demolition of structures. This comprehensive guide will delve into the historical context, key provisions, approval processes, challenges, recent reforms, and future prospects of building byelaws in India (The Himalayan Architect, 2023).

Historical Context

A. Evolution of Building Regulations in India: The evolution of building regulations in India can be traced back to ancient times, with the Indus Valley Civilization demonstrating a remarkable understanding of town planning and sanitation. However, modern building regulations took shape during British colonial rule, with the first comprehensive law introduced in 1920. Since then, India has witnessed several amendments and updates to these regulations to adapt to changing needs and technologies (Construction Placements, 2023).

B. Key Milestones and Amendments: Over the years, building regulations in India have undergone significant changes. Building regulations in India have undergone a series of key milestones and amendments over the years to adapt to changing needs, improve safety standards, and promote sustainable development. Here are some of the significant milestones and amendments in India's building regulations (Mishra, 2021; Bhadauria, 2023; BIS, 2023):

- **Pre-Independence Regulations**: Prior to India's independence in 1947, different regions and princely states had their own building regulations. These were often influenced by colonial-era codes and local building practices.
- **The Bombay Municipal Corporation Act, 1888**: This act was one of the earliest municipal laws in India and laid down some of the foundational building regulations for Bombay (now Mumbai). It included provisions related to building construction, sanitation, and public health.
- **The Bengal Building Regulations, 1948:** These regulations, applicable in the state of West Bengal, were among the earliest comprehensive building codes in post-independence India.
- **National Building Code of India (NBC), 1970:** The creation of the NBC was a landmark event in Indian building regulations. It served as a model code for the entire country, providing a standardized framework for construction practices. The NBC covered a wide range of aspects, from structural design to fire safety and building services.
- **Amendments to the NBC:** The NBC has been periodically updated and amended to incorporate international best practices, technological advancements, and emerging standards.

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These revisions have played a crucial role in keeping the code relevant and aligning it with global standards.

- **Introduction of Environmentally Sustainable Practices:** Building regulations in India have evolved to include provisions for environmental sustainability. With the growing concern for climate change and resource conservation, amendments have been made to encourage energy-efficient construction, rainwater harvesting, waste management, and green building practices.
- **The Real Estate (Regulation and Development) Act, 2016 (RERA):** While not exclusively a building regulation, RERA has had a significant impact on the real estate sector in India. It aims to protect the interests of homebuyers by promoting transparency, accountability, and efficiency in the real estate industry.
- **Local and State-Level Regulations:** Building regulations in India are not uniform across the country. Many states and local municipalities have their own building bylaws and regulations that are often adapted to local conditions and needs. These regulations can vary significantly from one region to another.
- **Smart City Initiatives:** In recent years, the Indian government has launched the Smart Cities Mission to promote sustainable and technologically advanced urban development. This has led to the formulation of specific guidelines and regulations tailored to smart city projects.
- **COVID-19 Pandemic Response:** The COVID-19 pandemic prompted temporary amendments and guidelines related to building regulations. These included measures to address issues such as social distancing in public buildings and quarantine facilities.
- **Affordable Housing Initiatives:** To address the housing shortage in India, building regulations have been amended to encourage and facilitate the construction of affordable housing projects. These initiatives aim to make housing more accessible to a wider segment of the population.

Understanding Building Byelaws

A. Scope and Applicability: Building byelaws in India are not one-size-fits-all; they vary from one municipality or region to another. Understanding the specific byelaws applicable to a given location is crucial for compliance.

B. Categories of Building Byelaws: Building byelaws are typically categorized based on the type of structures they govern. These categories include

i. Residential Buildings
ii. Commercial Buildings
iii. Industrial Buildings.

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C. Regulatory Authorities: The enforcement and administration of building byelaws are the responsibility of various authorities, with the National Building Code of India (NBC) serving as a guiding document at the national level. State and local municipalities have the authority to adapt and enforce these codes to suit their unique needs and conditions.

D. Role of Architects and Engineers: Architects and engineers play a pivotal role in ensuring compliance with building byelaws. They are responsible for designing structures that meet all the required standards and guidelines while accommodating the needs and aspirations of their clients.

Key Provisions and Guidelines

i. **Site Selection and Zoning Regulations:** Building byelaws outline regulations concerning site selection, land use, and zoning, ensuring that structures are built in appropriate locations and conform to the designated land use.

ii. **Building Height and Floor Area Ratio (FAR):** Height restrictions and floor area ratios determine the vertical and horizontal limits of a building, preventing overcrowding and maintaining urban aesthetics.

iii. **Setbacks and Open Space Requirements:** Setbacks and open space requirements mandate the distance between a building and property lines, roads, or other structures. These regulations ensure adequate ventilation, light, and privacy for neighboring properties.

iv. **Structural Requirements:** Building byelaws set stringent standards for structural stability, ensuring that buildings can withstand earthquakes, floods, and other natural disasters.

v. **Fire Safety Measures:** Safety is a top priority, and building byelaws mandate fire safety measures such as fire exits, fire-resistant materials, and firefighting equipment.

vi. **Ventilation and Natural Light:** Provisions for adequate ventilation and natural light are critical for the health and well-being of occupants.

vii. **Parking and Traffic Regulations:** To manage urban congestion, building byelaws often include parking and traffic regulations, promoting sustainable transportation solutions.

viii. **Environmental and Sustainability Standards:** In an era of climate change, building byelaws increasingly incorporate green building concepts, promoting energy efficiency, waste reduction, and sustainable materials.

ix. **Accessibility and Barrier-Free Design:** To ensure inclusivity, building byelaws require barrier-free design, making buildings accessible to people with disabilities.

x. **Signage and Advertisement Regulations:** Regulations governing signage and advertisements maintain the visual harmony of urban areas.

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S. No	Key considerations as per different categories of building byelaws		
	Residential Buildings	**Commercial Buildings**	**Industrial building**
1.	Zoning and Land Use	Zoning and Land Use	Zoning and Land Use
2.	Occupancy and Density	Building Height and Density:	Environmental Compliance
3.	Safety Measures	Accessibility	Structural Integrity
4.	Structural Requirements	Safety and Security	Safety Measures
5.	Amenities and Facilities	Parking and Traffic	Accessibility and Worker Safety
6.	Energy Efficiency	Environmental Impact	Utilities and Infrastructure

THE APPROVAL PROCESS

- **Building Plan Submission:** The process begins with the submission of building plans to the local municipal authority. These plans must comply with all relevant byelaws.
- **Scrutiny and Approval:** The authority scrutinizes the plans, ensuring compliance with byelaws. Upon approval, a building permit is issued.
- **Revisions and Amendments:** During construction, any revisions or amendments must be approved by the authorities to maintain compliance.
- **Inspection and Monitoring:** Regular inspections are conducted to ensure that construction aligns with the approved plans and byelaws.
- **Non-Compliance and Penalties:** Non-compliance with building byelaws can result in penalties, demolition, or legal action. It is essential for builders to adhere to these regulations to avoid costly consequences.

CHALLENGES TO BUILDING BYELAWS

- **Common Violations and Non-Compliance Issues:** Common violations include unauthorized construction, encroachment, and deviations from approved plans. These issues lead to legal disputes and public safety concerns.
- **Legal Disputes and Litigation:** Building byelaw violations often result in legal disputes, clogging the judicial system and delaying justice.
- **Balancing Development with Preservation:** There is an ongoing challenge in balancing the need for development with the preservation of heritage and environmental conservation.
- **Challenges in Urban and Rural Contexts:** Urban and rural areas present unique challenges, with different byelaws needed to address their distinct needs and conditions.

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RECENT REFORMS AND AMENDMENTS

- **Introduction of Digital Approvals**: Recent reforms have introduced digital approval processes, streamlined the building permit application process and reducing bureaucracy.
- **Simplification of Approval Processes:** Efforts have been made to simplify approval processes, making them more transparent and accessible.
- **Incorporation of Green Building Concepts:** To promote sustainability, building byelaws are increasingly incorporating green building concepts and renewable energy mandates.
- **Promoting Affordable Housing:** Reforms also aim to promote affordable housing solutions, addressing the housing shortage in urban areas.

FUTURE OUTLOOK

A. Potential Reforms and Changes: The future holds potential for more reforms and changes in building byelaws to address emerging challenges and technologies.

B. Technological Advancements in Building Regulation: Advancements in technology, such as Building Information Modeling (BIM), are expected to revolutionize the way building byelaws are implemented and monitored.

C. Sustainable and Smart Cities: Building byelaws will play a crucial role in shaping sustainable and smart cities that are resilient, energy-efficient, and inclusive.

CONCLUSION

We've journeyed through the depths of these regulations, exploring their scope, categorization, and the roles of regulatory authorities, architects, and engineers in ensuring compliance. From site selection to sustainability standards, we've dissected the core provisions, understanding the intricacies that govern construction in India. Recent reforms and case studies have illustrated the tangible impacts of these regulations on real-world projects, paving the way for streamlined processes, green building integration, and the promotion of affordable housing. Above all, we have underscored the paramount importance of compliance, the engagement of professionals, and the involvement of communities in navigating the ever-evolving landscape of building byelaws. Looking to the future, we anticipate further reforms, technological advancements, and the continued role of byelaws in fostering sustainable, smart, and resilient cities. As India continues its dynamic urban transformation, the knowledge and understanding shared in this article will serve as a compass, guiding all stakeholders toward a future where buildings not only stand tall but also stand responsibly, contributing to the growth and well-being of the nation.

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Modern Farming: Black Turmeric (*Curcuma caesia*) cultivation under soilless medium

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Abstract

Black turmeric commonly known as "**kali Haldi"**. It is an industrially important plant now categorized as endangered species. Due to the Ethnobotanical importance, it is useful for the treatment of many diseases. An experiment was conducted during, Sep.2021 to Jan.2022 at DIBER, DRDO, Haldwani, Nainital (Uttarakhand). During the study period, the maximum and minimum temperature of the field and low-cost shade net recorded was 28-34°C and 16 -18 °C, respectively. soil less cultivation system used for the growing the crop was a UV stabilized buckets white color and vertical net pot filled with mixture of coco peat and vermiculite and partite ratio (3:1:1). The aim of this study was grown Black Turmeric under soilless culture. The result found that the germination of turmeric rhizome takes place under soilless culture after 15 DAT. Nutrients solution supplied after the germination. The result shows the growth of crop after 15 days. The number of rhizomes arising from mother rhizome also positively effect on production under soilless culture. The 5-7 rhizome node growth found after one month. The maximum (20 cm) plant growth found after one month from DAT. The maximum yield (1-1.5 kg/plant) found under per pot. Whereas the minimum average yield was found (560 gm/plant) under per pot.

Key words: Modern Faming, Hydroponics, NFT, Black Turmeric

Introduction

1. Soilless is a method of growing the crops without soil with the help of nutrient solution. With increasing scarcity of water availability, increased levels of residual toxicity in conventionally farming and rapid growth rate of Urban population have attracted the global attention towards the use of intensive cropping systems and paved the way for new technologies such as soilless culture and hydroponics **(Al-Karaki *et. al.*,2012; Pant *et al.*, 2018; Agarwal *et. al.*, 2019).** The advantages of soilless cultivation are that it requires small space with provision to vertical space utilization, higher nutrients use efficiency. This technique also facilitates roof farming and indoor farming. Soilless culture also plays an important role towards the precision farming by supporting the principle of "right time, right input, right quantity and right location". Soilless technology not only

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offers vertical utilization but also maintains quality and increases productivity. Endangered Black turmeric **(*Curcuma caesia*) commonly** known as **"kali Haldi"** belong to the family Zingiberaceae. It is an industrially important plant now categorised as endangered species **(Behar *et.al.* 2014, Borah *et. al.*, 2020).** Traditionally it is useful for the treatment of many diseases such as asthma, leprosy, menstrual disbalance, piles, rheumatism related inflammatory pains etc. It is most important medicinal plant as well as aromatic plant. The aromatic nature found in kali haldi which play a vital role in the auspicious spiritually in various region of India. The colour of rhizome is blackish -blue it is well known as sister species of Curcuma its hold good economic importance for local tribe and for its high antibacterial and anti-fungal potential since ancient times. keeping in the view the ethnobotanical importance and current extinction status of the black turmeric species, the present research aim is the cultivation of black turmeric under soilless culture.

Advantages of Soilless cultivation: This technology having the following advantages as compared to conventionally farming:

2. Soilless cultivation also considering under organic farming due to zero use of insecticide, pesticides and chemical fertilizers.
3. More water saving takes place under soilless culture as compared to conventional farming in conventionally farming more wastage of water takes place due to sprinkler /overhead, irrigation and higher loss of water due to evapotranspiration.
4. soilless cultivation can be easily practices as kitchen gardening, roof farming and under indoor cultivation.
5. Soilless technology also suitable at boarder area which can play a vital role for Defence purpose.
6. Higher production and productivity can be achieved under soilless cultivation due to more utilization of vertical space and protection from soilborne diseases.
7. Hydroponics cultivation is low constable due to more interculture operation required under conventionally farming such as; weeding, hoeing, and the cost of fertilizers broadcasting, irrigation time is also affectable under conventionally farming.

Materials and methods

The experiment was conducted during, Sep.2021 to Jan.2022 at DIBER, DRDO, Haldwani, Nainital (Uttarakhand). During the study period, the maximum and minimum temperature of the field and low-cost shade net recorded was 28-34°C and 16 -18 °C, respectively. soil less cultivation system used for the growing the crop was a UV stabilized buckets white color and vertical net pot filled with mixture of coco peat and vermiculite and partite ratio (3:1:1). Nutrient solution supplied to grow the plants through irrigation pump. pH ranged from 6 to 7.0 during the experiment and Electrical

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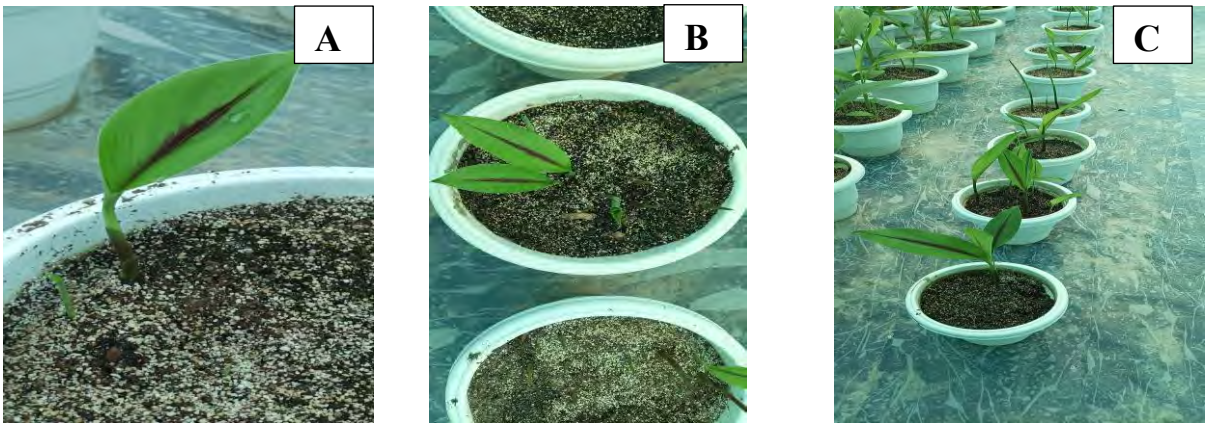
conductivity (EC) 1800±100ppm. Electrical conductivity (EC) and pH of nutrient solution were checked by using hand held pH and EC Meter (MCP and HANNA, respectively. The hydroponics solution consists all essential (Macro and micro) nutrients. elements in nutrient solution used for growing crops was nitrogen, potassium, phosphorus, calcium, magnesium (60 ppm), Sulphur these macro nutrients were supplied in prescribe quantity in major concentration by making a stock solution. Whereas the micro nutrients Fe, zinc (3 ppm), manganese (3 ppm), copper (less than 1 ppm), boron (4 ppm), molybdenum (less than 1 ppm), sodium (less than 1 ppm) was used in different concentration. Data were recorded as Days taken of germination, growth of plant after one month, weight of whole plant at 30 DAT, 60 DAT, 90 DAT, 120 DAT, plant height, width of leaves, number of rhizomes arising from mother rhizome.



Fig; A, B. Black Turmeric Rhizome germination after 15 DAT, **C.** Growth after 20 DAT under soilless culture.

Result

Effect on days taken to germination and plant growth

The result revealed that the endangered kali haldi can be easily cultivated under soilless culture with higher production and productivity due to well availability of nutrients and protection from soilborne disease as compared to conventional farming system. The result (Fig.1) shows the germination of turmeric rhizome very fastest under soilless culture after 15 DAT. Nutrients solution supplied after the germination. The result (Fig) shows the growth of crop after 15 days. The number of rhizomes arising from mother rhizome also positively effect on production under soilless culture. The 5-7 rhizome node growth found after one moth. The maximum (20 cm) plant growth found after one month from DAT.

Effect on Yield

Yield attributes also significantly varies under soilless cultivation as compared to conventionally farming. The maximum yield (1-1.5 kg/plant) found under per pot. Whereas the minimum average yield was found (560 gm/plant) under per pot.

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Conclusion

Our study is concluding that the Black turmeric can be easily cultivated under soilless culture. Keeping in the view of above study Kali Haldi has ethnobotanical importance for local tribe and beneficial for economic importance. Our study is concluding a new direction insight into the species' biology and ethnobotanical importance of Endangered species thus more efforts are required for the conservation of Endangered species on a wide spatial scale. This study may be beneficial for the people which facing scarcity of water availability and land shortage problem.

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Shining Light on Cellular Magic: The Story of Fluorescence Activated Cell Sorting

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Imagine being able to peek into the microscopic world of cells, each of which is an individual world with a variety of distinct features and purposes. Now, envision not only seeing these cells but also having the ability to sort and select them based on their individual characteristics. This remarkable feat is precisely what Fluorescence Activated Cell Sorting (FACS) accomplishes, and it forms the nucleus of our exploration into the captivating world of cellular sorting.

Flow cytometry analyses the cell population according to their physical properties such as size, shape and volume as well as their surface molecules and enables their individual investigation. FACS can be used to sort live cells based on similar principles. It allows to unravel the mysteries hidden within the diverse populations of cells that make up living organisms. Protein specific fluorescent dyes are used to stain the cells for analysis and automatic sorting according to the characteristic wavelength of light scattered by them.

The FACS systems have components to automatically detect, analyze and sort the cell samples loaded in to it.

THE FLUIDIC SYSTEM:

The fluidic system is a crucial part of FACS. It controls the movement of the cell sample suspended in a sheath fluid. This facilitates a smooth laminar flow within the system. Cells are properly lined, spaced and delivered (hydrodynamic focusing - layers of liquid at the outermost edges have zero velocity, while the center runs at a maximum velocity) to the laser for precise analysis and data collection. The fluidics system also helps in transporting sorted cells to their respective collection containers.

THE OPTIC SYSTEM:

They contain the lasers, lenses and filters. for selective emission of light and assimilation of the fluorescence emitted by the tagged cells

i. Laser: Lasers are used for shining beams of light of specific wavelengths uniformly on to the flowing sample within the system. Depending on the dye the cell has been tagged with, they will emit specific colours and allows for differentiating them. Depending on laser wavelength, different dyes are used. E.g., UV light (355nm) - DAPI, brilliant UV: Blue light (488nm) - FITC, Dylight 488.

Lasers may be parallelly arranged so that such that cells only encounter one source of stimulation at a time. While in a colinear arrangement lasers travel along the same optical path causing multiple lasers to simultaneously stimulate the cells.

ii. Filters: After the laser hits the cells, the machine has optics (like lenses) and filters that capture the fluorescent light emitted by the tagged cells. Filters are used to select specific colours of light.

Long pass (LP) filters: Transmission of photons above a specific wavelength. e.g., LP 500 filter. All lights above 500nm will pass.

Short pass (SP) filters: Transmission of photons below a specific wavelength. e.g., SP 500 filter. All lights below 500nm will pass.

Band pass (BP) filters: Transmission of photons within a specific wavelength. e.g., 525/30 BP filter. Light of 30nm below 525nm and 30nm above 525nm will pass

ELECTRONICS SYSTEM:

It is composed of the detectors, amplifiers and the computer. They evaluate the quantity and quality of the light emitted, *i.e.,* the intensity and wavelength (colour). The detectors are used to "see" the fluorescent light using photoelectric effect. The amplifier sends these signals to the computer as proportionally sized voltage pulses. The computer analyses this data to determine which cells are tagged with fluorescent molecules and how bright they glow.

Commonly used detectors are:

Photodiodes: Used for strong signals like forward scatter. When photon hits the photodiodes, it ionizes the atoms of detectors, creating a photocurrent which is directly transferred to the electronic system.

Photomultiplier tubes: Used for detecting small amounts of fluorescence and side scatter. It is sensitive to low levels of signals.

SORTING MECHANISM

If you want to sort cells, FACS machines have a way to do that. Electric charges or air pressure is used to push or divert cells into different containers based on the characteristics identified by the computer.

The entire procedure can be summarized as follows:

1. Preparation of Cell Sample: cell samples like tissues, blood, or cell cultures are ensured to be in a single-cell suspension, meaning they are separated and not clumped together.

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2. Fluorescent Labelling: Fluorescent molecules called fluorophores or fluorescent tags, are attached to specific parts of the cells. These tags can be designed to bind to particular proteins, DNA, or other cellular components. Each type of tag produces specific fluorescence when illuminated by a laser.
3. Introduction into the FACS Machine: The labelled cell sample is introduced into the FACS machine. The machine fluidic system controls the flow of the cell suspension, ensuring that cells pass in single file through the laser beam for analysis.
4. Laser Illumination: A laser is used to shine a beam of light onto the passing cells. Wavelength of the laser should be corresponding to the fluorescent tags. The resulting fluorescence of the tags are captured by the machine.
5. Optical Detection and Analysis: The emitted light is captured by detectors, which measure the intensity and colour of the fluorescence. This information is then sent to a computer for analysis. By analysing the emitted light, the computer can determine which cells are tagged and how brightly they fluoresce.
6. Sorting Decision: Based on the analysis, the computer makes real-time decisions on whether a particular cell meets the specified criteria for sorting. If so, it sends a signal to the sorting mechanism.
7. Sorting: The sorting mechanism, often using electrical charges or air pressure, guides the cells to different collection containers. This allows researchers to physically separate and collect specific cell populations based on their fluorescent characteristics.
8. Post-Sorting Analysis (Optional): After sorting, researchers may perform additional analyses on the sorted cells to validate their characteristics or perform further experiments

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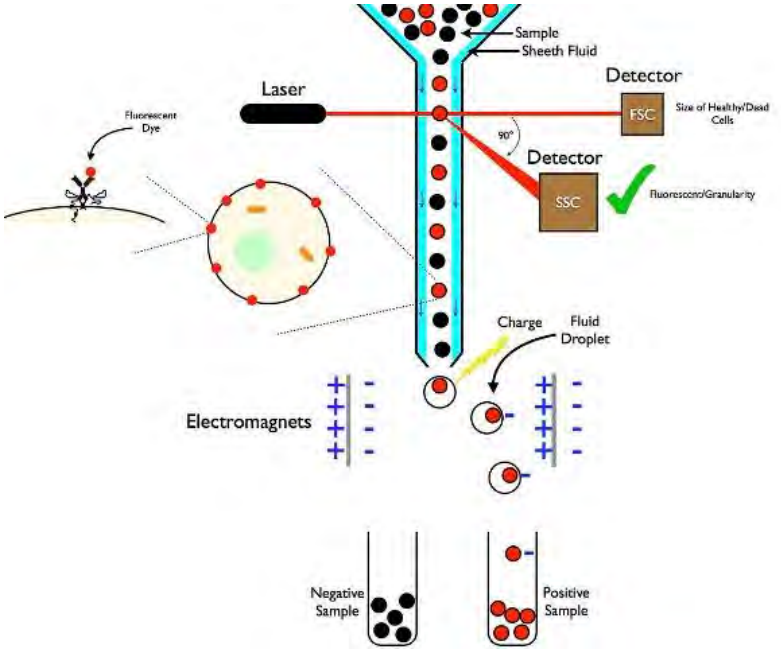

Figure 1: Fluorescence Assisted Cell Sorting (FACS) showing positive cell selection

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ANALYSIS

Depending upon the direction, the scattered light is of different types

i. Forward scattered light (FSC): It is the light refracted by a cell in the forward direction. This signal is collected by a detector called the forward scatter channel (FSC), measured and is used to determine particle size. Bigger particles will produce more forward scattered light than smaller ones and vice versa.

ii. Side scattered light (SSC): it is the light refracted by cells and travels in a different direction than its original path. Cells with a low granularity and complexity will produce less SSC, while highly granular cells with a high degree of internal complexity (such as neutrophils) will result in a higher SSC because granules inside the cell will also refract the light.

Table 1: Different lasers and tags used

Laser line	**Wavelength**	**Common fluorophores**
Ultraviolet (UV)	355 nm	DAPI, Hoechst, Brilliant Ultraviolet
Violet	405–407 nm	Pacific Blue, eFluor 450, Pacific Orange, Super Bright 436, Super Bright 600, Brilliant Violet
Blue	488 nm	FITC, Alexa Fluor 488, Dylight 488, PE, PE tandems, PerCP, PerCP tandems, PI, 7AAD, eGFP, YFP
Green	532 nm	PE, PE tandems, Alexa Fluor 532, PI, mCherry, dTomato, RFP
Yellow	561–568 nm	PE, PE tandems, PI, mCherry, dTomato, RFP
Red	633–647 nm	APC, Alexa Fluor 647, Alexa Fluor 700, APC tandems

RESULT PRESENTATION:

The results of a Fluorescence Activated Cell Sorting (FACS) procedure are typically presented in a graphical format on a computer screen. The presentation may include several key elements:

i. Scatter Plots: Scatter plots are commonly used to display FACS data. These plots show two parameters, often forward scatter (FSC) and side scatter (SSC). Each dot on the plot represents a single cell's size and granularity.

ii. Fluorescence Histograms: Histograms display the distribution of fluorescent signals emitted by the cells based on intensity. Peaks in the histogram indicate different populations of cells with varying levels of fluorescence.

iii. Overlay Plots: Overlay plots combine data from multiple fluorescent channels. They allow visualization of relationships between different markers on the same set of cells.

iv. Gating: Gating involves drawing regions or gates on the scatter plots and histograms to select specific populations of cells based on their size, granularity, and fluorescence intensity.

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v. Back-gating: It is a method of identification of cells to confirm a staining pattern or gating method using different parameters This can be useful if we are unsure of results and need additional information to identify our cells

vi. Statistics and Summary Metrics: The software may provide summary statistics such as the total number of cells analyzed, the number and percentage of cells falling within each gate or population, mean fluorescence intensity and other metrics relevant to the experiment.

vii. Graphical Representation of Sorting Decision: If the FACS machine is used for sorting, the software may display a graphical representation of how cells were sorted into different collection tubes or plates.

APPLICATIONS IN BIOTECHNOLOGY

i. Physiological research: Cell viability is the most widely used parameter for detection. It is possible to discriminate between undamaged, damaged (membrane depolarized) and dead cells.

ii. Cell Line Development: FACS is pivotal for the development and selection of high-producing cell lines and studying the properties and potential therapeutic applications of different types of stem cells. It enables the isolation of cells with desired characteristics, such as higher productivity or specific protein expression levels.

iii. Screening for enzymatic activity: Intracellular enzyme evolution with the aid of FACS can be screened for mutants. An example was demonstrated by the detection of aminoacyl-tRNA synthetase finally leading to the incorporation of unnatural amino acids into proteins

iv. Immunology and Immunotherapy: It plays a critical role in the development of immunotherapies by isolating and characterizing immune cells for therapeutic applications.

v. Cancer Research: It allows for the isolation and analysis of specific cancer cell populations, aiding in the understanding of tumour biology and the development of targeted therapies.

vi. Microbiology and Microbial Ecology: FACS can be utilized to study and sort microbial communities facilitating research in areas like bioremediation and environmental microbiology.

CONCLUSION

Fluorescence Activated Cell Sorting (FACS) stands as a transformative tool in biotechnology. Its ability to precisely analyze and sort cells has wide-ranging applications across various fields. FACS continues to push the boundaries of what is possible in cellular research and plays a nuclear role in advancing biotechnological solutions for human health and beyond.

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Lumpy skin disease: An emerging viral disease

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Abstract

The likelihood of the disease spreading to other parts of Asia and Europe is higher for lumpy skin disease, a developing bovine viral disease that is widespread in most African and some Middle Eastern nations. Understanding the restrictions and channels of distribution is crucial given the recent quick propagation of infectious diseases in nations that are currently disease-free. Capripoxvirus, the responsible agent, may result in goatpox and sheeppox. Given that they pose a threat to global trade and may be exploited as tools of financial bioterrorism, the economic impact of these illnesses is a major worry. Due to poor conditions in farming communities and limited availability to efficient immunizations, the dissemination of capripoxviruses appears to be spreading. This is mostly caused by the economic consequences of the Covid-19 pandemic, the enforcement of debilitating sanctions in endemic areas, a growth in the trading in livestock and animal products, both legally and illegally, as well as the effects of global climate change. The goal of the current review is to offer current knowledge on the different facets of the illness, including its clinicopathology, distribution, epidemiology, diagnostics, preventative and control strategies, and the probable contribution of wildlife to the disease's spread.

Introduction

Exanthema nodularis bovis, LSD, pseudo-urticaria, The Neethling virus illness, and knopvelsiekte are all names for the infectious condition lumpy skin disease. It is brought on by a virus (LSDV) from the genus Capripoxvirus in the family Poxviridae. Antigenically, it is very similar with the viruses that cause sheep and goat pox. However, standard serological tests cannot distinguish between these viruses. Cattle or water buffalo are affected by LSD. It is a transmitted via vectors disease spread by various biting and biting arthropods that feed on blood. Due to emaciation, harm to hides, infertility as mastitis, a decrease in milk supply, and death of up to 20%, LSD results in significant economic losses. The host cow breed and the capripoxvirus strain affect how severe the LSD clinical manifestations.

Etiology

The family Poxviridae member genus Capripoxvirus is the cause of Lumpy skin disorder. The sheep and goat poxviruses and the lumpy skin disease virus (LSDV) are closely linked antigenically.

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The LSDV genome (151 kbp) has 156 putative genes and a core coding region that is surrounded by similar 2.4 kbp-inverted terminal repeats. The chordopoxviruses from various genera, however, show 146 conserved genes, encoding proteins involved in virion structure and assembly, nucleotide metabolic processes, DNA replication, protein the process, transcription and mRNA synthesis, viral pathogenicity, and host spectrum. In particular, suipoxvirus, yatapoxvirus, and leporipoxvirus genes share a significant amount of colinearity and amino acid identity (an average of of 65%) with genes associated with other known mammalian poxviruses.

Transmission:

Mechanical transmission by vectors is the prime route of spread of disease. In most of the endemic countries like sub–Saharan Africa, Egypt and Ethopia, the disease incidences significantly increase with the onset of seasonal rains and summer season, coinciding with the peak activity of the vectors.

Diagnosis

In case of LSD, clinical signs can be confused with other diseases like foot and mouth disease (FMD), insect bite, demodicosis and hypersensitivity. Tentative diagnosis can be made on the basis of skin nodules observed on face, eyelid, neck, muzzle, nostrils, udder, limbs. Skin biopsy sample can be collected for further confirmation of disease. Samples should be transported in transport medium with 20 to 50% glycerol in phosphate buffer saline. Skin samples can be checked by electron microscopy to identify virus. Samples of skin also show characteristic histopathological changes, which include vasculitis and perivascular infiltration with white cells causing a thrombosis of the vessel in the dermis and subcutis. Cells infiltrating the lesion are epithelial cells, known as “celles clavelauses”, which are also described in sheep pox. Molecular diagnosis with PCR is most efficient and rapid test for the diagnosis of disease.

The effects of LSD on cattle health

The LSD-infected ill cattle displayed some clinical symptoms that were visible to the naked eye and could have an impact on their health, such as edema of the skin mucosa, decreased milk production in cows, enlargement of the lymph nodes, nodular lesions of various sizes on the outermost layer of the skin, lameness of the legs, etc. According to studies, the majority of infected animals' organs and tissues exhibit pathological alterations such orchitis, cow mastitis, necrotic hepatitis, disseminated vasculitis, lymph nodes, etc. Tracheitis, cardiac damage, and other pathological alterations are present in a small proportion of cattle, which makes LSDV more dangerous to the body and causes varying degrees of harm inducing in the affected animals.

Differential diagnosis

There are many diseases causing similar signs of LSD. It is important to obtain a definite diagnosis to ensure the best preventative and control measures for susceptible herds.

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LSD can be confused with the following diseases:

- Pseudo-lumpy-skin disease
- Bovine virus diarrhoea/mucosal disease
- Demodicosis (Demodex)
- Bovine malignant catarrhal fever (Snotsiekte)
- Rinderpest

Treatment

Lumpy skin disease is caused by virus and, therefore, has no known cure. However, antibiotics, anti-inflammatory drugs or a shot of vitamins are used in some cases to treat secondary bacterial infections or to deal with fever or inflammation and improvement of the animal's appetite.

Prevention and control

There is currently no effective LSD treatment available. Anti-inflammatory and antibacterial medications are used to treat symptoms. Effective preventative and control measures must be put in place in order to control the illness, including:

a) Restrict movement: To stop the spread of a transboundary disease, it should be strongly forbidden to move animals who have LSD infection. To stop the rapid propagation of disease inside a nation, animals having these lesions should be isolated for inspection.

b) Restrict vector movements: The migration of vectors brought on by the dominant winds may spread disease. The disease can also be prevented by employing vector control techniques like the use of mosquito traps and pesticides.

c) Vaccination: For LSD, a live attenuated vaccination is available. Businesses created vaccinations based on various LSD virus strains. It is either based on the SIS Neethling and type (Lumpyvax, MSD Animal Health-Intervet, South Africa) or the Neethling strain, such as the Lumpy Skin Disease Vaccine for Cows (Onderstepoort Biological Industries; OBP, South Africa) or Bovivax (MCI Sante Animale, Morocco). The sheeppox and goatpox vaccines can be used to treat LSD since the two viruses are closely related.

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Hypomagnesemic Tetany of Calves

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Synonym: Whole milk tetany.

Epidemiology:

1) It is sporadic disease.
2) Generally, 2-4 months old calves are affected.
3) Calves receiving greatest quantity of milk and growing fastly are more affected because there is greater need of Mg for incorporation into tissues.

Etiology:

1) **Calves maintained solely on whole milk*:*** The milk is low in Mg but due to its efficient absorption it is adequate for young calves but efficiency of Mg absorption markedly decreases by 3 months of age.
2) **Scouring / Diarrhea*:*** Due to reduced transit time, there is decreased absorption of Mg.
3) **Loss of endogenous Mg*:*** The loss of endogenous Mg through saliva in calves which are allowed to chew fibrous food material.
4) **Hay and silage deficient in Mg:** 2 - 4 months old calves maintained on hay and silage deficient in Mg.
5) **Feeding on milk replacer*:*** Calves maintained on milk replacer which is low in Mg may result in scouring and thereby reduced absorption.

Clinical Signs:

1) Muscular tremor
2) Constant movement of ears
3) Shaking of head
4) Retraction of eyelid

5) Ataxia
6) Hypersensitivity
7) Kicking at belly
8) Tetany of limbs
9) Convulsions
10) Opisthotonus
11) Champing of jaws
12) Froath at mouth
13) Dyspnoea
14) Death within ½ - 1 hrs.

Clinical pathology:

1) Serum Mg level is below 0.8 Mg /dl
2) Serum calcium level as decreased in severe cases but normal in mild cases.

Diagnosis:

1) History: Feeding of whole milk, milk replacer, scouring or diarrhea etc.

2) Clinical signs: Constant movement of ears, retraction of eyelids, hypersensitivity, tetany of limbs and convulsions.

3) Clinical pathology*:* Low serum Mg values (below 0.8 mg %).

Differential Diagnosis:

1) *Tetanus*: 1) History of umbilical infection.
2) More common in calves below one month of age.
3) Longer course.
4) Prolapse of third eyelid – not typical in calves.
5) Tetany is persistent and more marked.
6) No complete response to Mg therapy.

2) *Encephalitis / Meningitis*:

1) High fever
2) Comparatively longer course
3) Rigidity of neck
4) No response to Mg therapy

3) *Lead Poisoning*:

1) History of access to lead poison
2) Blindness
3) No response to Mg therapy

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4) *Rabies*:

1) History of dog bite
2) Ascending paralysis, profuse salivation, longer course
3) Tetany is absent
4) No response to Mg therapy

5) *Strychnine poisoning:*

1) H/o access to strychnine
2) Rare in calves.

6) *Polio encephalomalacia:*

1) Clonic convulsions.
2) Good response to vit. B_1 therapy.
3) No response to Mg therapy.

7) *Pesticide Poisoning:*

1) H/o access to poison
2) Temporary response to Mg therapy

Treatment:

1) Mag. (10%) sulphate @ 100 ml i/v. Good but transient response because of severe depletion of bone reserves.
2) Follow up supplementation of diet with magnesium oxide or carbonate.
3) Tranquilizers to avoid death due to respiratory failure.
   e.g. Diazepam @ 0.25 – 0.5 mg/kg body wt. I/M or i/v.

Control:

1) Provision of good quality hay.
2) Supplementation of MgO from 10 days to at least 10 wks of age.

MgO @1 gm/day	upto	5 wks.
2 gm/day	upto	5 - 10 wks.
3 gm/day	upto	10 - 25 wks.

Magnesium carbonate should be given in double dose.

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Methodology To Analyze Cost of Milk Production in India

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Introduction

Dairying in India is closely knitted as an integral part of agriculture, playing an indispensable role in the upliftment of rural poor. Indian livestock production systems are characterized by low inputs and low yields. Landless, marginal and small farmers own about 68 percent of livestock and contribute largely to the livestock economy. Apart from ensuring nutrient supplies to the families owning dairy animals, dairy sector also offers promising employment opportunities and economic returns on a regular basis. Dairy sector is an important source of secondary income for over 80-90 million milk producers in the country.

The profitability of dairy enterprise is determined by sale price of milk and of late there is lot of uproar from farming community on lack of proper support price for milk. Having adequate data on cost of milk production will enable policy makers to arrive at a minimum support price for milk, so that the farmer will not be put to loss.

Methodology

The cost of inputs was taken by considering the fixed costs and variable costs involved. The total costs involved in dairy farm operations consisted of depreciation on different components such as shed, animals, equipment, interest on fixed capital and imputed values for family labour, sale price of milk, value of dung etc. For the estimation and calculation of various costs, the following methodology was used.

Fixed cost: Fixed cost was taken as the expenditure which was incurred whether or not the production was carried out. It included interest on fixed capital and depreciation value. The components of fixed

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cost were as following

Interest on fixed capital: The interest on fixed capital was worked out at the prevailing rate. This amount was taken into consideration by calculating the total interest to be paid divided by 365 to arrive at the interest per day.

Depreciation on fixed capital: Depreciation was taken as the loss in the value of an asset as a result of the use, wear and tear, accidental damage and time obsolete. It was worked out for milch animals (10%), animal shed (2.5%), machinery and equipment (2.5%) keeping in view the present value and life time. This amount was arrived at by dividing the total amountof depreciation per annum by 365 to arrive at the depreciation amount per day.

Variable cost: Variable costs were taken as those costs which were incurred on the variable factors of production and which varied on day-to-day basis. It includes feed cost, labour cost, and miscellaneous cost. The variable expenses on dry fodder, green fodder, concentrate feed and labour were calculated per individual milch animal. Per day expenditure on miscellaneous items per milch animal were worked out on the basis ofdaily and annual expenditure on these items.

Feed and fodder cost: The information on the quantity of dry fodder, green fodder and concentrate fed to individual milch animal need to be recorded. The jowar and maize varieties were fed to animals as a green fodder. The dry fodder available was paddy straw, jowar kutti, groundnut crop residue. Concentrates were fed to the dairy animals, being the major source of meeting the nutrient requirements, and the concentrate mixture was prepared from the ingredients procured by dairy farm owners. The major ingredients used for making concentrate mixture were cotton seed cake, ground nut cake, maize, jowar, etc. The rates per kg of green, dry fodder and concentrates were to be recorded.

Labour cost: It includes cost of family as well as paid labour (hired labour). The cost of hired labour was calculated considering type of work allotted and wages paid whereas, family labour costs were determined on the basis of existing market rate of farm labour. The number of man hours of labour engaged per day was converted into monetary terms by multiplying with the corresponding wage rate.

Miscellaneous cost: Miscellaneous cost includes the cost of breeding for AI or service charge of bull as well as cost of vaccination and medicines. They were calculated on the basis of per milch animal per day for different milch animals kept by the household. The amount was arrived on per animal basis.

Other cost concepts used

Gross cost: It was obtained by adding all the cost components including fixed and variable costs,

i.e., Gross Cost/Total cost = Total Variable Cost + Total Fixed Cost

Income from dung: For value of dung, rough estimate of dung voided by animal per day was taken as 30 kg fresh and calculated per year and finally divided by 365 to arrive at the per day value after removal of 60% of moisture. The total income from dung of all the milch animals was taken to arrive at the average value.

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Net cost: The net cost was worked out by deducting the imputed income earned through sale of dung, from the gross cost,

i.e., Net Cost = Gross Cost – Income from dung (Kumawat *et al*.2016)

Gross returns: Gross returns were obtained by multiplying milk yield of an individual milch animal with respective prevailing sale prices in the study area,

i.e., Gross returns = Quantity of milk × Sale price of milk

Net income: Net income was calculated by subtracting net cost from gross returns,

i.e., Net Income= Gross returns – Net cost

Sale price of milk: The price of milk was taken as per the market rate and as per informed by dairy farm owners.

Cost of milk production

In order to estimate the cost of milk production, the average net cost per animal per day was divided by average milk yield of animal per day, i.e.,

Net cost =X1 + X2+ X3+ X4+ X5 – VD

$$\text{Cost of milk production per day per kg (C)} = \frac{\text{TNMC}}{\text{TM}}$$

Where,

X1= Cost of green fodder per day per animal

X2= Cost of dry fodder per day per animal

X3= Cost of concentrates per day per animal

X4= Labour cost per day

X5= Miscellaneous cost per day per animal

VD= Income from dung (Arrived figure per day per animal)

TNMC = Total Net Maintenance Cost or Net Cost

TM= Average quantity of milk produced per day per animal in litre

Benefit-cost ratio: In order to look from the angle of input and output the following formulae was used to calculate the Benefit-cost ratio.

1 =R / C

Where,

R= Sale price of milk sold per litre

C= Cost of milk production per litre

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Conclusion

By this methodology the actual cost dairy owners are investing in maintaining their animals and the cost they spend for production of one litre milk is calculated. It also makes a conclusion to dairy farm owners whether the dairy farm is profitable or in loss. This methodology will enable policy makers to arrive at a minimum support price for milk, so that the farmer will not be put to loss.

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Prion Diseases in Animals and Human Beings

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A group of proteinaceous infectious pathogens known as 'Prions', which cause fatal neurodegenerative illnesses in man and animals, through entirely *de novo* mechanism. Transmissible Spongiform Encephalopathies (TSE) - a group rapidly progressive and rare fatal neurologic disease conditions caused by prions. It affects humans and mammals like sheep, goat, bovine, cattle and felines. The word 'Prion' was coined by Dr. Stanley B. Prusiner in 1982, which is derived from 'protein and infection'. A Prion, is proteinaceous infectious particle, neurotropic, radiation and heat resistant, sensitive to protease, devoid of nucleic acid, forms amyloid fibrils, and has high β-helices (normal proteins are high in α-helices).

History

The history of prion began in the 18th century, with emergence of strange disease affecting Merino sheep to pathologically scrape against fences, a defining clinical sign that led to the disease being named 'Scrapie'. In the early 20th century, pathologists, Creutzfeldt and Jakob described a neurodegenerative disease, which was later included with Scrapie into a group of diseases known as TSEs.

Scenario In India

Over the period of span from 1968 to 1997, National Institute of Mental Health and Neurosciences (NlMHANS), Bangalore, registered 69 cases of CJD from different parts of India. From 1990-1998, Department of Neurology, G.B. Pant Hospital, New Delhi admitted 10 cases of CJD from North India various studies have reported annual incidence of 0.5-1cases of CJD per million of general population. Variant CJD was recorded in Karnataka and Kerala in 1991.

Etiology

The nature of etiological agent was under discussion for many years. The result of the infection was described as the accumulated abnormal prion protein in the central nervous system (CNS), which is the isoform of a cellular protein (PrP^c) with different physical and chemical properties. Prions are

devoid of nucleic acid and seem to be composed exclusively of a modified isoform of PrP designated PrP^{Sc}. The normal, cellular PrP, denoted PrP^{c}, is converted into PrP^{Sc} through a process whereby a portion of its α-helical and coil structure is refolded into β-sheet. Although the exact mechanism of prion replication remains unclear, the agent is believed to promote the conversion of the cellular prion protein into the abnormal conformer by an autocatalytic or other unidentified process.

Pathogenesis

The PrP^{c} which is the normal form, is a tissue sialo glycoprotein found at highest degree in the central nervous system (CNS) and immune systems. PrP^{c} is involved in many functions as the formation, and maintenance of synapses, signaling, neuritogenesis and neuroprotection and copper binding. Normal PrP binds with copper and prevent oxidative damage to cell, whereas abnormal prion protein cannot bind with copper, it induces apoptosis of neurons. The protein agent (PrP^{sc}) induces abnormal refolding of the normal protein.

This leads to aggregation of misfolded proteins which leads to formation of dense plaques and fibers called amyloid. This amyloid deposition results in cell death and tissue damage.

The main acquisition route for animal TSEs is the oral route. During prion infection, before reaching CNS, prions are first detected in lymphoid tissues, frequently associated with follicular dendritic cells (FDCs). They then progress through the nerves of the autonomic nervous system and finally reach the CNS, although activated microglial cells and astrocytes are present. Then there is increase in density of activated microglial cells. It is associated with the upregulation of the TNF-α astrocyte. Astrocytes are the cells directly implicated in the direct neurotoxic effects in prion diseases and act as inflammation promoters. Microglial cells phagocytize prions and promote apoptotic cell clearance of neurons, a process mediated by the secretion of milk fat globule epidermal growth factor 8 (MFGE8) by astrocytes. Then the protective role of microglia becomes insufficient, which can induce microglia to convert from the phagocytic to pro inflammatory cells. This altered phenotype may exacerbate the secretion of cytotoxic mediators and contributes to the spreading of prions.

Transmission

In animals, Scrapie showed lateral transmission (direct and indirect). The BSE transmitted through contaminated feed, bone meal and meat meal. In human beings, the transmission of Variant CJD is reported through consumption of meat of animals suffered with BSE, Kuru caused by endocannibalism, and CJD has Iatrogenic transmission.

Animal Prion Diseases

In the animals, prion diseases include Scrapie, Bovine Spongiform Encephalopathy (BSE), Chronic Wasting Disease (CWD), Transmissible Mink Encephalopathy (TME) and Feline Spongiform Encephalopathy (FSE).

Scrapie is reported all over the world, except in New Zealand and Australia. BSE was mostly

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reported in the European countries. In India, Scrapie was reported in Garole and Kamach breeds of sheep.

Scrapie is the natural disease of sheep and goat**.** The first BSE case was remarked in 1986 in which the Dairy cows had developed nervous symptoms. Chronic wasting disease (CWD) is a TSE affecting mule, deer and elk, predominantly in the USA. Transmissible mink encephalopathy (TME) is a progressive and fatal neuro-degenerative disease that affects ranched mink. FSE affects the brain and liver in felines.

Human Prion Diseases

Human prion diseases, include Creutzfeldt Jakobs Disease (CJD), German- Straussler-Scheinker Syndrome (GSS), Fatal Familial Insomnia (FFI) and Kuru.

There are 4 forms of CJD: sporadic, inherited, iatrogenic and variant form/

Classical Clinical Signs

Scrapie, BSE and CWD affects the brain stem, FFI - thalamus, and Kuru – cerebellum**.** Scrapie is the natural disease of sheep characterized by intensive pruritis; a classical disease transmitted during lambing. BSE is also known as 'Mad cow disease', affected cattle presents 'dog sitting posture'.

Diagnosis

From early years, the diagnosis of TSE was based upon the observation of the typical histopathologic lesions. For the development of alternative diagnostic methods, specific antibodies against the characteristic marker of TSE, the PrP^{sc} have been developed. Scrapie is diagnosed by Biopsy of lymphoid follicle of 3rd eyelid validated in U.S.A as diagnostic test.

Prevention And Control

Currently there is no treatment and vaccine available. To impose 'Import restrictions' on live ruminant species and their products from countries where BSE is endemic. Should follow FDA "animal feed rule. There should be a ban on mammalian proteins as food source for animals. Scrapie free flock certification programme should be implemented. Regular monitoring and surveillance for CJD/BSE. Blood/plasma should be properly screened before infusion. Disinfection of instruments is done by using 2.5N NaOH and infectious carcasses should be incinerated at 134-138°c for more than 18min and digested by using NaOH.

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Nutritional Considerations in Canine Dermatological Disorders

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Abstract

Nutrients play a major role in the health status of skin and hair coat in dogs. Nutritional deficiencies are reported as an indirect cause of dermatological disorders resulting from reduced intake of diet, unbalanced diet or reduced absorption or utilization of the nutrients as a result of disease or genetic factors. Most often nutritional deficiency and excess are not commonly identified as direct causes of dermatological disorders but dietary modifications often found to reduce the severity of such diseases. Hence knowledge on common clinical conditions caused by deficiency or excess of these nutrients will provide useful information on nutritional interventions for correcting the problems. This article discusses on the role of various nutrients in health of skin and coat of dogs.

Keywords: Canine, Dermatology, Nutrients

Introduction

A healthy lustrous skin and coat indicate vitality and health status of pet dogs. Nutrients have an important role in the health status of skin and hair coat in dogs. Nutrients such as proteins and amino acids are required for keratinization, pigmentation and hair growth. Polyunsaturated fatty acids are essential for sebum production which is associated with skin and coat protection. In addition to this, several minerals and vitamins are also playing important roles in the health of skin. Nutritional deficiencies are encountered due to reduced intake of diet, unbalanced diet or reduced absorption or utilization of nutrients as a result of disease or genetic factors. Dietary interactions as a result of errors in formulation, prolonged storage or injudicious over supplementation can also result in reduced nutrient availability. Typical signs of nutritional dermatosis include excessive scale, erythema, alopecia or poor hair growth and greasy skin, which may be accompanied by secondary bacterial infection and pruritus. It is generally accepted that signs become evident only after feeding deficient diets for several months. Hence, knowledge on common clinical conditions caused by deficiency or excess of these nutrients will provide useful information on nutritional interventions for correcting the problems.

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Protein

Proteins and amino acids are essential for skin and hair production. Hair is composed of approximately 95 percent of protein. Hence there is high demand of protein for normal hair growth and skin keratinization (Scott *et al.,* 1995). Phenylalanine and Tyrosine are precursors of melanine, the skin pigment (Anderson *et al.,* 2002) and methionine and cysteine are present in large amounts in hair. Hence their deficiency may reduce hair growth and increase hair fragility (Prelaud and Harvey, 2006). Proline, a non-essential amino acid, is essential for formation of collagen in skin. If diet is not containing adequate protein the dog may develop areas of hair slow re-growth and depigmentation of hair and hair become dry, dull and brittle. There will be excessive scaling and hyperpigmentation of skin and it becomes thin and in-elastic.

Dermatological disorders due to protein deficiency are usually rare in clinical practice. Protein deficiency is usually encountered due to starvation, disease induced inappetence or feeding of an unbalanced diet. Primary protein deficiency can occur in young growing pups and pregnant or lactating female dogs due to increased protein demand for growth and development. Protein deficiency can also result from excessive protein loss due to chronic illness or protein losing nephro-enteropathies. Dietary correction can be made by supplementing good quality protein sources such as meat, egg and milk, but prognosis depends on the cure from underlying diseases.

Fat

Fat is another important group of nutrients for good quality of skin and hair coat in dogs. Essential fatty acids have a structural role in cell membranes, act as precursors for eicosanoids such as prostaglandins and leukotrienes and are vital for maintaining normal skin structure and function (Watson, 1998). Essential fatty acids (EFA) must be provided in the diet because the body cannot synthesize them. Deficiency of EFA results in scaly and dry skin with poor elasticity. Linoleic acid appears to be the most important for maintaining normal skin (Kirby *et al.,* 2009). Dandruff, thin hair, discolored hair, increased shedding and poor healing are all associated with low linoleic acid levels in skin and diet. Omega-3 fatty acids, such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), may reduce inflammation secondary to allergic disease in affected dogs (Bauer, 2011). Omega-3 fatty acids help to protect the skin and coat and keep it shiny. Sources of omega-3 fatty acids include fish and algae oil. Dietary deficiencies of essential fatty acids are uncommon but may occasionally occur in dogs that are fed poor quality, low fat dry foods or unbalanced home-prepared diets. Levels of polyunsaturated fatty acids may also be reduced in food after oxidative damage resulting from prolonged storage or inadequate levels of antioxidants such as Vitamin E. Rarely, fatty acid deficiency may occur in association with malabsorption due to hepatic, pancreatic or gastrointestinal disease. Prolonged deficiency results in alopecia, greasy skin particularly on the ears and between the toes and secondary pyoderma.

In uncomplicated cases, response to fatty acid supplementation will be visible within three to

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eight weeks (Scott *et al.,* 1995). Deficiency can be corrected by changing to higher fat diet, by the addition of edible oils to diet or by administration of fatty acid supplements. Vegetable oils such as sunflower oil are a rich source of linoleic acid, but arachidonic acid is found only in animal fats. Feeding a better-quality prepared pet food or a balanced veterinary supplement containing essential fatty acids, Vitamin E and Zinc is preferable (Harvey, 1993). Dietary fatty acid supplementation is also useful for management of some inflammatory skin disorders, particularly those associated with hypersensitivity reactions.

Vitamins

Vitamins that play critical roles in the skin health of dogs include Vitamin A, E and B.

Vitamin A

Vitamin A is required for epidermal differentiation and normal sebum production and its deficiency is rare in dogs as they can convert beta-carotene to retinol (NRC, 2006). Vitamin A-responsive dermatosis is characterized by skin proliferation and keratinization. It has a genetic basis and is more commonly encountered in American cocker spaniels. Lesions include crusts and plaques mostly seen on the ventral and lateral chest and abdomen. The hair coat may be dull, dry, scaly and secondary bacterial or yeast infections are common.

The diagnosis of Vitamin A-responsive dermatosis is made by first ruling out other common causes of crusty, scaly skin and by skin biopsy. Biopsy of affected skin shows marked excessive scaling of skin and hair follicles. Most affected animals require lifelong Vitamin A supplementation at a dose rate of 10,000 IU orally with a fatty meal for a period of 6-8 weeks. Antiseborrheic shampoos and moisturizing conditioners are also helpful. Dogs should be treated for secondary bacterial or yeast infections if any.

Vitamin E

Vitamin E is the primary antioxidant in cell membranes and alpha-tocopherol is the form with greatest activity in cells, although others may be added to commercial diets as natural preservatives. Deficiency of Vitamin E has been implicated in the development of various dermatological disorders in dogs. Skin disorders characterized by an early keratinization defect and a later inflammatory phase with a tendency to develop secondary pyoderma were experimentally produced by Vitamin E deficiency. Supplementation of Vitamin E has been found to be effective in dogs with discoid lupus erythematosus. Scott and Walton (1985) reported that Vitamin E therapy @ 200 mg twice daily was effective for gradual elimination of pruritus, inflammation, lichenification, greasiness and odour in dogs with acanthosis nigricans after 60 days of treatment. Even though there is no record of naturally occurring Vitamin E deficiency in dogs, use of Vitamin E in the treatment of canine discoid lupus erythematosus and primary acanthosis nigricans with variable success has been reported.

Vitamin B

Vitamins B are involved in many biochemical reactions in body and their deficiency is

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associated with variety of skin lesions. Vitamin B_3 (Niacin) and B_5 (Pantothenic acid) supplementation has reduced trans-epidermal water loss in dogs and contributed to the integrity of the stratum corneum (Watson *et al.,* 2006). Biotin and B-Vitamins play important roles as co-factors in many of the body's metabolic processes, including fat metabolism. This is important in the skin because Biotin and B Vitamins are involved in aiding linoleic acid function in the epidermis and dermis.

Minerals

Among the minerals, Zinc and Copper have an important role in maintaining good skin and hair coat quality.

Zinc

Zinc is an important co-factor of many metalloenzymes involved in cell functions and is particularly important for maintenance of epidermal integrity. It is critical for transition of nucleated epidermal cells to anucleate squamous cells in stratum corneum. The presence of Zinc is of particular importance in rapidly dividing cells and is also for biosynthesis of fatty acids, participates in both the inflammatory and immune systems and is involved in metabolism of Vitamin A. Zinc is also associated with immunity, neurological and intestinal functions. Zinc deficiency can result in hair loss, skin ulcers and areas of skin thickening and cracking, particularly over joints and on foot pads. Appetite may be depressed in affected animals as a result of diminished sense of taste and smell. Prolonged deficiency can result in weight loss, impaired wound healing, conjunctivitis and keratitis. Generalized lymphadenopathy is also a common feature, particularly in young animals. The skin-related signs of mineral deficiency clear up quickly with appropriate levels in diet.

Zinc responsive dermatoses due to nutritional deficiency are associated with reduced dietary availability of Zinc. It can be due to reduced levels of Zinc in diet due to other factors which reduce the availability of Zinc present in the diet. Absorption of Zinc can be inhibited by excessive levels of dietary calcium, iron and copper, which compete with Zinc for intestinal absorption sites. Dietary phytate, which is found in cereal-based diets, chelates Zinc and high levels may also hinder intestinal Zinc absorption. Such types of dermatoses are more common in rapidly growing pups of large breeds such as Great Dane. Prolonged enteritis or other malabsorption syndromes may also prevent normal Zinc absorption and may precipitate clinical signs of deficiency, particularly when combined with other predisposing factors.

Clinical signs associated with Zinc responsive dermatoses include erythema, alopecia, crusting and scaling around the mouth, eyes and ears. Lesions are also seen in other mucocutaneous areas such as vulva, scrotum and anal areas. Hyperkeratosis is also observed especially at pressure points such as the elbows and footpads. Clinical signs may vary in individual dogs and in presence of concurrent bacterial or fungal dermatitis. Severely affected dogs may have growth retardation, fever and depression. Diagnosis of the condition can be achieved from the history, clinical signs, skin biopsy results and response to Zinc supplementation. In cases of Zinc- responsive dermatoses due to

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metabolic abnormality, lifelong Zinc supplementation is necessary. Supplementation with Zinc sulphate (10 mg/kg daily) or Zinc methionate (1.7 mg/kg daily) is usually adequate. But for lifelong therapy, the dosage may be adjusted for long term maintenance (Scott *et al.,* 1995). In deficiency cases, dietary correction alone may be curative and signs will resolve after a change to a diet with greater Zinc concentrations and/or with reduced Zinc-binding compounds.

Copper

Copper serves as a co-factor in the enzymatic conversion of tyrosine to melanin. Copper deficiency causes a dull and dry hair coat with patchy hair loss and loss of normal hair pigment resulting in a washed-out appearance of coat. Copper along with tyrosine, is essential for development of healthy hair. If one of these two substances is missing, the hair will grow incorrectly pigmented (Zentek *et al.,* 1991).

Conclusion

Understanding the various clinical manifestations associated with deficiency of nutrients, vitamins and minerals and their therapeutic management will help in correcting the problems and maintaining the health status of skin and hair coat in dogs.

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The Elnady Technique: An Innovative method for Tissue Preservation

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Abstract

Shortage of cadavers and organs in teaching veterinary anatomy has led to the development of new techniques such as the Elnday technique to keep anatomical specimens preserved. Common tissue preservation techniques can result in offensive odours, discolorations of the tissue or dangerous chemical residues. Plastination is a valuable tool in teaching anatomy but the complexity and high cost involved in the process limits its use in developing anatomical specimen. Elnady technique is innovative, simple and inexpensive used. The specimen produced with this technique are flexible, soft and realistic. The Elnady approach works well for creating better contrast specimens for educational purposes.

Introduction

Immediately after death or removal of the tissue from the living body, the post-mortem changes by way of autolysis of cells, multiplication of micro-organisms and splitting of proteins into amino acids occurs. These immediate changes occurring in the tissue can be prevented by coagulating the tissue proteins with the help of chemical treatment. The elnady technique, developed by Dr. Fawzy Elnady in the Department of Anatomy and Embryology, Faculty of Veterinary Medicine, at Cairo University is innovative technique for tissue preservation and it is simple and inexpensive method. The specimen produced with this technique are soft, realistic, durable and flexible. Even though plastination provides high-quality teaching specimen, the complexity and the cost involved in the process limits the use of it. The plasticated tissues are rigid and lacks natural elasticity which doesn't suite for endoscopic cadaveric observations and teaching-learning process.

Steps involved in Elnady Technique:

Step 1: Fixation with Formalin

The tissue is fixed with formalin after euthanizing the animal along with bleeding followed by cannulation and injection of 10% formalin into the common carotid artery. The amount of formalin injected depends on the size of the animal. Formalin is the preferred fixative as it penetrates faster than other fixative solutions. The cadavers are then kept in the lab at room temperature for one week for small animals and two weeks for large species, during this time the tissues become completely soaked with formalin.

Step 2: Dissection and dye injection

After complete fixation the cadaver is dissected for the tissue or organ of interest for the purpose of practical class within anatomy, embryology or surgery, museum display or research studies. For proper penetration of acetone and glycerin proper dissection of the tissues is required especially larger specimen and muscle tissue can be dissected to smaller sizes. Small holes can be drilled in the marrow cavity of long bones enhance defatting and to prevent greasy specimens.

Staining of the specimens with dye of interest can be done to produce realistic appearance of the tissue and mask the darkening of the tissue due to formaldehyde.

Step 3: Dehydration with Acetone

The entire process of dehydration of the tissue is carried out at the room temperature. After the formalin fixed tissue samples can be thoroughly washed under running tap water to remove the formalin fixative and immersed in pure (100%) acetone bath for one week. Two or three subsequently pure (100%) acetone baths are required for complete dehydration. Hydrometer can be used to measure the concentration of acetone.

Step 4: Glycerin Impregnation

The dehydrated specimen can be gently hand pressed and left to drain of acetone through a sieve or on a flat smooth stainless-steel mesh plate for half an hour. Then tissue samples are then immersed in glycerin water bath for one or two weeks depending on the size and type of the tissue.

Step 5: Cornstarch Curing

The glycerinated tissue samples are drained for half an hour and thoroughly wiped with a tissue paper. The samples are then placed in a cloth bag that are 2-3 times the size of the samples and cornstarch is rubbed outside the bag. The bag is tightly ligated and can be placed in plastic buckets containing cornstarch for one to three weeks until glycerin exudation from the sample is no longer observed. The clumsy cornstarch can be replaced intermittently. If glycerin exudation is observed then second curing can be performed. Once the curing step is completed the cornstarch cleaned from the tissue with help of air brushes or air compressors if necessary. Then, vessels or other features like the pericardium or muscles can be painted using acrylic or fabric dyes. The final specimen is kept either in a plastic bag or sealed container that is kept in a clean environment.

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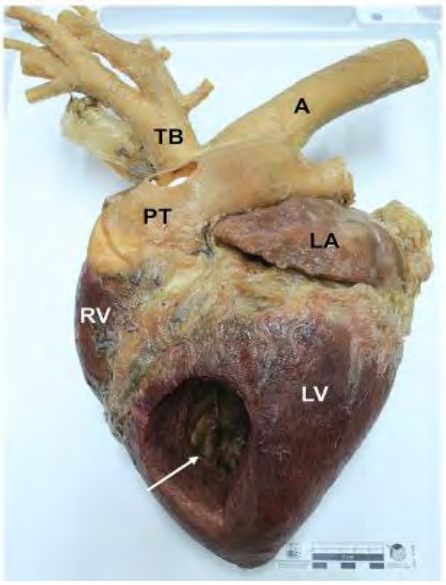
Conclusion

The elnady technique developed by Dr. Fawzy Elnady is a simple, innovative and inexpensive method for tissue preservation for educational, display in museum or research purpose. The limitations of plastination are overcome by the elnady technique. The cadavers or the tissue samples are fixed with formalin as fixative. After complete fixation of the tissue the sample is dissected and can be dyed for proper visualization of the blood vessels and internal structures. The formalin fixed specimen is washed under running tap water and dehydrated with pure (100%) acetone for two-three weeks. After draining the specimen from acetone, it is immersed in glycerin for one to two weeks depending on the size and type of specimen. Then the specimen is subjected for cornstarch curing one to three weeks until glycerin exudation from the specimen is stopped.



Photograph of the left side of an equine heart preserved and stained by the modified Elnady technique. A window opening in the left ventricle (white arrow). A: Aorta; LA: Left auricle; TB: Brachiocephalic trunk; PT: Pulmonary trunk; LV: Left ventricle; RV: Right ventricle.

Photograph of two specimens of Chilean frog (Caudiverbera gayi), ventral view, preserved by the modified Elnady technique. Notice that the musculature and organs are pale and unnatural.

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Popular Article

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Role of Exocrine Pancreas in Ruminant Digestion

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Abstract

Pancreas is a tubuloalveolar gland with exocrine and endocrine function. The pancreas of the ruminants consists of a distinguishable short body with left and right lobes. The exocrine part of the pancreas secretes the pancreatic juice which consists of the bicarbonates and enzymes essential for the digestion. The release of the pancreatic juice is triggered by the hormone cholecystokinin, which is produced when the food reaches small intestine. The alkaline secretion of the pancreas contains digestive enzymes and the enzyme precursors (proenzymes) that can digest protein, carbohydrates and lipids.

Introduction

The pancreas plays a crucial role in the process of digestion. It produces a juice filled with enzymes that are essential for breaking down carbohydrates, proteins, and fats, making them more easily absorbable by the body. This pancreatic juice is composed of water and bicarbonate ions, which are a clear, odorless, and tasteless liquid. This liquid dilutes other components and raises the pH level of stomach acids to an optimal range for enzyme activity. Within this digestive juice, you can find enzymes like amylase, lipase, proteases, nucleases, and elastase, all of which contribute to the efficient breakdown of fats, proteins, and carbohydrates to facilitate absorption.

The pancreas has a dual nature as a tubuloalveolar gland. It functions as an exocrine gland, primarily responsible for producing digestive enzymes (the larger part of its role), and also acts as an endocrine gland, producing hormones (a smaller part of its role). In ruminants, the pancreas is characterized by a distinct anatomy. It consists of a relatively short body with left and right lobes. The left lobe is situated in the retroperitoneal space and is in close proximity to the liver, diaphragm, and major blood vessels on its dorsal side. On its ventral side, it comes into contact with the intestines and the dorsal sac of the rumen. Meanwhile, the right lobe is larger in size and is positioned in the mesoduodenum, adjacent to the animal's flank. It runs along a portion of the descending duodenum.

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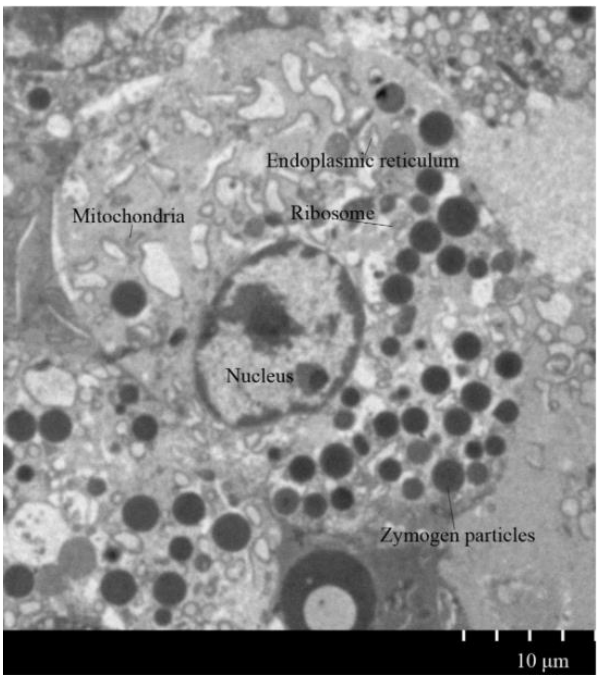
Functional Anatomy of exocrine pancreas of ruminants

The pancreas is segmented into distinct regions: head, neck, body, and tail. A delicate layer of connective tissue covers the outer surface of the pancreas. Within the exocrine part of the pancreas exists a complex structure known as the multi-branched lobular acinus, responsible for producing pancreatic enzymes, electrolytes, and other fluids. The pancreatic juice itself is composed of inorganic salts, zymogen particles, and water. This pancreatic juice flows through a duct into the duodenum, where it plays a crucial role in the digestion of starch, protein, and fat present in the chyme.

The acinus serves as the fundamental functional unit of the pancreas dedicated to its exocrine function. It consists of cone-shaped serous gland cells primarily synthesizing, storing, and secretion of various digestive enzymes. These acinar cells release zymogen granules into the acinar cavity through the process of exocytosis, and subsequently, these zymogen granules find their way into the duodenum via the pancreatic duct.



Ultrastructure of pancreatic acinar cells in dairy cows. Showing mitochondria, endoplasmic reticulum, and nucleus and zymogen particles.

Pancreatic Secretions

Only the exocrine part of pancreatic secretions is involved in the digestive process in the ruminants. It involves secretion of bicarbonate and digestive enzyme or precursors. The exocrine pancreas synthesizes and secretes several digestive enzymes (including amylase, lipase, and proteases) to digest feedstuff, supplying ruminants with nutrients (such as starch, fat, and protein).

Alkaline Secretion

The alkaline secretion of the pancreas consists of the bicarbonates and the chloride ions which is discharged in the duodenum through the ducts. The release of pancreatic juice (along with bile from the liver) is triggered by the hormone cholecystokinin, which is produced by the small intestine. This hormone is released as soon as food reaches the small intestine. The secretion of bicarbonate is required to neutralize the HCl concentration of the ruminal contents that enter the duodenum and also

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to neutralize acids produced from fermentation in the rumen. This is advantageous because it provides an optimal pH for the pancreatic enzymes and prevents damage to the thin, absorptive mucosa of the duodenum.

Enzymatic Secretion

The alkaline secretion of the pancreas contains digestive enzymes and the enzyme precursors (proenzymes) that can digest protein, carbohydrates and lipids.

Trypsinogen is a precursor to the digestive enzyme trypsin; it helps break down proteins and is activated by enterokinase present in the intestinal epithelium. Trypsin then becomes the activator for the other proenzymes. Digestion of the pancreas is prevented because the proteolytic enzymes are secreted as proenzymes. Spontaneous conversion of trypsinogen to trypsin is prevented in the pancreas by the presence of trypsin inhibitor.

Chymotrypsinogen a precursor to the digestive enzyme chymotrypsin, it works alongside trypsin to break down proteins and is activated by trypsin itself.

Procarboxypeptidase is a precursor to the digestive enzyme carboxypeptidase, it helps break down proteins and is also activated by trypsin.

Carbohydrates: The enzymes pancreatic amylase and maltase help break down carbohydrates into simpler sugars in the small intestine, which can then be absorbed by the body.

Lipids: The enzyme pancreatic lipase helps to digest triglycerides by breaking them down into fatty acids and glycerol in the small intestine.

The gastrointestinal hormones gastrin, CCK, and secretin work in conjunction with autonomic nerves to regulate the exocrine secretions of the pancreas. The release of enzymes and proenzymes is increased by parasympathetic stimulation, whereas the secretion of electrolytes and water is decreased.

Factors affecting exocrine function of the pancreas:

1. Age of the animal

The pancreatic exocrine function of ruminants is mostly influenced by the animal's age. The pancreas of animals gradually matures with age, producing more pancreatic juice overall and more digesting enzymes. In the small intestine of newborn calves, the activity of digestive enzymes containing amylase, protease, and lipase is low, but as age advances, the activity of these enzymes rises dramatically above that at birth.

2. Neurohumoral regulation

The central nervous system regulates pancreatic secretion through the vagus nerve. Blocking vagus nerve reduces the secretion of pancreatic juice and the activity of trypsin. Stimulation of cholinergic nerves can increase pancreatic exocrine secretion and increase secretion of endogenous secretin and cholecystokinin (CCK).

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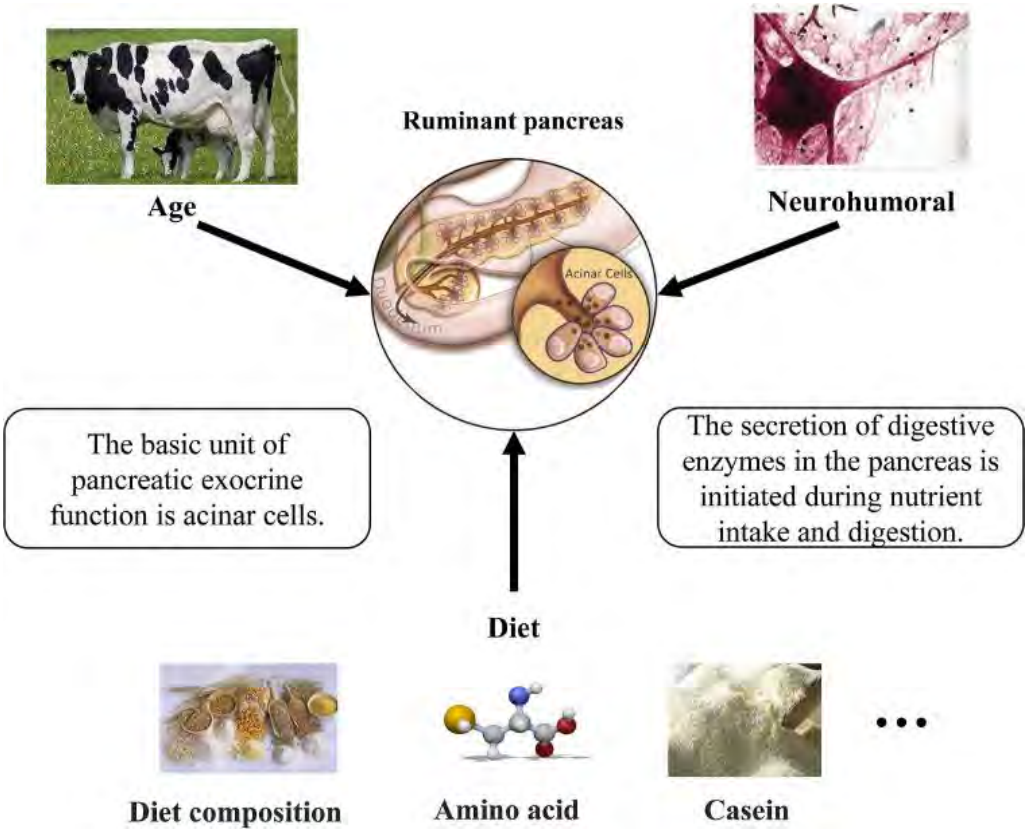
3. Animal Diet

When ruminants smell or see feeds, it stimulates the release of digestive enzymes by the pancreas. Different types of feed can affect the secretion of pancreatic enzymes. The proportion and type of dietary carbohydrates can affect the exocrine function of the pancreas, especially the secretion of amylase. There is a significant linear relationship between starch digestibility and chyme amylase, which indicates dietary rumen-protected starch affects pancreatic amylase secretion.

Functional amino acid such as leucine can be used as a nutrient signal to stimulate the secretion of α-amylase, trypsin, chymotrypsin, and lipase in a dose- and time-dependent manner. Phenylalanine increased amylase, trypsin synthesis, secretion, and mRNA expression in cow pancreas cultured in vitro.



Conclusion

Pancreatic secretions play very important role in digestive process of the ruminants. The alkaline secretion consists of bicarbonate ions that neutralize the HCl concentration of the ruminal contents. Cholecystokinin hormone secreted by the small intestine triggers the release of the pancreatic juice. The digestive enzymes and the proenzymes digest carbohydrates, proteins and lipids. Enterokinase enzyme present in the intestinal epithelium converts trypsinogen to trypsin which activates the other proenzymes. Trypsin, chymotrypsin and carboxypeptidase breakdown the proteins. Pancreatic amylase and lipase breakdown the carbohydrates and pancreatic lipase helps to digest triglycerides by breaking them down into fatty acids and glycerol. The activity of digestive enzymes containing amylase, protease, and lipase is low in newborn calves and increases with advancement of

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age. The secretion of pancreatic juice is regulated by CNS through vagus nerve, secretin and CCK hormones secreted by the duodenum.

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Popular Article

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An Overview of Syphilis

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Introduction

Syphilis is a sexually transmitted infection caused by a spirochaete Bacteria *Treponema pallidum* subsp. *pallidum*. The only known natural host of the bacterium is the human. It is highly contagious disease usually transmitted through sexual activity (venereal) including oral and anal sex, and can also be transmitted by other mean (non-venereal) such as contaminated needles exposed to injected blood, from infected mother to child across the placenta. syphilis is passed from person to person through direct contact with a syphilis sore. Infection is initiated when the organism penetrates the dermal micro abrasions or intact mucus membranes of a person. Treponema pallidum penetrates a broad variety of tissues, including central nervous system, eye and placenta.

The epidemic of the disease 1st recorded in Europe in 1495. It is spread widely throughout Europe in virulent form called pox and then on to India, China and Japan. At least three hypotheses about the origin of syphilis in Europe were advanced. Most popular and best supported by historical, archaeological studies is so called Columbian hypothesis which suggests that the disease is spread from Africa through Asia and entering North America. The presence of skeletal evidence of syphilis at the site of the Columbus's landing suggests that the Columbus soldiers got infected there and then transmitted the disease to the Europe when they returned in 1492.

The name "syphilis" is coined by the sixteenth century poet and Italian physician Girolamo Fracastoro of Verona in his epic noted poem written in Latin, titled Syphilis Sive Morbus Gallicus in 1530. The protagonist of the poem is a shepherd named Syphilus who is presented as the first man to contract the disease.

Etiology: *Treponema pallidum* subsp. *pallidum*

Gram negative motile, thin, spiral (6-12 regular spirals) or coil shaped spirochaetal bacterium (0.2µm in diameter and between 6-15µm in length).

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The Helical structure of the bacterium allow it to move in a corkscrew motion through viscous medium such as mucus. The causative agent of syphilis was first demonstration under magnification in Barlin on March 3, 1905 by schauddin and Hoffman in the chancres and inguinal lymph nodes of syphilitic patient.

Pathogenesis

Syphilis is starts with the formation of small lesion called chancre. which is present at the site of entry of the Spirochetes. Spirochete enters through the micro abrasion or mucosa of genitalia. When the syphilis is acquired through sexual activity (Venereal) most of the chancres are on the genitals, but may also develop in or on the mouth or on the breast. But when the syphilis is acquired non venereal (as occupationally in doctors or nurses), the primary chancre is extragenital, usually on the fingers.

Usual locations of the chancre

In Women	**In Man**
On the vulva (outside the vagina) On the cervix (neck of the wombs)	On the penis, around the anus and mouth.
In Both sexes The eye may be affected this may be seen as swelling in the blood vessel nervous or any part of eye. On genitals mouth breast and on rectal are common in male homosexuals. Multiple chancres may be seen in HIV infected or immunocompromise persons. In the rare instances where syphilis is transmitted by blood transfusion the primary chance does not occurs.	

Mode of Transmission: syphilis is transmitted by following routes:

- Through sexual intercourse: Anal, vaginal, or oral.
- From infected mother to foetus through the placenta at any time during pregnancy or through the Child's contact with syphilitic ulcers during the birth process.
- Through contaminated needles.
- Through needle sharing by drug addict and also through kissing.
- Transmission by blood transfusion is possible but rare because blood products one screened for the disease and spirochetes also die within 24 hours in stored blood.
- It is not transmitted by food, water, air, by sharing baths, toilets, towel or eating utensils because *Treponema* is delicate, fastidious, fragile and very sensitive to environmental factor and dies rapidly in water.

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Stages of syphilis:

Primary Stage

Primary stage of syphilis is the entry of the organism into the body. This is an asymptomatic period and first signs of infection are not always notice.

Incubation period: 10 to 90 days.

- After an incubation of 10 to 90 days the patient develops a primary syphilis.
- A small blister like hard sore (chancre) about 0.5 in (13mm) size, appear on genitals, anus or elsewhere.
- The chancre is round, painless, avascular and indurate.
- The chancre can remain unnoticed by up to 50% of patients and will heal in 3-10 days.
- Progresses to the second stage if untreated.

Secondary stage: Secondary stage of syphilis is sets in six to eight weeks to six months after the healing of primary chancre.

- Chancre heals spontaneously without leaving a conspicuous scar.
- During this interval patient is asymptomatic.
- Secondary syphilis is a systematic infection due to the wide spread multiplication of the spirochetes and their dissemination through the blood.

Clinical Features

- **Skin rashes:** Red pumpy skin rashes appear on arms, leg chest face or other area. Later reddish brown raised rash is seen on palms, hands and soles of the feet.
- **Skin lesion:** large raised white or gray lesion appear in warm moist area of the body including perineum, anus, at the site of the chancre.
- **Oral lesion:** Shallow irregular sore with greyish white covering found in the mouth (mucous plaques).

  Symptoms will go away without treatment.

  Latent stage: Absence of external symptoms. The latent phase is sometimes divided into two:
- **Early latent syphilis:** less than two years after infection.

  During this period symptoms of secondary syphilis can return.

  Transmittable sexually or from mother to child, resulting in congenital syphilis.
- **Late Latent syphilis:** Asymptomatic infection of longer than one year or of unknown duration.

Tertiary stage

Untreated individuals with latent syphilis infection developed tertiary syphilis.

Without treatment, the tertiary phase of syphilis may lead to several complications. At this stage, syphilis can affect multiple organs and systems, including brain, nerves, eyes, liver, heart, blood

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vessels, bones and joints. Tertiary syphilis can also cause death.

Neurosyphilis, ocular syphilis and otosyphilis can occur at any stage of the disease.

Neurosyphilis

About 8% of patients will develops symptoms in the central nervous system. It is mainly involving the brain or spinal cord. It is more common in HIV patients can cause strong headache, serious muscular problems and mental health issues, including dementia.

Ocular syphilis: can cause pain in the eye, blurry vision, sensitivity to light or blindness.

Otosyphilis: Affects the person's hearing and/or balance can case tinnitus, vertigo and sudden hearing loss.

Congenital syphilis: Congenital syphilis acquired in utero (transmitted from mother to a child during gestation).

- **Clinical features:** Deafness Blindness, bone and joint problems, meningitis, seizures and triad notched teeth.

Epidemiology

The venereal syphilis is worldwide in distribution. During the second world war the incidence of syphilis increased and reaches its peak in 1946. Each cases of syphilis is the potential source of small outbreak of the disease. Today the syphilis is increase more rapidly in United state and Canada. The world Health organization (WHO) estimates that there are 12 million new cases of syphilis per year. In 2020, WHO estimated that 7.1 million adults aged 15–49 acquired syphilis globally. The high-risk group for syphilis in the United State and Canada include the sexually active teenager, sexually abused children and prostitutes of either sex or their customers. Unprotected sexual intercourse is one of the increases among gay and bisexual men. (***Burton Goldberg groupThedefinitive Guide Fife WA: Future medicine Publishing in 1995***). In 2006 64% of the reported (P&S) syphilis cases were among men who have sex with man (MSM) have been reported in various cities including Chicago, Seattle, San Francisco, Southern California, Miami and New York city.

Laboratory Diagnosis

The diagnosis of syphilis is based on the person's clinical and sexual history, physical examination, laboratory testing and sometimes radiology, as symptoms are not common or noticeable. Laboratory tests for syphilis include direct detection of *T. pallidum* through a microscope (bacteriological tests) or indirect methods such as blood tests. Rapid tests are also available and can provide results in minutes. serological test for the detection of antibodies in the patient's serum.

Treatment

The early stage of syphilis is treated antibiotic given either intramuscularly ***(Benzathine, penicillin or ceftriaxone)*** and orally ***(Doxycycline, minocycline, tetracycline or azithromycin).***

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Pregnant women should be treated with either aqueous crystalline penicillin Gor aqueous procaine penicillin G. Children who acquired syphilis after birth treated with ***benzathine penicillin G.***

Prevention and control:

- Education to people about syphilis.
- Education about protected sexual behaviour and including the use of condoms. Syphilis can also spread through contact with other areas of the body not covered by a condom, including genitals, anus and mouth.
- Pregnant women should be tested for syphilis to reduce the risk of congenital syphilis in the infants.
- People diagnosed with syphilis should notify their sexual partners to prevent new infections.
- The only reliable methods for preventing the transmission of syphilis are abstinence or monogamous relationship between uninfected partner.

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Sex Sorted Semen Technology

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Abstract

As farming has become more mechanized, male bovines have become less useful. Farmers don't want to keep bullocks for farming or any other kind of draught work. Because of this, male cows born at a farmer's house are now a problem. Farmers often let the male calves run free, which makes the number of wild animals grow. With more than 90% accuracy, new technologies like the Sex Sorted Semen in AI programme can be used to make only female calves. The use of sex-sorted sperm will be a game-changer for farms because 90% of the times, only female calves are born, instead of a 50:50 male to female sex ratio with normal semen. If it is used a lot, the number of female animals will go up. This will help farmers make more money by selling the female animals or milk. Using sex-sorted sperm will also lower the number of male cattle, which will cut down on the number of stray cattle in the country.

What is sex sorted semen?

Sex-sorted semen is a specialized form of semen used in artificial insemination in livestock, particularly in the dairy and beef cattle industry. It is also sometimes used in other species such as horses and swine. The primary purpose of sex-sorted semen is to increase the probability of producing offspring of a specific gender, typically female.

How sex sorting of semen is done?

The process of sex sorting semen involves separating sperm cells into two groups: one is containing sperm cells with X chromosomes (which will result in female offspring when they fertilize an egg) and the other containing sperm cells with Y chromosomes (which will result in male offspring when they fertilize an egg).

There are a few methods for sex sorting semen, but the most common one is flow cytometry. Flow cytometry uses lasers and detectors to differentiate between X and Y chromosome-bearing sperm based on their DNA content. Once the sperm are sorted, they can be stored and used for artificial insemination.

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Methods of sex sorted semen-

Sex sorting semen is achieved through a process called flow cytometry, which separates sperm cells into two groups based on their DNA content, allowing for the selection of the desired gender of offspring. There are two main methods for sex sorting semen:

1. **Flow Cytometry**: Flow cytometry is the most common and widely used method for sex sorting semen. This technique relies on the differences in DNA content between sperm cells carrying X chromosomes (female-producing sperm) and those carrying Y chromosomes (male-producing sperm). Here's a simplified overview of the process:
    - **Sample Collection**: Semen is collected from the male animal, typically through artificial insemination techniques.
    - **Sperm Staining**: The collected semen is treated with a DNA-specific fluorescent dye that binds to the DNA in each sperm cell.
    - **Flow Cytometer**: The stained semen is then passed through a flow cytometer, which is a sophisticated machine that uses lasers and detectors to measure the fluorescence of each sperm cell. Based on the amount of DNA in each cell, the machine classifies them as X or Y chromosome-bearing sperm.
    - **Sorting**: After classification, an electrostatic charge is applied to the sperm cells as they pass through the machine. This charge causes the X and Y chromosome-bearing sperm to separate into different collection tubes or channels.
    - **Collection**: The sorted sperm are collected into separate containers and can be further processed, extended, and stored for artificial insemination.
2. **Magnetic-Activated Cell Sorting (MACS)**: While less common than flow cytometry, MACS is another method for sex sorting semen. MACS relies on the different surface charge and properties of X and Y chromosome-bearing sperm. The process involves the following steps:
    - **Sample Collection**: Semen is collected from the male animal.
    - **Sperm Separation**: The semen is processed and exposed to magnetic microbeads coated with antibodies that specifically bind to either X or Y chromosome-bearing sperm.
    - **Magnetic Field**: The treated sperm are then passed through a magnetic field. The microbeads attached to the sperm cells are affected by the magnetic field, causing the X and Y chromosome-bearing sperm to separate based on their surface properties.
    - **Collection**: The sorted sperm are collected and can be further processed, extended, and stored for artificial insemination.

Both flow cytometry and MACS have been used successfully to sort sperm by gender. However, flow cytometry is more widely adopted and tends to offer higher sorting accuracy and

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efficiency. The choice of method often depends on the specific goals, resources, and equipment available to the producer or breeding program.

Advantages of sex sorted semen-

The use of sex-sorted semen in livestock breeding offers several advantages, which can be beneficial for producers and the industry as a whole. Some of the key advantages include:

1. **Gender Selection**: Sex-sorted semen offers higher accuracy in selecting offspring gender, benefiting producers with breeding goals related to desired animal gender.
2. **Strategic Breeding**: Sex-sorted semen can be strategically utilized by producers to achieve breeding objectives, such as dairy farmers preferring female offspring for milk production and beef producers seeking more male calves for meat production.
3. **Improved Genetics**: Gender selection in offspring breeding allows producers to make informed decisions, leading to improved genetics, increased productivity, efficiency, and market demand.
4. **Reduced Culling**: Sex-sorted semen can minimize the need for animal culling, saving time and resources, and addressing ethical issues associated with culling.
5. **Increased Herd Uniformity**: Sex-sorted semen provides precise genetic control, enhancing uniformity in desirable traits like milk production and meat quality in herds.
6. **Better Animal Welfare**: Reduced culling can enhance animal welfare practices, as fewer animals are born with the intention of culling, reducing stress and ethical challenges.
7. **Maximized Efficiency**: Sex-sorted semen improves breeding efficiency by increasing the likelihood of producing desired offspring gender, thereby reducing the number of matings needed to achieve breeding goals.
8. **Market Demand**: Sex-sorted semen aids producers in meeting market demand by producing animals of higher demand, particularly in industries with fluctuating market preferences.
9. **Reduced Environmental Impact**: Sex-sorted semen reduces environmental impact of livestock farming by producing only the necessary animal gender, reducing resources needed for surplus animal production and maintenance.
10. **Research and Genetic Improvement:** Sex-sorted semen in controlled breeding programs can enhance research on animal genetics and breeding practices, thereby promoting continuous industry improvements.
11. **Improved animal welfare**: By avoiding the need to cull unwanted animals, sex-sorted semen can contribute to better animal welfare practices.

Sex-sorted semen, though potentially more expensive and inaccurate than conventional semen, is a valuable tool in modern livestock breeding programs, enabling producers to make strategic decisions.

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Constraint of sex sorted semen-

Sex-sorted semen offers numerous benefits in livestock breeding, but also presents several constraints and challenges for producers, including:

1. **Reduced Fertility**: Sex-sorting semen can decrease fertility due to damage to sperm cells, reducing their effectiveness in fertilizing eggs, leading to lower conception rates and constraints for producers.
2. **Higher Cost**: Sex-sorted semen is expensive due to the high cost of technology, equipment, and additional costs passed on to the producer, potentially limiting its affordability for some operations.
3. **Lower Sperm Viability**: Sorting and processing sperm can decrease cell viability, limiting fertilization opportunities, and may necessitate precise timing for optimal conception rates.
4. **Accuracy Variability**: Sex-sorting technology has improved, but accuracy may vary, potentially leading to misclassified sperm cells, requiring producers to be aware of this variability when using sex-sorted semen for breeding.
5. **Decreased Sperm Quantity**: Sorting can decrease the number of viable sperm in a semen sample, posing challenges when inseminating multiple animals or dealing with low fertility animals.
6. **Limited Availability**: Sex-sorted semen may not be accessible for all livestock breeds or species, with availability varying by region and potentially limited for less common or specialized breeds.
7. **Special Handling Requirements**: Sex-sorted semen necessitates meticulous handling and storage to ensure sperm viability, necessitating specific protocols for producers to ensure its viability until insemination.
8. **Expertise Required**: Expertise in artificial insemination techniques and proper timing is crucial for effective use of sex-sorted semen, as inexperienced breeders may struggle to achieve high conception rates.
9. **Regulatory Considerations:** Some regions may have regulations regarding the use of sex-sorted semen in livestock breeding, and producers should be aware and comply with these regulations.
10. **Environmental Impact**: Sex-sorted semen can reduce unwanted male animals but can also cause gender imbalances in livestock populations, impacting herd dynamics and genetic diversity.

Sex-sorted semen is a valuable tool in livestock breeding, but producers must weigh its advantages and constraints, considering their specific breeding goals and resources.

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Future perspectives of sex sorted semen

Research and technological advancements are advancing the potential of sex-sorted semen in livestock breeding, shaping its future perspectives and developments:

1. **Improved Accuracy**: Research aims to enhance sex sorting accuracy using flow cytometry technology and sperm biology knowledge, potentially reducing gender misclassification.
2. **Enhanced Fertility:** Researchers are enhancing the fertility of sex-sorted sperm by improving its viability and longevity, thereby increasing the chances of successful fertilization and higher conception rates.
3. **Reduced Costs**: The increasing accessibility of technology could potentially lower the cost of sex-sorted semen, making it more affordable for a wider range of livestock producers.
4. **Expanded Availability**: Sex-sorted semen may become available for a broader range of livestock species and breeds, allowing more producers to benefit from gender selection.
5. **Customized Genetic Improvement**: Livestock producers can enhance their breeding programs by controlling the gender of offspring, thereby achieving specific genetic improvements and meeting market demands.
6. **Genetic Diversity Management**: Breeders can strategically utilize sex-sorted semen to manage genetic diversity in livestock populations, preventing genetic bottlenecks and ensuring healthy, diverse populations.
7. **Expanded Species**: Sex sorting, primarily used in cattle, and may expand to other livestock species like swine, sheep, and goats, offering new genetic improvement opportunities.
8. **Genomic Selection Integration**: Sex sorting technology and genomic selection methods can enhance breeding programs by allowing producers to select not only for gender but for specific genetic traits also.
9. **Customized Genetic Traits**: Advancements in technology may enable genetic traits like disease resistance, meat quality, or milk production to be selected for sperm sorting beyond gender.
10. **Consumer Preferences:** Consumer preferences for animal products can influence the use of sex-sorted semen, leading producers to adjust breeding strategies based on growing demand for specific meat or dairy products.
11. **Research Opportunities**: Sex-sorted semen in controlled breeding programs can offer valuable insights into animal genetics, reproductive biology, and breeding strategies, aiding ongoing research in the field.
12. **Environmental Sustainability:** Sex-sorted semen can enhance sustainable livestock farming by decreasing surplus animals and potentially reducing the environmental impact of animal agriculture.

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13. **Reduced Need for Hormonal Treatments**: Hormones are frequently used in sex sorting, but future advancements may aim to reduce or eliminate their use to address concerns in livestock production.
14. **Regulatory Considerations**: Future developments may lead to changes in regulatory frameworks related to sex-sorted semen, including guidelines on its use and safety.
15. **Integration with Other Technologies**: Sex sorting semen may be integrated with other network error

The adoption of sex-sorted semen depends on livestock producer goals, economics, and advanced technology. As factors evolve, it offers genetic improvement and sustainable livestock production.

Conclusion

There are a lot of different ways that sexed semen is better than regular semen. The most important thing for the farmer is how much more likely it is to get pregnant with sexed semen than with regular semen. This difference in birth rates seems to have gotten smaller over the past few years. A high fertility sexed semen product gives the breeding management programme a lot more flexibility. It reduces the number of low-value male dairy calves, which could be a concern for animal welfare. It also increases dairy beef production, reduces greenhouse gas emissions from beef production, allows for more intense selection on the dam line, makes it easier to crossbreed with Jersey breed, makes raising heifers easier and improves biosecurity.

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Popular Article

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Fungal Infections Linked to COVID-19: A Critical Need for Alternative Therapeutic Strategies?

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Abstract

The clinical course of patients with viral respiratory disorders, particularly those hospitalised to intensive care units, may be complicated by secondary fungal infections. Hospitalised COVID-19 patients are more likely to develop fungal co-infections, which can worsen the prognosis of the illness due to misdiagnosis, which frequently leads to ineffective treatment and a high mortality rate. Fungal infections linked to COVID-19, primarily caused by Aspergillus, and fungi of the order Mucorales have been documented to pose a serious burden to the healthcare system. To enhance clinical results, early identification and proper antifungal medication are necessary; nevertheless, the developing trend in drug resistance highlights the need for new therapeutic agents. This article's goal is to provide an overview of current understanding of COVID-19-associated mycoses, treatment options, and most recent developments in the development of antifungal drugs, with a focus on peptides with antifungal action.

Introduction

Given that they pose a nearly one-billion-person global hazard to human health, fungi diseases continue to be a serious medical concern. The prevalence of invasive fungal infections has been steadily rising for a number of reasons, including the use of immunosuppressive medications during cancer treatment or organ transplantation, an increase in the use of contemporary medical devices like catheters and implants, and the use of broad-spectrum antibiotics. The 2019 Coronavirus Disease (COVID-19) Pandemic made matters worse because it makes it more challenging to get an accurate diagnosis and predisposes patients to additional, fatal fungal infections in intensive care units. The management of COVID-19 is made more challenging by the concomitant respiratory symptoms. Lymphopenia, leukopenia, and systemic hyperinflammatory response, combined with a prolonged hospital stay and perhaps requiring mechanical ventilation, encourage the growth of fungus in COVID-19 patients. Additionally, the (WHO) COVID-19 treatment guidelines advise against prescribing broad-spectrum antibiotics based solely on symptoms to address potential bacterial co-infections (WHO, 2021). Most significant fungal illnesses are caused by the main pathogenic species Candida, Aspergillus, Mucorales, and Cryptococcus. Despite the unacceptably high mortality rate

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linked with fungal healthcare-related invasive infections, the actual number of deaths is probably underestimated because of inadequate epidemiological data and misdiagnosis. Antifungal drugs are widely used as a result of the high clinical mortality and financial burden caused by invasive fungal infections. Prophylaxis and antifungal therapies are crucial to lowering the comorbidities and fatalities brought on by fungus infections. However, under the strain of selective pharmaceuticals, the effectiveness of few systemic antifungal medications has changed, giving rise to species with less predictable antifungal susceptibility. Some fungal species are prone to microbial resistance, which can be either secondary (acquired resistance in an otherwise susceptible strain as a result of medication exposure) or intrinsic (strains are naturally less susceptible to a given antifungal agent). Triazole-resistant Aspergillus fumigatus is the most notable species that has recently emerged and is thought to be a serious threat to public health. The hunt for safer alternatives with lower toxicity, enhanced pharmacodynamics and pharmacokinetics, and increased specificity has been sparked by the limited spectrum activity and cross-resistance caused by similar mechanisms of action across medications.

Aspergillosis

Aspergillus spp. are common environmental moulds that produce spores that can be inhaled and cause illness. Due to the conidia's relatively tiny size and ability to deeply penetrate the alveolar space, A. fumigatus is the most prevalent etiological agent globally. Immunocompetent people' lungs are usually cleared of Aspergillus spores by neutrophils and macrophages, which are cellular elements of the innate immune system. However, in those with impaired immune systems, Aspergillus spp. can result in a range of clinical symptoms. After exposure to environmental spores by inhalation or inoculation, an infection may form, triggering allergic reactions or infectious disorders that may spread from the respiratory system to become widespread or invasive. According to reports, critically sick individuals frequently develop invasive pulmonary aspergillosis (IPA), which has a high morbidity and fatality rate. Hospitalized patients who get corticosteroid medication, antibiotics, or have hematologic malignancies are more likely to develop IPA. Influenza and other respiratory viral illnesses have also been linked to IPA. Critically ill patients run the risk of developing secondary infections with Aspergillus spp. due to immunopathological similarities between severe influenza and severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pneumonia (such as cytokine storm syndrome, epithelial damage within the airways, and lymphopenia). Since COVID-19 patients in ICUs typically exhibit less-specific radiological indicators of infection in the presence of acute respiratory distress syndrome, the identification of COVID-19-associated pulmonary aspergillosis (CAPA) is challenging. The diagnosis of CAPA mostly relies on indirect fungal biomarkers (galactomannan and 1,3-D-glucan), culture-based approaches, and direct microscopic indication of fungal features that are unique to Aspergillus spp. Established CAPA categories include confirmed, likely, and possible based on sample validity and diagnostic evidence. Although serum -D-glucan and serum galactomannan both have poor sensitivity and specificity, and upper respiratory samples frequently are unable to

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distinguish between Aspergillus colonization and invasive disease, the presence of galactomannan in lower respiratory samples, such as bronchoalveolar lavage, is strongly suggestive of CAPA. Although the majority of experts considered bronchoscopy with bronchoalveolar lavage to be an effective method for detecting CAPA, bronchoscopy is not frequently carried out in many institutions in order to lower the danger of Covid-19 transmission due to aerosolization produced during this sampling method. Due to the fact that it has frequently been challenging to demonstrate the association between IPA and COVID-19, the majority of reported cases were therefore labelled as probable or possible CAPA. Since the incidence of CAPA post-mortem was somewhat lower than anticipated based on clinical findings, a comprehensive examination of autopsy series including histological investigations of COVID-19 decedents has further illustrated the difficulties with CAPA diagnosis.

Additional risk factors are frequently related to the care of severe COVID-19 patients. Studies with prospective and retrospective cohorts of COVID-19 patients admitted to intensive care units revealed a connection between the administration of high doses of corticosteroids and co-infection with Aspergillus. In addition, anti-interleukin-6 (IL-6) receptor therapy, like tocilizumab therapy, which is frequently used to treat COVID-19, seems to potentially confer higher risk for developing CAPA because the significantly elevated level of IL-6 in severe COVID-19 patients has also been found to be a contributing factor in protection against Aspergillus. The importance of worldwide awareness and early diagnosis is shown by the incidences of CAPA, COVID-19, which increased the likelihood of developing an IPA, and CAPA, which was strongly associated with a higher mortality rate (up to 50%). VOR or isavuconazole are the first-line antifungal medications advised for CAPA by the European Confederation of Medical Mycology (ECMM) and International Society for Human and Animal Mycology (ISHAM). However, a number of adverse consequences of VOR therapy are well-known (for example, hepatic problems and gastrointestinal disturbances). Remdesivir, a medication frequently used in the treatment of COVID-19, and VOR both interact with other medications due to the cytochrome P450 enzyme CYP3A4's involvement in their metabolism. Due to VOR's unpredictable metabolism and the fact that both sub-therapeutic and hazardous amounts have been found in individuals who are severely unwell, plasma concentration monitoring is necessary. Its limited use in ICU patients was caused by its limited therapeutic window, toxicity, and medication interactions. Isavuconazole has a superior pharmacokinetic profile and is less toxic than VOR, but it also acts as a substrate for CYP3A4, which lowers its effectiveness. The alternate treatment is liposomal amphotericin B, with the exception of those who have renal impairment caused by COVID-19. Posaconazole and echinocandins are two other second-line medications. Echinocandins must be used as a last resort or in conjunction with other medications.

Mucor mycosis

Mucorales, an order of filamentous fungi, are the source of the Angio invasive fungal illness known as Mucor mycosis. After aspergillosis and candidiasis, it is the third most frequent fungal

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infection, accounting for 9% of all invasive mycosis in immunocompromised patients. Even with adequate treatment, the disease has a high fatality rate (reaching 40–80%) and a rapidly progressing nature. The pathogens that cause Mucor mycosis are Rhizopus species, Mucor species, Lichteimia species, Rhizomucor species, Cunninghamella species, Apophysomyces species, and Saksenaea species. In recent years and during the COVID-19 pandemic, the prevalence of Mucor mycosis has gradually increased, particularly in India. In the second wave of COVID-19, which was designated an outbreak in May 2021, India experienced a sharp rise in cases of COVID-19-associated Mucor mycosis (CAM), which caused the healthcare system to crumble in the midst of the pandemic. However, Mucor mycosis cases among individuals with COVID-19 or those who are recovering from it have been rising globally. Mucorales are widespread in nature and can be found in the soil and on decomposing organic waste. Fungal spores, which are always present in the air, can cause infection when they are breathed or when they are injected into damaged mucous membranes or wounds. Regardless of the route of invasion, hyphal development causes invasion of blood vessels, leading to thrombosis and gradual necrosis, which destroys soft tissue and bones. Six unique clinical manifestations—rhino-orbital-cerebral, pulmonary, gastrointestinal, cutaneous, disseminated, and rare infection—could be seen in susceptible hosts. The most prevalent type of Mucor mycosis is rhino-orbital-cerebral, with Rhizopus spp. being the most common etiological pathogen. Uncontrolled diabetic mellitus with ketoacidosis, neutropenia, haematological malignancy, stem cell and solid organ transplantations, iron chelation therapy with deferoxamine, and corticosteroid use are the main risk factors for the development of Mucor mycosis. Most COVID-19 patients had hyperglycemia, low oxygen levels, high iron levels, an acidic environment, and impaired phagocytic activity, all of which promote the growth of fungus, notably Mucorales, which rely on free iron levels in the serum for their pathogenesis. The non-specific clinical and radiological signs of pulmonary and disseminated Mucor mycosis could be confused with symptoms of COVID-19, making a diagnosis difficult. Furthermore, the results of imaging procedures or serological testing from sputum and BAL samples are illuminating, thus CAM can easily be mistaken for CAPA, the most common mould infection in patients with COVID-19-associated acute respiratory distress syndrome. The gold standard for disease diagnosis is thought to be histological evaluation of paraffin-embedded tissue samples. Mucorales species contain aseptate hyphae that are wide, ribbon-like, and branch at right angles. Polymerase chain reaction (PCR) is a new molecular diagnostic tool that may provide an alternate method for quick diagnosis and early medication initiation. Controlling the underlying condition or risk factor, surgically removing necrotic infected tissue, and administering appropriate antifungal medication are crucial therapeutic tenets for Mucor mycosis. In order to successfully manage Mucor mycosis, surgery must be performed before the illness spreads to other organs and tissues. When paired with early, appropriate systemic antifungal therapy, surgery is associated with noticeably better clinical outcomes. Due to the difficulties in making the right diagnosis, patients are typically treated

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empirically for Mucor mycosis. Due to Mucorales' inherent resistance to the majority of antifungal medications, there are few effective treatment choices available, which results in therapeutic failure. Since lipid formulations of amphotericin B have less nephrotoxicity than other formulations, they are especially advantageous when given in high daily doses in case of orbital-cerebral involvement and are strongly advised as first-line treatment for serious life-threatening Mucor mycosis. For people with reduced renal function, posaconazole and isavuconazole have become standard second-line or salvage therapies. Echinocandins and VOR are ineffective. In severe cases of Mucor mycosis, other preventative measures (such combination therapy) should be taken.

Biologically Active Peptides as Potential Therapeutic Agents for Fungi

The need for novel medicines with enhanced safety profiles and broad-spectrum antimicrobial efficacy has been driven by the narrow spectrum of activity, side effects, drug-drug interactions, and high emergence of resistance of currently utilized antifungals. To overcome these obstacles, novel antifungals are now being researched, with a focus on toxicity reduction, pharmacodynamic and pharmacokinetic optimization, formulation enhancement, and increased specificity. Rezafungin, tetrazoles, and ibrexafungerp are some examples of innovations that have concentrated on medicines with new structures for established targets or on the establishment of completely new targets. Despite current efforts, antifungal drug resistance remained a significant issue; therefore, it is indisputable that different therapeutic techniques should be introduced. One of the possible therapeutic methods could involve combining conventional antifungals with quorum-sensing molecules (like farnesol or tyrosol) or non-antifungal medicines. Antimicrobial peptides (AMPs) are one of the other potential antimicrobial possibilities grabbing researchers' interest. The host defense peptides known as AMPs are crucial to the innate immune response. The 15–50 amino acids that make up AMPs are primarily cationic at physiological pH, and their amphipathic shape makes it easier for them to interact with the negatively charged membrane of microorganisms, which can result in membrane insertion, cell rupture, and membrane destabilization. Because AMPs exhibit a swift and dramatic effect on the slowly evolving fungal cell membrane, resistance to them is less likely to develop.

Future perspective

As a result of COVID-19, secondary fungal infections are a major cause for concern as the mortality rate in ICUs, particularly in patients with underlying conditions, rises due to delayed diagnosis brought on by similar symptoms of infections and the difficulties of identification techniques and treatment. Along with candidiasis, aspergillosis, and Mucor mycosis, COVID-19 patients are increasingly reporting fungaemia caused by Cryptococcus and Trichosporon species. Medical practices are challenged by the need to quickly and accurately identify fungal pathogens and adopt stringent infection control measures, which understates the prevalence of fungal co-infection in COVID-19 patients. Corticosteroid, immunosuppressant, and broad-spectrum antibiotic dosage and duration should all be carefully examined. Corticosteroid, immunosuppressant, and broad-spectrum

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antibiotic dosage and duration should all be carefully examined. The survival rate of hospitalized COVID-19 patients with fungal co-infections may be increased with prompt diagnosis and appropriate antifungal management; however, the therapeutic options currently available are limited, and the emergence of resistant or MDR fungal species compels us to look for new alternatives to combat nosocomial drug-resistant infections in hospital settings. Because of their variety and broad-spectrum activity, AMPs become excellent candidates for the creation of brand-new antimycotics. Commercial applications of AMPs are hampered by their poor pharmacological characteristics, toxicity, and high cost of large-scale manufacture.

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Popular Article

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Common Name of Parasites

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1. *Acanthocephalan* – thorny headed worm
2. *Ancylostoma duodenale* – hook worm (man)
3. *Ancylostoma tubaeforme* – hook worm (cat)
4. *Anoplocephala megna* – large horse worm
5. *Anoplocephala perfoliata* – lappet tapeworm
6. *Binitellobitharzia* – portal vein of elephant
7. *Bunostomum phelebotomum* - hook worm.
8. *Bunostomum trigonocephalum* - hook worm (sheep & goat)
9. *Capillaria species* –bobilo
10. *Chlonorchis sinensis*
11. *Chlonorchis sinensis* or *Oopistherchis sinensis* – oriental or Chinese liver fluke
12. *Corynosoma strumosum* – thorny headed worm
13. *Cotugnia digonopora* – bipore tapeworm of poultry
14. *Cutaneous habronemiasis* – other name is summer sore , bersati, granular dermatitis
15. *Davainea proglottina* – smallest poultry tapeworm but most pathogenic
16. *Davaineidae family* – hammer shaped hooks
17. *Dicrocaelium dentriticum* – lancet fluke
18. *Dictyocaulus filaria* – boot shape spicule, milky white
19. *Dilepididae family* – rose thorn shaped hooks
20. *Dioctophyma renale* – largest nematode – kidney worm of dog
21. *Diphyllobothrium latum* – public health importance – macrocytic hypochromic anemia
22. *Dipylidium caninum* – commonest and bipolar tapeworm of dog
23. *Dirofilaria immitis* – dog heart worm
24. *Draschia megastoma* – nodule form in stomach
25. *Draschia megastoma* and *Habronema muscae* – musca domestica
26. *Echinococcus granulosus* – zoonotic tapeworm
27. *Echinostomatidae* – head collar present
28. *Enterobius vermicularis* – pin worm or seat worm in man
29. *Fasciolopsia buskii* – raw water chestnut (eating) (transmitted)
30. *Filicolis anatis* – thorny headed worm

31. *Fimbriaria fasciolaris* – pseudo scolex
32. *Gaigeria pachyscelius* – hookworm (sheep & goat)
33. *Gastrodiscus agyptiacus* – saucers shaped body
34. *Gigantobitharzia* – birds
35. Habronema majus – stable fly (Stomoxys calcitrons)
36. *Haemonchus contortus* – wire worm, barbers pole worm, twisted worm, stomach worm, dorsal lancet, found in abomasum of sheep
37. *Heterakis gallinarum* - caecal worm of poultry
38. *Heterophidae family* – smallest trematodes
39. *Hydatid cyst* – metacestodes – larval stage
40. *Hymenolepis nana* – dwarf tapeworm of human being and rodents, autoinfection
41. *Macrocanthorhynchus hirudinacius* – thorny headed
42. *Micronema detetrii* – cerebrospinal nematodes (horse)
43. *Moniezia benedeni* – double pore
44. *Moniezia expansa* – largest tapeworm (double pore)
45. *Muellerius capillaris* – lung worm of sheep (commonest)
46. *Necator americanus* - hook worm (man)
47. *Nematomorphs* – hair worm
48. *Neorickettsia helminthrica* – solomon poisoning
49. *O. equi*- false whip worm
50. *Oesophagostomum radiatum* - pimply gut-found in intestine of cattle
51. *Oncicola canis* – thorny headed
52. *Opisthorchis fecinens*
53. *Opisthorchis sinensis*
54. *Opisthorchis tenuicollis*
55. *Oxyuris equi* – false whip worm or horse pin worm, single pin shape spicule
56. *Paramphistomatidae family* – plug feeder
57. *Paramphistomum cervi* – conical flukes
58. *Paranoplocephala mamillana* – without lappet and dwarf tapeworm
59. *Parascaris equorum* – large round worm of horse
60. *Polymorphus boschadis* – thorny headed worm
61. *Prosthogonimidae* – grape like bunches
62. *Raillietina echinobothrida* – nodular tapeworm
63. *Raillietina tetragona* – largest fowl worm
64. *Setaria cervi* – buffalo
65. *Setaria digitata* – cattle and buffalo
66. *Setaria labiatopapillosa* – sheep, goat
67. *Setaria species*- eye worm (cerebrospinal nematodiasis)
68. *Stephanofilaria assamensis* – Hump sore
69. *Stephanofilaria zaheeri* - ear sore
70. *Stephanurus dentatus* - kidney worm of swine
71. *Stilesia hepatica* – dumbbell shaped uterus
72. *Strongylus edentates* - palisade worm
73. *Strongylus equi* - palisade worm
74. *Strongylus vulgaris* – palisade worm
75. *Subulura brumpti* - caecal worm of poultry

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76. *Syngamus trachea* - gapeworm of poultry
77. Taenia multiceps – gid or staggers (brain)
78. *Taenia taeniaformis* – bell shaped, post proglottis, strobilocercus fasciolaris
79. *Thelazia alfortensis* – cattle
80. *Thelazia californionsis* – sheep eye worm
81. *Thelazia gulosa* – cattle eye worm
82. *Thelazia lacrymalis* - eye worm of horse
83. *Thelazia rhodesia* - (common in all) - ruminant eye worm
84. *Thysaniezia giardia* – undulating uterus
85. *Thysaniezia helictometra*
86. *Thysanosoma actinoides* – fringed tapeworm
87. *Toxocara canis* - arrow worm of dog and canine
88. *Toxocara cati* – arrow worm of cat and feline
89. *Toxocara leolina* - arrow headed worm (cervical alae present)
90. *Toxocara transfuga* - arrow worm
91. *Toxoplasma* and *Sarcocystis* - endodyogeny (protozoans)
92. *Trichinella spiralis* – Smallest nematode
93. *Trichostrongylus axei* - Ring worm
94. *Trichuris globulosa* – Ceccal worm of camel
95. T*richuris ovis* – whip worm, longer male than female
96. *Uncinata stenocephala* - hook worm of dog

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Popular Article

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Dilated Cardiomyopathy in Dogs

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Abstract

Dilated Cardiomyopathy (DCM) is a disease of predominantly large and giant breed dogs that results in progressive heart muscle dysfunction, chamber dilatation, and eventual congestive heart failure or death of affected patients. The exact cause of the condition is unknown but genetic factors are presumed to play a role. There is no known effective preventative strategy for the condition. Treatment of affected individuals may improve their quality of life, delay the onset of heart failure symptoms and potentially improve life expectancy. Treatment is not curative; however, most affected individuals eventually die from the disease.
Keywords: DCM, Treatment, Dogs

Introduction

Cardiomyopathies are recognized as common ailments in small animal clinical practice. Among cardiomyopathies, Dilated Cardiomyopathy (DCM) remains as an independent risk factor for chronic morbidity and mortality (Thomas, 1987). DCM is a primary disease of the heart muscle in which the heart muscle (myocardium) of the lower pumping chambers (ventricles) becomes weak and loses its ability to contract normally. DCM most commonly affects the left side of the heart (the side that receives blood from the lungs and pumps it to the body), specifically the left ventricle. When the myocardium cannot pump blood out of the left heart effectively, the kidneys retain sodium and water to increase the amount of blood returning to the heart. This leads to an enlargement of the ventricles in order to compensate for the ineffective pumping. This is helpful for years but ultimately becomes detrimental when it causes the blood pressure in the heart to back up into the lungs, thereby causing fluid accumulation within the lungs (pulmonary edema). This is called heart failure or Congestive Heart Failure (CHF) (Wynne and Braunwald, 2001). Although less common, DCM affecting the right ventricle can also occur. Blood backs up on the right side, which receives blood from the body and

pumps it to the lungs, resulting in right-sided CHF, where fluid accumulates in the abdomen (ascites) and chest (pleural effusion). DCM affecting the right ventricle is almost always accompanied by DCM of the left ventricle (Sisson *et al.,* 2000; Tidholm *et al.,* 2001).

CAUSATIVE FACTORS

Breed predisposition

- There are several breeds that are predisposed to DCM. These include Doberman Pinschers, Great Danes, Irish Wolfhounds, Boxers, Newfoundlands, Portuguese Water Dogs, Dalmatians and Cocker Spaniels. Large and giant breeds are most commonly affected, but it also occurs in smaller breed dogs.
- Genetic factors seem to play a large role in the inheritance and development of DCM in the dog. In fact, the definitive genetic mutation causes DCM in some breeds, such as the Doberman and Boxer. Boxers get a specific type of cardiomyopathy called Arrhythmogenic Right Ventricular Cardiomyopathy (ARVC). They are prone to fainting and sudden death. The fainting most commonly happens when they develop a very fast heart rate (greater than 300 beats/min). Sudden death usually occurs when this fast rate degenerates into ventricular fibrillation (cardiac arrest) (Kittleson and Dion, 1991; McEwan, 2000).

Nutritional deficiencies

- Taurine is an amino acid required for the development and function of the myocardium. Consequently, pets may develop DCM on taurine-deficient diets, such as vegetarian diets, and may benefit from appropriate supplementation. Some breeds, such as American Cocker Spaniels and Golden Retrievers, may have a predisposition to taurine deficiency, possibly through defects in metabolizing taurine (Martin *et al.,* 2010)
- L-carnitine is another amino acid that has rarely been implicated in the development of DCM in people. L-carnitine is required for the myocardial cells to produce energy and thus contract. There is some evidence that a deficiency in this molecule will contribute to myocardial dysfunction in Boxers (reported in earlier studies). Some American cocker spaniels need to be supplemented with it, along with taurine, to produce a beneficial response.

Diet

- Grain-free diets, certain boutique diets, and diets with exotic ingredients may also be linked to dilated cardiomyopathy.

Drug or Toxin induced

- Occasionally, toxins can cause DCM. The most common toxin is Doxorubicin (Adriamycin), an anti-cancer drug used to treat various cancers in dogs. In some cases, dogs receiving Doxorubicin will develop DCM.

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Hormonal problems

- There are a few less common secondary causes of dilated cardiomyopathy. Hormonal issues like hypothyroidism and hypoadrenocorticism (Addison's disease) can predispose dogs to heart diseases (Satish Kumar *et al.,* 2012)

Infectious (Myocarditis)

- Infectious causes of dilated cardiomyopathy are rare. Puppies infected with parvovirus at two to four weeks of age can develop dilated cardiomyopathy (Braz-Ruivo, 1999).

CLINICAL SIGNS

- DCM occurs in dogs of all ages, but the risk increases substantially with advanced age. The majority of dogs with DCM were above 6 years of age (Kathryn, 2005).
- Signs of DCM vary depending on the breed of dog and stage of the disease. Loss of appetite, pale gums, increased heart rate, coughing, difficulty breathing, periods of weakness, and fainting are signs commonly seen.
- Since blood is backed up into the lungs, respiratory signs (CHF) due to pulmonary edema are most common. Blood returning to the right side of the heart from the body may also back up leading to fluid accumulation in the abdomen (ascites) or in the chest cavity (pleural effusion). Weakness or collapse may be caused by abnormal heart rhythms (arrhythmias) and occasionally by decreased blood flow to the body (depressed cardiac output).
- In some breeds, sudden death or fainting can occur well before any signs of CHF.

DIAGNOSIS

- The identification of DCM is initially based on physical examination findings, chest radiographs, electrocardiography, and recognition of characteristic features (dilated poorly contracting heart) on an echocardiogram.
- Chest radiographs identify any pulmonary edema (fluid in the lungs backed up from the heart) or pleural effusion (around the lungs) and evaluate the heart size.
- The echocardiogram is interpreted in conjunction with several other tests to rule out systemic conditions that can cause similar echocardiographic findings such as a low thyroid level, amino acid deficiency (taurine, carnitine), inflammation of the heart muscle (myocarditis), or decreased blood flow to the heart muscle (ischemic heart disease) (Paul Wotton, 2010).
- In some breeds (Boxer, Doberman pinscher), screening with a 24-hour ECG recording (Holter monitor) may be able to identify animals early in the course of the disease process so that they can be removed from the breeding population if they are potential breeding animals (Jeyaraja *et al.,* 2008).

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- In other affected individuals, a Holter monitor may be recommended to determine the frequency and severity of irregular heart rhythms to help guide treatment.
- Genetic mutation causing DCM is known in a certain breed (Doberman, Boxer), DNA from a cheek swab or blood sample can be used to screen for the disease.

TREATMENT

- There are no proven strategies for preventing the development of DCM, although many medical protocols and nutritional supplements have been proposed. Some medical therapies have been demonstrated to delay the progression of DCM once a diagnosis is reached, and in patients with underlying conditions causing heart muscle weakness (thyroid deficiency, taurine deficiency), supplementation with the appropriate therapies can halt or reverse the heart muscle changes.

Diuretics

These are drugs that stimulate the kidneys to remove excess fluid from the body. Furosemide and spironolactone are two commonly used diuretics.

Angiotensin converting enzyme (ACE) inhibitors

ACE-inhibitors work by lowering blood pressure and reducing the after-load or resistance to blood flowing out of the heart. ACE-inhibitors are the only drugs proven to extend life expectancy in both humans and dogs. Enalapril and benazepril are commonly used ACE-inhibitors in dogs.

Cardiac glycosides

These drugs improve heart function in several ways. They slow the heart rate and strengthen heart contractions, so the blood is pumped more effectively. Digoxin is the most common digitalis glycoside used in veterinary medicine. Because of the potential for toxic side-effects, the dose must be closely regulated and monitored through routine blood tests and ECG (Electrocardiography) analyses.

Vasodilators

These drugs dilate the arteries or veins of the body so that the heart does not have to work so hard to pump blood to the body. ACE-inhibitors have vasodilator activity and are the vasodilators used most widely in the therapy of congestive heart failure associated with DCM.

Bronchodilators

These drugs make breathing easier for dogs experiencing DCM. It includes theophylline and aminophylline.

Pimobendan

This drug lowers the pressure in the arteries and veins and improves the heart muscle strength, therefore increasing blood flow to the body.

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Anti-arrhythmic drugs

Many dogs with DCM have arrhythmias. If arrhythmias are not controlled with the above medications, antiarrhythmic drugs may be added cautiously. Two main classes are beta-blockers (Atenolol, sotalol, carvedilol) and calcium channel blockers (Diltiazem). Other types of antiarrhythmic drugs used long term can include procainamide, mexiletine, and amiodarone.

CONCLUSION

Dilated Cardiomyopathy in dogs is a disease that causes enlargement of the heart, meaning it cannot pump blood effectively. Treatment and prognosis can vary depending on the underlying causes. The prognosis for dogs with secondary dilated cardiomyopathy is generally good, as long as the underlying disease can be identified and treated. However, the prognosis for dogs with primary dilated cardiomyopathy is more variable and depends on their condition. Boxers and Dobermans with inherited heart disease typically live only for a few weeks to a few months after diagnosis. Dogs with dilated cardiomyopathy will require monitoring for the rest of their lives.

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Popular Article

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Total Intravenous Anaesthesia

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While mentioning anything regarding intravenous route it is important to mention the contributions of Francis Rynd (hollow needle in 1845) and Charles Gabriel Parvaz (syringe in 1853), that has made intravenous administration of drugs so feasible and effective.

Now a days when the field of medical science is widely progressing in all the aspects, the techniques and concepts for the use of anaesthetic agents has also evolved in order to improve the depth of surgical plane of anaesthesia and post operative recovery of the patient. One of such evolved techniques is Total Intravenous Anaesthesia. Where solely injectable anaesthetics are used to induce and maintain the anaesthetic planes. Prior to this technique the most routinely practiced protocol was Combined anaesthetic Protocol, where the combination of Injectable and gaseous anaesthetics was used for induction and maintenance.

TIVA is the popular abbreviation used for Total Intravenous anaesthesia. TIVA helps to attain general anaesthesia and hence prevents the side effects that are caused by the certain volatile inhalant anaesthetic agents (Murray et al. 2009). In this technique the intravenous agents are titrated considering the safety doses for the maintenance of surgical plane of anaesthesia. Broadly considering, the combination of any hypnotics and opioids can be used for Total Intravenous anaesthesia. Sedative-hypnotic agents like Ketamine, Propofol and Etomidate are widely used as TIVA in human medical practice (Hendrickx et al. 2008)

Objectives:

- Smooth induction depending upon the amount of titrated anaesthetic agents.
- Rapid recovery by the end of titration of anaesthetic agents.
- Effective and easy monitoring of anaesthesia.

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Specific indications for TIVA

- Anaesthesia in non-theatre environments
- Malignant hyperthermia risk
- History of severe PONV
- Patients with anticipated difficult intubation/extubation
- Surgery requiring neurophysiological monitoring
- Transfer of an anaesthetised patient between environments

Equipments and Maintenance

The delivery of intravenous anaesthetics is dependent on different types of infusion devices. Examples of infusion devices include smart pumps, syringe pumps and target controlled infusion (TCI) devices.

During TIVA, the continuous assessment of heart rate, blood pressure, and state of consciousness is essential when titrating anaesthetic agents. (Bowdle et al., 2021; Nimmo et al., 2018) Processed electroencephalogram (EEG) monitoring is used to assess anaesthetic depth.

Ideal properties of TIVA

- Should be water soluble,
- Should be stable in solution and chemically compatible with other drugs.
- Should be Non- tissue toxic (in case of peri-vascular injection),
- Can be given in concentrated form,
- Not absorbed by plastics (tubing etc.),
- Should not promote bacterial growth,
- Rapid onset of action and clearance from the body for rapid predictable recovery,
- Should have Fewer adverse/side effects and should be cheaper.

Conclusion

TIVA can be considered as one of the safest, cheapest and more convenient anaesthetic techniques. TIVA is the default solution for a patient with malignant hyperthermia risk who requires general anaesthesia. It is the finest alternative currently available for administering anaesthesia to field veterinarians since it can be utilised in field situations.

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Popular Article

Mastitis

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DEFINITION

Mastitis is inflammation of the parenchyma of the mammary gland regardless of the cause. It is therefore characterized by a range of physical and chemical changes in the milk and pathological changes in the glandular tissue.

Important changes in the milk include: discoloration, the presence of clots and the presence of large numbers of leukocytes.

Important changes in the mammary gland: swelling, heat, pain and edema.

ETIOLOGY:

Bovine mastitis is associated with many different infectious agents, commonly divided into those causing

Contagious Mastitis: which are spread from infected quarters to other quarters and cows.

Opportunistic Mastitis: those that are normal teat skin inhabitants and cause

Environmental Mastitis: which are usually present in the cow's environment and reach the teat from that source.

Contagious Pathogens: *Staphylococcus aureus, Streptococcus agalactiae, Mycoplasma bovis* and *Corynebacterium bovis*

Teat Skin Opportunistic Pathogens: coagulase-negative staphylococci

Environmental Pathogens: environmental Streptococcus spp. including *Streptococcus uberis and Streptococcus dysgalactiae,* which are the most prevalent;less prevalent is *Streptococcus equinus.*

Environmental coliforms: include the Gram-negative bacteria *Escherichia coli, Klebsiella spp.* and *Enterobacter spp.,* and *Arcanobacterium pyogenes*

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Methods of transmission

1. Teat canal
2. Infection originating from either an infected udder or the environment;
3. Inert carrier: milking machine liners, milkers' hands, wash cloths.
4. Flies
5. Contact

Risk Factors

Age and parity: The prevalence of infected quarters increases with age, peaking at 7years.

Stage of lactation: Most new infections occur during the early part of the dry period and in the first 2 months of lactation.

Breed: Generally, the incidence of mastitis is greater in Holstein-Friesians than in Jerseys

Udder hygiene: Dirty udders are associated with increased prevalence ofintra mammary infection due to contagious pathogens.

Nutritional status: Vitamins E and A and selenium may be involved in resistance to certain types of mastitis.

Zoonotic potential

Bacterial contamination of milk from affected cows may render it unsuitable for human consumption by causing food poisoning. Tuberculosis, streptococcal sore throat and brucellosis may be spread in this way.

PATHOGENESIS

Invasion: is the stage at which pathogens move from the teat end to the milk inside the teat canal.

Infection: is the stage in which the pathogens multiply rapidly and invade the mammary tissue.

Inflammation: follows infection and represents the stage at which clinical mastitis occurs with varying degrees of clinical abnormalities of the udder.

Abnormalities of the udder include marked swelling, increased warmth and, in acute and per-acute stages, gangrene in some cases and abscess formation and atrophy of glands in chronic stages.

- The most significant sub-clinical abnormality of the milk is the increase in the somatic cell count.
- Milk somatic cells in a healthy gland consist of several cell types, including neutrophils « 11 %), macrophages (66-88%), lymphocytes (10-27%), and a smaller percentage of epithelial cells (0 -7%)

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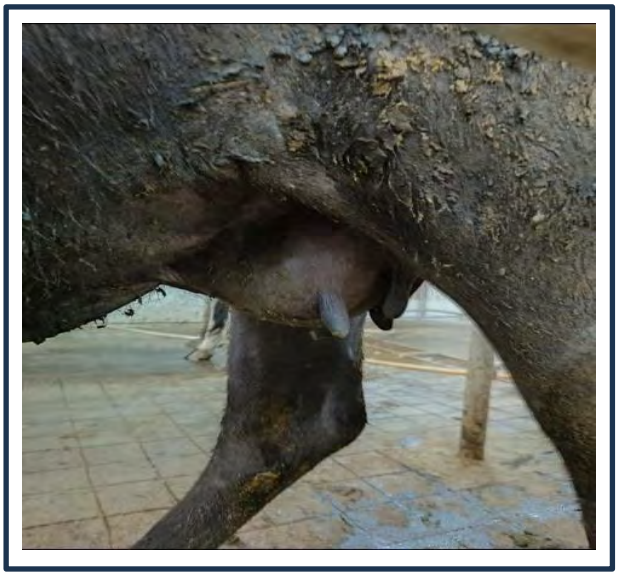
- Neutrophils are the predominant cell type found in mammary tissues and secretions during inflammation.
- In the healthy lactating mammary gland, the scc is less than 100 000 cells/mL of milk. During intramammary infection, the glandular sec can increase to more than 1000000 cells/mL.

CLINICAL FINDINGS



3 categories of clinical mastitis: abnormal milk, abnormal gland and an abnormal cow.

Severity is characterized as:

Per-acute: severe inflammation, with swelling, heat and pain of the quarter, with a marked systemic reaction, which may be fatal

Acute: severe inflammation without a marked systemic reaction

Sub-acute: mild inflammation with persistent abnormality of the milk.

Abnormal milk:

Blood-staining or wateriness Clots or flakes. Blood clots are of little significance in a mastitis case, neither are the small plugs of wax that are often present in the milk during the first few days after calving (in heifers). Flakes at the end of milking may be indicative of mammary tuberculosis in cattle.

Abnormal gland:

Abnormalities of size and consistency of the quarters may be seen and felt

The supra-mammary lymph nodes should also be palpated for evidence of enlargement.

The terminal stage of chronic mastitis is atrophy of the gland. On casual examination an atrophied quarter may be classed as normal because of its small size, while the normal quarter is judged to be hypertrophic. Careful palpation may reveal that, in the atrophic quarter, little functioning mammary tissue remains.

Abnormal cow (systemic response):

Toxemia, fever, tachycardia, ruminal stasis, depression, recumbency and anorexia may or may not be present, depending on the type and severity of the infection.

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DIAGNOSIS:

Detection at the herd level

The prevalence of sub-clinical mastitis or intramammary infection is monitored by determining the bulk tank milk SCC and by culturing bulk tank milk. These two methods are recommended to diagnose the presence and prevalence of mastitis pathogens on a herd basis.

Detection at the individual cow level

Individual cow examination and application of an indirect (screening) test for infection, such as the SCC of a composite milk sample.

Culture of individual cow milk - Individual quarter samples are preferred.

If individual quarter samples are collected, screw-cap vials are most satisfactory. If there is delay between the collection of samples and laboratory examinations, the specimens should be refrigerated or frozen. Freezing of milk samples appears to have variable effects on bacterial counts, depending on the bacteria.

Indirect tests for sub-clinical mastitis

California Mastitis Test

Increases in electrical conductivity of milk

Increases in the activity of cell associated enzymes (such as NAGase) in milk.

ELISA tests to detect neutrophil components

Of these indirect tests, only the CMT and electrical conductivity can be used cowside,with CMT providing a more accurate screening test than electrical conductivity.

The CMT is also known as the Rapid Mastitis test, Schalm test or Mastitis-N-K test,was developed in 1957.

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Procedure:

Add milk in 4 chambers of plastic paddleAdd

⇩

reagent in equal amounts Cell lysis

⇩

Gel is formed (due to increased leukocytes)

⇩

More the gel and more is the infection

⇩

California Mastitis Test Scores
Correlation of CMT Score with Somatic Cell Count

CMT Score	Somatic Cell Range		
N	0	to	200,000
T	200,000	to	400,000
1	400,000	to	1,200,000
2	1,200,000	to	5,000,000
3	Over 5,000,000		

Jasper,D.E. 1967. Proceedings of National Mastitis Council (adapted)

N-Negative T- Trace

The NAGase test:

The NAGase test is based on the measurement of a cell-associated enzyme (N- acetyl-B- D-glucosaminidase) in the milk, a high enzyme activity indicating a high cell count.

NAGase is an intracellular lysosomal enzyme derived primarily from neutrophils but also from damaged epithelial cells.

Biopsy of mammary tissue

A biopsy of mammary tissue can be used for histological and biochemical evaluation in research studies.

TREATMENT

Antibiotics - penicillin, Cephalosporin, Gentamicin, Tetracyclines Pulv. Mammidium + jaggery (As an adjuvant to antibiotic therapy) @50gm daily for 4 days Intramammary infusions - Mastiwok- Cefoperazone sodium - Mammicef

Topical: Mastilep spray & gel - used as prophylactic and treatment for mastitis

- Wisprec advanced cream

- Inflamin vet cream

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Supportive therapy:

Supportive treatment, including the intravenous administration of large quantities of isotonic crystalloid fluids, is indicated in cattle with severe systemic illness.

Dry cow therapy

Is the use of intramammary antimicrobial therapy immediately after the last milking of lactation and is an important component of an effective mastitis control program. Intramammary infusions at drying off decrease the number of existing infections and prevent new infections during the early weeks of the dry period.

Blanket dry cow therapy is treatment of all four quarters at drying off, compared to selective dry cow therapy based on treatment of only those quarters that are infected

Permanently drying off chronically affected quarters

If a quarter does not respond to treatment and is classified as incurable, the affectedanimal should be isolated from the milking herd or the affected quarter may be permanently dried off by inducing a chemical mastitis.

The best method for permanently drying off a quarter is infusion of 120 mL of 5% povidone-iodine solution (0.5% iodine) after complete milk-out and administration of flunixin meglumine (1 mg/kg BW, intravenously). This causes permanent cessation of lactation in the quarter but does not alter total milk production by the cow.

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Intestinal Obstructions in Large Ruminants

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Introduction

Large animals, primarily cattle, commonly suffer from intestinal obstructions. These blockages can be either mechanical (luminal or extraluminal) or functional, with functional obstructions being more common. Extraluminal obstructions may result from conditions like volvulus or abdominal masses (e.g., lymphosarcoma or fat necrosis) in cattle. Functional obstructions, though lacking gross abnormalities, are characterized by reduced intestinal movement (ileus).

Etiology and Pathogenesis

Functional intestinal obstructions often have unclear causes and relate to changes in intestinal motility, possibly due to dietary, management, phytobezoars, parasites, enteritis, peritonitis, or electrolyte imbalances.

Mechanical obstructions result from physical GI tract blockages, including congenital issues like atresia jejuni, coli, recti, and ani in calves, and atresia ani.Specific causes of intestinal obstruction include: Duodenal sigmoid flexure volvulus, Jejunal and ileal intussusception, Jejunoileal flange volvulus, Mesenteric root volvulus, Jejunal luminal occlusion due to hemorrhagic jejunitis-induced blood clot, Small intestine or spiral colon obstruction by phytobezoars, Cecocolic volvulus, Coli, recti, and ani atresia.

Intussusceptions may result from irregular peristaltic movements due to enteritis, parasitic infections, dietary issues, or mural masses.

Clinical Findings and Diagnosis

Cattle in pain may display behaviors such as hind limb treading, stretching, restlessness, kicking the abdomen, and teeth grinding. In cattle, signs of intestinal obstruction include reduced or

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absent feces, variable abdominal swelling, and abnormalities detectable through rectal examination, ultrasound, clinicopathologic analysis, or laparotomy.

Additional indicators of intestinal obstruction in cattle encompass decreased appetite, diminished milk production in lactating cows, and abnormal feces, sometimes mixed with mucus or blood. The presence of raspberry-colored blood mixed with feces suggests small-intestinal bleeding, while brighter red blood typically signifies colon or rectal bleeding. Abomasal bleeding is associated with melena.

Cecal distention may not cause abdominal swelling but can be detected by a ping in the caudal dorsal paralumbar fossa. In cases of cecocolic volvulus, palpation reveals distended loops of the large intestine, accompanied by rumen hypomotility. Metabolic and cardiovascular issues are generally mild, except for prolonged cecocolic volvulus.

Ultrasonography, performed through the right paralumbar fossa or rectum, can identify small-intestinal distention, ileus, hypomotility, atony, and increased peritoneal fluid. In some instances, it may detect intussusception.

Severe changes in cardiovascular parameters, such as tachycardia, abnormal mucous membrane color, prolonged capillary refill time, and dehydration, are often associated with hemorrhagic strangulating obstructions like volvulus of the jejunal-ileal flange or volvulus at the root of the mesentery. These conditions manifest sudden cardiovascular deterioration, unlike cecocolic volvulus or intussusception, which can persist for several days. Peritoneal fluid analysis can gauge the extent of peritonitis and assist in diagnosis.

Treatment

Treatment of functional intestinal obstruction in cattle involves identifying and addressing the underlying cause, correcting dehydration and electrolyte imbalances with fluid therapy, administering calcium supplements as needed, providing oral potassium chloride, and managing secondary ketosis. Erythromycin may be considered to enhance abomasal emptying and intestinal motility, although evidence for functional obstruction is limited. Prokinetic agents are not recommended for mechanical obstruction due to the risk of intestinal rupture.

Mechanical obstructions almost always necessitate surgical intervention, with preoperative antimicrobial treatment and supportive care including fluids, electrolytes, and calcium. Most functional obstructions have a favourable prognosis when appropriate supportive therapy is applied, especially if the underlying cause is resolved.

Prevention

Preventing all or most cases of intestinal obstruction in cattle may not be entirely possible. Nevertheless, several preventive measures can help reduce the risk:

1. Avoid abrupt changes in feeding and management practices.

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2. Ensure cattle have access to an adequate supply of water to prevent dehydration.
3. Implement effective parasite control measures to minimize the risk of infection.
4. Address dental abnormalities in cattle to facilitate proper chewing and digestion.
5. Provide access to appropriate feeds and avoid coarse feeds, highly fermentable feedstuffs, and foreign materials that can contribute to obstructions.

While complete prevention may be challenging, these measures can significantly decrease the likelihood of intestinal obstructions in cattle.

Conclusion

In conclusion, a comprehensive approach is crucial for managing mechanical intestinal ileus in cattle. This entails promoting proper feeding practices, employing thorough diagnostics, and utilizing prokinetic treatments. This approach helps prevent, diagnose, and treat the condition effectively, enhancing cattle well-being and reducing treatment costs, thus ensuring their overall health and welfare.

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Ozone Therapy

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Ozone is a powerful sterilizer that destroys bacteria, viruses, and Odors. When contaminants such as bacteria or viruses make contact with ozone, it breaks down cell walls, thus destroying bacteria in a process is called oxidation. To clean water, promoting its potent microbicidal action Ozone was successfully used to treat chronic wounds, ulcers, infected wounds. (Stubinger et al., 2006)

Ozone is relatively safe if used correctly. Extended exposure to very elevated levels of ozone can cause irritation to the lungs. Ozone is a great disinfectant used for livestock water tanks, cattle embryo transfer (ETT), swimming pools, spas and the water treatment systems of over 2,000 municipalities around the world

Mechanism of action

1. **Decreasing Inflammation:** This increase of carbon dioxide contributes to inflammation and pain. Increasing the amount of oxygen delivered to the tissue in the form of reactive ozone decreases inflammation, pain and swelling, and helps increase healing.
2. **Activating the Immune System:** Ozone therapy has also been shown to activate the immune system by stimulating Cytokine production. Cytokines are “messenger cells”.
3. **Inactivating bacteria, viruses, fungi, yeast and protozoa:** Healthy cells are surrounded by an enzyme coating, which ozone does not penetrate, but bacteria and viruses have no such coatings. Ozone therapy disrupts the integrity of the bacterial cell envelope through oxidation of the phospholipids and lipoproteins (peroxidation). In viruses, this peroxidation disrupts the reproductive cycle and damages the viral capsid. In fungi, ozone inhibits cell growth

Properties

1. Ozone is a potent regulator of the immune system
2. Ozone stimulates increased uptake and utilization of oxygen
3. Ozone increases the efficiency of the body’s antioxidant enzyme system

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4. Ozone improves circulation
5. Ozone is anti-inflammatory
6. Ozone is anti-microbial

Therapeutic use

1. Skin – wounds, especially degloving ones and deep abrasions; hot spots; pyodermas; allergic dermatitis; abscesses
2. Pain relief
3. Head trauma, spinal cord inflammation–ozone and oxygen go through the blood/brain barrier so it is an excellent way to aid treatment of any neurological issue
4. Mouth–stomatitis, gingivitis, abscesses;
5. Cancer and autoimmune problems
6. Ears – chronic and acute otitis from bacteria or yeast; aural hematomas
7. Eyes – infections and allergic reactions
8. Upper respiratory ailments
9. Potentiates acupuncture, homeopathy and chiropractic treatments as it brings more needed oxygen to the body
10. GI tract – constipation, diarrhea, IBS
11. Equine infectious anemia
12. Musculoskeletal Injuries

Way of administration:

1. Major or minor autohemotherapy (mixing ozone with blood and re-infusing)
2. Dissolved in IV fluid solutions (saline or distilled water)
3. Intestinal insufflations (rectal & vaginal)
4. Auricular insufflations
5. Limb bagging (Interdigital/Toe infections, wounds, pyoderma, Malassezia, tumor)
6. Topical exposure (ozonated olive oil)
7. Joint or subcutaneous injections (Prolozone)
8. After percolating ozone through olive oil it can be used in an incubator as an inhalant.
9. Ozone can also be percolated into saline fluids and use it for flushing (decreases inflammation and pain) wounds, ear, bladder, nose and mouth.
10. Prolotherapy (prolozone) injection is used for ailments of joints. In Human, studies have showed efficacy in pain relief for many conditions.
11. Biophotonic blood can also be used

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Teaching -Learning Process: Emerging Methods of Pedagogies

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INTRODUCTION

"Everyone is a genius. But if you judge a fish by its ability to climb a tree, it will live its whole life believing that it is stupid"

-Albert Einstein

Pedagogy is the art, science or profession of teaching. In today's classroom we have students with different needs, interests, learning capacity, language abilities and background. In this context pedagogy plays a crucial role in the education system by shaping the learning experiences of students. With increasingly diversified need of the world, it has become imperative for pedagogy to adapt and cater to the needs of students. Diversified students bring unique perspectives and learning styles to the classroom and all-inclusive pedagogical approach helps to create an equitable and supportive learning environment for all.

Pedagogies promotes students at the centre of the educational process. It recognizes the diverse needs and abilities of student, allowing educators to tailor made instruction to meet individual learning style. As the education evolves in 21st century, the need for emerging pedagogies in teaching and learning becomes increasing evident. It offers innovative and effective methods that facilitates acquisition of knowledge and skills. Emerging pedagogies are revolutionizing the way educators want to rejuvenate the students by providing a more encouraging and personalized learning experience. There are many institutes, universities and schools who have incorporated innovative pedagogies in teaching-learning process.

EMERGING METHODS OF PEDAGOGIES

1. Flipped classroom

The flipped classroom is an innovative teaching method that has gained popularity in recent years, particularly in higher education settings. This approach flips the traditional model of in-class lectures

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and homework assignments by providing students with pre-recorded video lectures to watch at home and utilizing class time for interactive discussions and hands-on activities. This method offers several benefits to students, including increased engagement, personalized learning experiences, and improved critical thinking skills.

One of the key benefits of the flipped classroom is that it enhances student engagement. By watching pre-recorded lectures at their own pace and convenience, students have the opportunity to engage with the materials on their own terms, leading to increased motivation and participation. Moreover, in-class activities and discussions allow students to apply the knowledge they have gained from the video lectures, fostering a deeper understanding of the subject matter.

Another advantage of the flipped classroom is that it promotes personalized learning experiences. The use of pre-recorded lectures allows students to pause, rewind, and re-watch the content as needed, catering to their individual learning styles and preferences. Additionally, students can access the lectures outside of the classroom, giving them the flexibility to review the material at their convenience. This personalized approach not only accommodates different learning speeds but also ensures that every student can grasp the concepts before moving on to more complex topics.

Furthermore, the flipped classroom fosters the development of critical thinking skills. In traditional teaching approaches, students often rely on teachers for answers and explanations during class time. However, the flipped classroom encourages students to become active learners by engaging in discussions, problem-solving activities, and debates during class. This collaborative learning environment challenges students to think critically, analyze information, and articulate their thoughts effectively.

Flipped classroom teaching has been adopted across various top premier institution, universities, business schools across India. Some of the examples are as follows-

Example: a) IIT Kharagpur, IIT Delhi, IIT Bombay, IIIT Bangalore, IISWBM Calcutta adopted flipped classroom teaching for application-oriented business courses.

b) IIM Sambalpur, IIM Ahmedabad, IIM Bangalore, IIM Kolkata, IIM Kozhikode, MDI Gurgaon flipped their classroom teaching for PhD course.

c) Indian School of Business, Hyderabad adopted flipped classroom teaching for entrepreneurial decision-making course.

d) SP Jain Institute of Management and Research, Maharashtra flipped their classroom teaching for executive MBA course.

e) Harvest International school and Shantinikethana school, Karnataka adopted flipped classroom teaching for some topics in science for school students.

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2. Game-based learning

Game-based learning is an innovative educational approach that utilizes games and gaming elements used to enable and engage students in effective learning, *viz.* Using card games, board games, video games, quiz and puzzles along with the classroom teaching and learning.

In recent years, it has gained significant attention and recognition for its potential to enhance student learning outcomes in various academic subjects. One of the major benefits of game-based learning is its ability to foster critical thinking skills. Games often present students with challenging problems or puzzles that require them to think critically, analyse information, and come up with creative solutions. This process not only improves their problem-solving abilities but also enhances their overall cognitive skills.

Another significant advantage of game-based learning is its capability to improve student engagement and motivation. Traditional methods of teaching often fail to capture students' interest and enthusiasm, resulting in disengagement and passive learning. Games, on the other hand, are designed to be interactive and visually appealing, which makes the learning experience more enjoyable and captivating for students. By incorporating game-based learning strategies, educators can create a more dynamic and immersive learning environment, where students actively participate and stay motivated to achieve their educational goals.

Furthermore, game-based learning can also help students develop important social and collaborative skills. Many educational games offer multiplayer options that allow students to interact and work together, promoting teamwork and cooperation. Through these collaborative experiences, students learn effective communication skills, negotiation of ideas and collective problem solving skills. These skills are crucial for their future success in the 21st-century workforce, where collaboration and teamwork are highly valued.

3. Crossover learning

Crossover learning a strategy that combines formal classroom instruction with learning that place outside of the formal classroom setting. Incorporation of such teaching method in education helps students to enhance critical and analytical thinking skills, fosters creative thinking and deep comprehension.

Example: Students going for field trips, visiting museum, theatre, exhibition after a formal lecture to gain in-depth knowledge on the content being taught in the classroom.

4. Personalized learning

Personalized learning, often referred to as customized education is an approach to teaching and learning that tailor's education to each student's unique needs, interests, and pace of learning.

Example: Self- paced through e-textbooks, online videos.

This approach focuses on individualized learning experience in order to facilitate improved outputs from students. Personalized learning offers wide range of advantages to students which

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including more involvement, deep understanding of subject matter which lead to higher sense of achievement among the students.

One of the key benefits of personalized learning is its ability to foster student engagement. By customizing learning experiences to align with students' interests and strengths, educators can pique students' curiosity and motivation. When students are engaged, they are more likely to actively participate in the learning process, ask questions, and gain knowledge. Additionally, personalized learning allows students to expose to topics that resonate with them personally, encouraging a sense of leadership and autonomy in their education.

Furthermore, personalized learning has been shown to lead to improved academic achievement. Because the instruction is tailored to meet the specific needs of each student, they are able to progress at their own pace. This facilitates a deep understanding of the material before moving on to more complex concepts. Students who receive personalized instruction are also more likely to take risks and persevere through challenges, as they feel a stronger connection to their learning

5. Collaborative learning

Collaborative learning is an instructional approach that encourages students to work together in small groups to achieve a common goal, for example revision of entire course syllabus one day before exam through interaction among the peers or co- learners under the guidance of teacher.

This method has proven to be highly beneficial to students across various academic disciplines which promote deeper learning, critical thinking, and problem-solving skills. Collaborative learning, enhances students' intelligence and comprehension by tapping their peer groups knowledge and experiences collectively.

One of the key benefits of collaborative learning is the development of critical thinking abilities. By encouraging group discussions and debates to widen students' perspectives and viewpoints. This exposure allows them to broaden their understanding of complex subjects and consider alternative solutions and strategies. Through active participation in collaborative activities, students can strengthen their analytical and evaluative skills, thereby improving their decision- making skills in respective fields. Additionally, collaborative learning promotes the acquisition of teamwork and communication skills, which are vital in professional settings. As a student, being able to effectively collaborate and communicate with colleagues is essential for research projects, group assignments, and presentations. Through working collaboratively, students learn how to effectively contribute to a team, resolve conflicts, and express their ideas coherently and persuasively. These skills not only benefit students academically but also prepare them for future career success, as employers value team players who can effectively interact and cooperate with others.

Furthermore, collaborative learning fosters a more engaging and inclusive learning environment. Through group activities, graduate students can exchange ideas, ask questions, and share knowledge, which enhances the overall learning experience. Collaborative learning allows students to

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take ownership of their education and be actively involved in the learning process. It encourages them to become independent thinkers while also honing their ability to cooperate and empathize with their peers.

6. Incidental learning

Incidental learning is a type of learning that occurs outside the framework of class room and in an informal educational setting, such as in everyday life experiences or by simply observing and engaging with the surrounding environment, like new words while reading a book and social skills while playing with others.

While formal education remains paramount in equipping students with essential knowledge and skills, incidental learning offers numerous benefits to students at all educational levels. One of the major benefits of incidental learning is its ability to broaden students' knowledge base beyond the confines of their textbooks or academic curriculum. Through everyday experiences, casual conversations, or exposure to diverse environments, students are constantly exposed to new information and concepts, allowing for a more comprehensive understanding of the world around them. This type of learning encourages critical thinking, as students are compelled to make connections between what they have learned incidentally and their formal education, fostering a deeper comprehension of complex topics.

Moreover, incidental learning promotes a well-rounded education by developing a range of skills that extend beyond academic subjects. For instance, students may acquire problem-solving skills through real-life challenges, such as fixing a broken appliance or navigating public transportation. Similarly, interpersonal skills can be honed as students interact with diverse individuals in their surroundings. By being exposed to such experiences, students develop adaptability, autonomy, and a sense of confidence in their ability to navigate the complex world they are a part of.

Furthermore, incidental learning encourages curiosity and a lifelong love of learning. By exposing students to various real-world scenarios and unexpected information, incidental learning sparks a natural inquisitiveness that fuels intellectual growth. This self-driven exploration allows students to develop a thirst for knowledge that extends beyond the classroom, which can have long-term benefits in their personal and professional lives. Moreover, incidental learning empowers students to take agency over their own education, as they become active seekers of knowledge rather than passive recipients of information.

7. Embodied learning

Embodied learning, also known as experiential learning or learning by doing, is an educational approach that emphasizes physical engagement and sensory experiences to enhance the learning process, for example performing experiments and conducting research.

Embodied learning offers numerous benefits to students, especially in terms of enhancing their cognition, increasing retention of knowledge, and supporting emotional well-being. Firstly, embodied learning promotes enhanced intelligence and comprehension among students. When students actively

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engage in physical activities, such as performing experiments, conducting research, or participating in hands-on projects, they are more likely to grasp complex concepts and understand their real-world applications. By connecting abstract ideas with concrete experiences, embodied learning facilitates deeper understanding and critical thinking skills. This approach encourages students to actively think and reflect upon their actions, leading to a more profound comprehension of the subject matter.

Secondly, embodied learning significantly improves knowledge retention. Research has shown that active learning experiences enhance long-term memory compared to passive forms of learning, such as reading or listening to lectures. Through embodied learning, students are more likely to remember information due to the multisensory experiences associated with physical engagement. By involving multiple senses like touch, sight, and movement, embodied learning creates a stronger neural connection within the brain, leading to better recall and retention of learned material.

Furthermore, embodied learning supports students' emotional well-being. Traditional classroom settings can sometimes be stressful or monotonous, leading to disengagement and limited motivation. However, through embodied learning, students are actively involved, which can reduce anxiety and increase enjoyment in the learning process. Physical activities and interactive experiences foster a sense of achievement, boosting students' self-confidence and self-efficacy.

8. Adaptive learning

Adaptive learning is a progressive approach that tailors' educational materials and strategies to meet the unique needs and abilities of individual students. By leveraging sophisticated data analytics and machine learning algorithms, adaptive learning technologies can assess students' knowledge and skills, identify areas of weakness, and provide personalized recommendations and resources to improve learning outcomes. This method has been widely adopted across various educational institutions and has proven to offer numerous benefits to students.

One of the key advantages of adaptive learning is its ability to promote student engagement by addressing their specific learning needs. Traditional classroom settings often adopt a one-size-fits-all approach, which can leave some students either disengaged or struggling to keep up. Through adaptive learning, students receive customized content and activities that are adapted to their proficiency levels and learning styles, making the learning process more personalized and meaningful. This personalization not only enhances motivation but also maximizes the potential for knowledge retention and understanding.

Another benefit of adaptive learning is its potential to accelerate students' learning progress. The adaptive nature of this approach allows students to move at their own pace, focusing more time and effort on challenging concepts while quickly moving through areas where they excel. This individualized advancement ensures that students are not held back by the average pace of the class, enabling them to reach higher levels of achievement. Adaptive learning also provides instant feedback, allowing students to address misconceptions immediately and facilitating real-time adjustments in their

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learning strategies. By identifying and addressing knowledge gaps promptly, students can make continuous progress towards their learning goals.

Furthermore, adaptive learning provides valuable insights into students' learning patterns and performance, allowing instructors to identify areas that require additional support or intervention. This data-driven approach enables educators to make informed decisions about instructional methods, resources, and interventions to better support individual students. By receiving targeted and timely guidance, students are more likely to overcome challenges and reach their full potential. Additionally, adaptive learning platforms can offer personalized recommendations for additional learning resources, further augmenting students' overall learning experience.

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Agro Advisory Services for Risk Management in Agriculture

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Introduction

Indian agriculture pulled the country out of dire food deficit through the Green Revolution in the mid-1960s contributing immensely to the food security and wellbeing of its people. The situation however, started turning adverse for the sector around mid-nineties, with slowdown in growth rate of output, which then resulted in stagnation or even decline in farmer's income because of various risks. To overcome the risks and to enhance agricultural productivity the government of India, Ministry of agriculture and farmers welfare and ICAR has taken several steps to provide agro advisories to farmers based on current adverse conditions.

Risk in agriculture

The uncertainties inherent in weather, yields, prices, government policies, global markets, and other factors that impact farming can cause wide swings in farm income.

Types of risk in agriculture

1. **Production risk**: Derives from the uncertain natural growth processes of crops and livestock. Like Weather, disease, pests, and other factors affect both the quantity and quality of commodities produced.
2. **Price/ market risk**: It refers to uncertainty about the prices producers will receive for commodities or the prices they must pay for inputs.
3. **Financial risk**: It results when the farm business borrows money and creates an obligation to repay debt. Rising interest rates and restricted credit availability are also aspects of financial risk

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4. **Institutional risk**: It results from uncertainties surrounding Government actions and Regulations. Like for chemical use, rules for animal waste disposal, and the level of price or income support payments are examples of government decisions that can have a major impact on the farm business.

5. **Human risk:** Use of the heavy dose of chemicals causes health hazards and improper and unsafe handling of agricultural equipment's and machineries may become fatal in human beings.

Risk management

- The practice of identifying potential risks in advance analyzing them and taking precautionary steps to reduce the risk.
- It involves choosing among alternatives that reduce financial effects that can result from such uncertainties**.**

Process of risk management

1. Identify - Different types of risk in all husbandries
2. Analyze - Cause to mitigate
3. Evaluate - Alternative ways to solve
4. Treat - Apply appropriate methodology
5. Monitor - Observe the outcome

Three broad categories of risk management in agriculture.

- **Prevention** - Eliminate or reduce the occurrence of disaster- causing hazards
- **Mitigation** - Reduce and manage the potential adverse impact of a disaster
- **Adaptation** - Measures of coping with and relieving post-disaster impacts.

Agro advisory services for risk management

It refers to the entire set of organizations that support and facilitate people engaged in agricultural production to solve problems and obtain information, skills and technologies to improve their livelihoods. AAS are the farm decisions taken in response to past, current and future weather change. it includes agronomical, pest and disease, water and input management.

Need of agro advisory services for farmers

- Guides in decision making of farmers
- Improves crop production quality
- Increases input efficiency (water, labour and energy)
- Develop sustainability in crop production
- Economize the quality crop production
- Meets real-time needs of farmers
- Enhance crop production and food security
- Bridges gap between farmers and researchers

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Importance of AAS

- It enhances crop yields and farm income and reducing cost of cultivation and farm expenditure with suggested management practices.
- Farmer can plan their farm operations well in advance and make their farming decision in shorter duration of time.
- Accurate forecast and timely dissemination of information are prerequisite for reducing the losses that arise due to weather adversities.
- The risk and uncertainty associated with farming can be minimised using the weather advisories.
- Weather forecast based information on soil moisture status and guidance for application of irrigation, fertilizer and herbicides etc.
- Advisories on sowing/planting dates and suitability of intercultural operations, to guide farmer in their day-to-day cultural operations.
- Weather forecast based forewarning system for major pests and diseases of major crops and advises on plant protection measures.
- Propagation of techniques for manipulation of crop's microclimate e.g. shading, mulching, etc. to protect crops under stressed conditions.
- Advisory for livestock on health, shelter, and nutrition.

Organisations contributing to AAS

1. ICAR- Indian Council of Agricultural Research
2. IMD- Indian Meteorological Department
3. Micro-Level Weather based Advisory Services (NICRA)
4. Gramin Krishi Mausam Sewa

ICAR- Indian Council of Agricultural Research

ICAR has prepared agro-advisories for all major kharif and Rabi crops, livestock in tune with the growing environments in different agro-ecologies spread across the country. It provides advisories on best management practices, efficient utilization of resources, seeds, nutrients and cost-effective solutions to mitigate crop losses due to weather, pests and diseases with technical inputs from research

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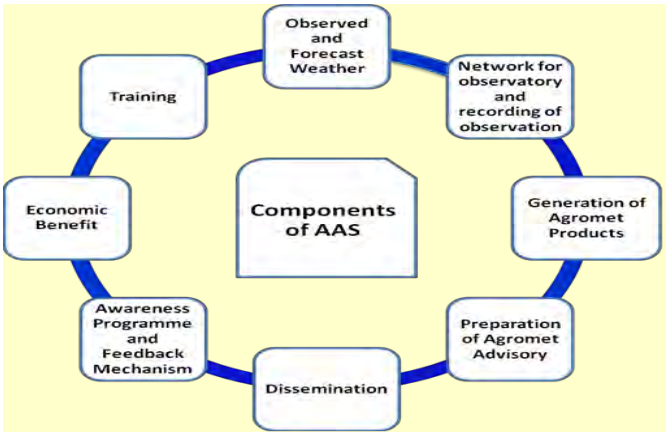
institutes and SAU's compiled the kharif and rabi advisories for timely dissemination to farmers and farmers groups in all states and UT's through KVKs along with line departments.

IMD- Indian Meteorological Department

- IMD provides a very special kind of inputs to the farmer as advisories that can make a **tremendous difference to the agriculture production** by taking the advantage of benevolent weather and minimize the adverse impact of malevolent weather.
- Some of the components identified to provide Agricultural Advisories services through IMD are depicted as shown in the figure.



Micro-Level Weather based Advisory Services

- Considering the variability of weather, climate and soil, CRIDA, Hyderabad pioneered in starting flagship research programme of the ICAR named NICRA. It is a network project of the ICAR launched in February, 2011
- Aims to enhance resilience of Indian agriculture to climate change and climate vulnerability through strategic research and technology demonstration
- Conduct research on adaptation and mitigation covers crops, livestock, fisheries and natural resource management
- As part of NICRA, the AICRPAM took up a pilot project during 2010 to develop and disseminate micro-level AAS through its 25 cooperating centres enabling capacity building of farmers for climate resilience. (Vijayakumar *et al*., 2017)
- The pilot micro-level agromet advisory services started in Belagavi district of Karnataka under AICRPAM-NICRA project for which IMD provided block level weather forecasted information since 2014

Gramin Krishi Mausam Sewa

- IMD is rendering district level weather based AAS named as GKMS since 2015 in the country to cope up with weather and climatic risks and uncertainties.
- It issues **crop** and **location-specific** weather-based agricultural advisories for the benefit of the farming community.

Conclusion

Agro advisory services are boon to the farming community in enhancing their knowledge about innovative farming practices which includes latest technologies and good management practices in crop and animal husbandry. Farmers can receive weather forecast

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based agro-advisories, including selection of suitable crops and varieties on real time basis. Farmers adopting the recommendations of agro met advisories could able to take wise decision on day-to-day farm operations to reduce the input cost and reap the benefits.

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Milk Fever: A Comprehensive Overview

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Abstract

Now a day's metabolic disorder is a major cause of concern in high yielding livestock. Out of many metabolic disorders, milk fever is one of the most important disorders which not only reduces the production performance of dairy animals but also create problems for other metabolic disease occurrence and infertility or repeat breeding like reproductive disorders in future. So, proper feeding management is prerequisite during advance pregnancy to reduce risk of milk fever. Metabolic profiling tests, which are using specific parameters known to be responsive to dietary intake, can be used to complement dietary evaluation of current feeding programme adequacy or a response to a feeding programme change. Blood Ca^{+2} and serum Ca^{+2} in all (normal parturient and recumbent) cattle should be within the range of 0.22–1.22 mmol/L and 2.81–10.91 mg/dl, respectively.

Key words: Milk Fever, Hypercalcemia, Parturient Apoplexy, Metabolic Disorder

Introduction

Clinical hypocalcaemia, commonly referred to as milk fever, was first described in 1793, which coincided with the provision of additional nutrition to cows to increase milk production. Milk fever is arguably the classic veterinary disease of dairy cattle, with stories of recumbent cows soon after calving recounted for centuries. The enormous and immediate requirement of calcium (Ca) for colostrum and milk production, paired with a normal decrease in dry matter intake around parturition, creates a large Ca deficit that takes days to rectify. Although a detailed discussion of Ca metabolism is beyond the scope of this article, multiple hormones and minerals are important for appropriate Ca regulation. To maintain Ca concentrations at a level required for life (eg, thermoregulation, muscle contraction) while transferring a large quantity to colostrum and milk, cows increase the secretion of parathyroid hormone which increases release of Ca from bone, decreases Ca excretion by the kidney, and indirectly increases intestinal absorption of Ca via vitamin D-dependent means. As sufficient

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magnesium (Mg) concentrations are required for proper interaction of parathyroid hormone with its receptor, adequate blood Mg concentration is also important for Ca regulation. Appropriate and timely coordination of these Ca regulation mediators is essential, as milk fever results when blood and extracellular Ca concentrations fall faster than homeostatic mechanisms can adapt to the demands of lactation, resulting in insufficient Ca for normal bodily functions and weakness that can progress to recumbency and death (Sabine Mann et al.2019).

Etiology

Dairy cows are at considerable risk for hypocalcaemia at the onset of lactation, when daily calcium excretion suddenly increases from about 10 g to 30 g per day. This stresses calcium homeostasis and may cause blood calcium concentrations to fall well below the normal lower reference range of approximately 8.5 mg/dL. Blood calcium concentrations typically decrease around the onset of parturition but recover quickly. Cows with parturient paresis have a more profound decrease in blood calcium concentration—typically below 5.5 mg/dL.

Clinical signs

The main clinical manifestations are divided into three stages**.**

1. **First stage or Stage of excitement**: Anorexia (decreased appetite), nervousness or hypersensitivity, mixed excitement or tetany without recumbency, weakness or weight shifting, stiffness of hind legs, rapid heart rate, rectal temperature is usually normal or above normal (>102.2 F)
2. **Second stage or Stage of sternal recumbency**: Sternal recumbency comprising down on chest and drowsiness, characteristic “S” shaped posture- sitting with lateral kink in neck or head turned to lateral flank, depression, fine muscle tremors, rapid heart rate with decreased intensity of heart sounds, cold extremities, decreased rectal temperature (97 F to 98F), decreased gastrointestinal activity, pupils dilated and unresponsive to light
3. **Third stage or Stage of lateral recumbency**: Lateral recumbency, comprising of almost comatose condition, progressing to loss of consciousness, severe bloat, flaccid muscles profound gastrointestinal atony, rapid heart rate, impalpable pulse and almost inaudible heart sounds. (Dr. R.C. Ramteke et al. 2023)

Clinical Diagnosis:

A combination of information gathering, clinical examination, and laboratory testing is used to diagnose milk fever. Cow's age, breed, lactation stage, milk yield, calving day, and response to intravenous calcium borogluconate solution were obtained during history tracing. Milk fever is common in mature dairy cows (>5 years old) within 72 hours of parturition. It occurs more frequently in dairy cows that produce much volume of milk (Radostits et al., 2007). Paresis and weakness depression in cows that have recently given birth to young are diagnostic indications of the condition. Whereas laboratory investigation of blood calcium levels and a positive response to intravenous

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calcium solutions is the most accurate technique to diagnose a case of milk fever. The blood calcium level should be between 8 and 10 mg/dL (Thirunavukkarasu et al., 2010). Cows having blood calcium levels less than 7.5 mg/dL are classified as hypocalcaemic. Stage I Hypocalcaemic cows have a blood Ca concentration of < 7.5 mg/dl. Stage II hypocalcemia cows have blood Ca level ranging from 3.5 to 6.5 mg/dl, whereas stage III has concentrations as low as 2 mg/dl. Bradford, (1996) states that prolonged recumbency causes ischemic muscle necrosis as well as an elevation in the serum muscle enzymes CPK and AST. CPK levels typically vary between 105 and 409 IU/L, with values larger than 1000 IU/L indicating serious muscle injury from being low, and AST levels greater than 500 IU/L indicating severe muscular damage. Recently a study group from Germany diagnosed subclinical hypocalcemia by taking the historical clinical impression of "cold ears" and using an infrared thermometer to determine the skin temperature of ears in fresh cows. However, diagnosis of subclinical hypocalcemia by ear temperature is an unreliable method, because the results were greatly affected by the ambient temperature (Nurye, M et al. 2022).

Treatment

1. Oral calcium supplementation for standing cows
2. Intravenous calcium infusion for recumbent cows
3. Prevention of hypocalcemic relapses in all affected cows

Recumbent cows are at extremely high risk for muscle and nerve damage therefore, treatment of parturient paresis must be prompt. Excessive exogenous calcium administration increases the risk for hypocalcemic relapse. The lowest dose of calcium needed to restore normal blood calcium concentration should be used.

Cows with stage 1 parturient paresis (ie, cows that are still standing) should be treated with an oral calcium supplement which is rapidly absorbed into the bloodstream and poses little risk for subsequent hypercalcemia followed by a rebound hypocalcemia. Bolus formulations of oral calcium are the safest means of providing oral calcium supplementation. Oral paste, gel, or liquid formulations of supplemental calcium are not recommended due to unnecessary risk for aspiration and pharyngeal irritation. Oral calcium boluses should include a coating to protect the cow from mucosal damage should the bolus remain in contact with pharyngeal or esophageal mucosa. The preferred approach to oral calcium supplementation is an acidogenic source of calcium (usually calcium chloride or calcium sulfate) in a bolus form. These are highly available and promote the cow's own calcium homeostasis by enhancing parathyroid hormone (PTH) receptor responsiveness. A standard oral dose provides 40–55 g of elemental calcium. Blood calcium increases to peak concentrations within 30 minutes of oral administration and equals about 4 g of IV calcium. Higher doses could cause uncompensated metabolic acidosis, decreased feed intake, and increased risk for hypocalcemic relapses.

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Non-acidogenic calcium sources (usually calcium propionate) can be used for oral calcium supplementation: however, they are not preferred for cows in stage 1 parturient paresis. Oral calcium propionate requires a higher dose of elemental calcium (100 g or more), does not enhance the cow's own calcium homeostatic mechanisms, and unnecessarily increases blood glucose at a time when many cows are hyperglycaemic. Oral calcium propionate is best reserved for cows that are two or more days post-calving.

Cows with stage 2or3 hypercalcemia (ie, cows that are recumbent) require immediate correction of their hypocalcaemia by intravenous calcium infusion. The standard treatment for an adult dairy cow is 500 mL of a 23% calcium gluconate solution. These solutions must contain boric acid to solubilize the calcium gluconate and stabilize the solution; thus, they may be labelled as calcium borogluconate. This standard treatment provides 10.7 g of elemental calcium, which is more than sufficient to restore normocalcemia for even the largest cows with the most profound hypercalcemia.

Many products marketed for treatment of hypocalcemia include phosphorus, magnesium, glucose, or potassium in addition to calcium. No additional electrolytes are needed to treat parturient paresis, and some could be harmful. Calcium gluconate alone is the best choice for intravenous treatment of parturient paresis.

The jugular vein is the preferred site for intravenous calcium infusion. Asepsis at the injection site and accurate placement of the needle within the lumen of the jugular vein is necessary to lower the risk for thrombosis and perivascular leakage.

The cranial superficial epigastric (mammary) vein may be more accessible than the jugular vein in some recumbent cows but it is prone to thrombosis and phlebitis so should be used only when jugular vein is unavailable.

The response to intravenous calcium infusion is usually immediate and rewarding. Response to intravenous treatment is the main means of confirming the diagnosis. It is an excellent practice to routinely collect a pre-treatment blood sample before starting the intravenous calcium infusion. If the cow does not respond favourably, this sample can be submitted for laboratory confirmation of hypocalcemia. Blood samples collected after intravenous calcium infusion cannot be used for diagnostic purposes, because the calcium concentration has been confounded.

A typical response to intravenous calcium infusion includes declining heart rate and increasing pulse intensity as cardiac contractility is restored. Muscular paresis is reversed, resulting in muscle tremoring and attempts by the cow to rise. About 75% of recumbent cows are able to rise within 2 hours. Pre-existing musculoskeletal and nerve damage is the main reason that cows remain recumbent after successful correction of hypocalcemia. Intravenous infusion of calcium transiently raises blood calcium concentrations to nearly twice the normal upper limit. This puts the cow at risk for fatal cardiac arrhythmia. Therefore, calcium-containing solutions should be administered slowly

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(over 10–20 minutes) while cardiac rhythm is monitored by auscultation or carotid pulse. If severe dysrhythmias or bradycardia develop, administration should be stopped until the heart rhythm has returned to normal. Endotoxic animals are especially prone to dysrhythmias due to intravenous calcium treatment.

Transient hypercalcemia due to intravenous calcium infusion places the cow at risk of a hypercalcaemic relapse. Hypercalcemia shuts down the cow's efforts to mobilize its own calcium stores by halting PTH release and triggering calcitonin (CT) secretion instead. About 25% to 40% of recumbent cows that are able to rise after intravenous calcium infusion become recumbent again (usually in 12 to 24 hours) unless measures are taken to decrease the risk for relapse.

The treatment of choice for preventing hypocalcaemia relapses is oral calcium administration, as described above for treatment of stage 1 cases of parturient paresis. Cows should be standing, alert, and able to swallow before administering an oral calcium bolus.

Subcutaneous calcium is a second choice for the prevention of hypercalcaemic relapses. Subcutaneous calcium alone may not be adequately absorbed because of poor peripheral perfusion during the initial hypocalcemia and should not be the sole route of treatment. Strict asepsis is necessary to prevent infection at the site of the subcutaneous injection. Solutions containing formaldehyde or dextrose should not be administered subcutaneously because they are highly irritating. Calcium gluconate (500 mL, 23% solution [the same as used for IV infusion]) is the best choice for SC calcium administration. This solution is still quite irritating and should be divided into multiple sites with smaller volume. (MSD manuals).

Conclusion

In managing milk fever, a combination of prompt diagnosis, appropriate treatment, and preventive measures is essential to ensure the health and well-being of dairy cows during the critical transition period around calving.

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Bihar's Aquatic Wonders: Exploring the World of Freshwater Crabs

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Abstract

Bihar's freshwater crabs, hidden gems within its waterways, contribute significantly to the region's diverse aquatic ecosystems. Despite their adaptability and ecological importance, these crabs face threats due to deforestation and pollution. Urgent conservation actions are necessary to protect both their habitats and the rich biodiversity they represent. Bihar's freshwater crabs are not only essential for ecological balance but also hold potential for medicinal and economic benefits, underscoring the importance of their preservation.

Introduction

When we think of Bihar, the first images that come to mind are often lush farmlands, historical monuments, and rich cultural traditions. However, this diverse Indian state also harbours a hidden gem beneath its waters: a world of freshwater crabs that boasts its own unique charm. In this article, we will dive into the fascinating realm of Bihar's crabs, shedding light on their intriguing characteristics and vital role in the state's ecosystems. Bihar, in eastern India, has this amazing network of rivers, lakes, and wetlands that basically shape its look and take care of its wildlife.

The big-shot Ganges, known as India's life support, runs right through Bihar, making the soil super fertile for farming and keeping the fields hydrated. And it's not just the Ganges; there are other cool rivers like the Gandak, Kosi, Sone, and Mahananda that crisscross the state, making it all green and cultural. These rivers aren't just for show; they're like nature's pipelines for watering the farms. Plus, they're like a fancy buffet for all sorts of water creatures, including freshwater crabs. Those little crab buddies have a party in there, alongside other aquatic pals! Now, let's talk about Bihar's lakes and wetlands. Kanwar Lake Bird Sanctuary, the big cheese in this category, is like a pit stop for birds migrating from who-knows-where. Birds come from far-off lands to chill here for a bit. Then you've got Harikund, Motijheel, Karakatgarh, and Rajgir Wetland; these places aren't just pretty, they're also like nature's cleaning crew, doing important stuff for the environment.

Meet the Amazing World of Freshwater Crabs!

When we think of crabs, we often picture those scuttling along the sandy shores of the ocean. But did you know that there's a whole other world of crabs that call freshwater habitats home? These amazing creatures are quite different from their beach-dwelling cousins, and they have some fascinating tricks up their sleeves.

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What Makes Freshwater Crabs Special?

Freshwater crabs are like the rebels of the crab world. They've evolved to thrive in a wide range of environments, from rivers and ponds to even dry land. The most incredible thing about them is that they don't need the salty ocean to survive. They've found a way to live life on their terms, away from the sea.

The Incredible Diversity of Crabs

Crabs are way more diverse than you might think. Globally, there are a mind-boggling 6,700 different crab species. But when it comes to these freshwater marvels, there are about 1,564 unique types.

India's Freshwater Crab Scene

In India alone, there are 125 species, and they belong to 8 families namely Pseudothelphusidae, Trichodactylidae, Potamonautidae, Deckeniidae, Platythelphusidae, Potamidae, Gecarcinucidae and Parathelphusidae (Rodríguez and Magalhaes 2005). If you're curious about Bihar, they've got their own gang of eight different freshwater crab species. It's like a mini crab party right in your own backyard! In River Burhi Gnadak and its oxbow lake, Manika at Muzaffarpur district of Bihar alone accommodates three crab species making their presence known. These are *Sartoriana tribolata*, *Acanthopotamon martensi*, and *Sartoriana spinigera*. These little crab buddies are adding their unique flair to the local ecosystem, each with its own story to tell.

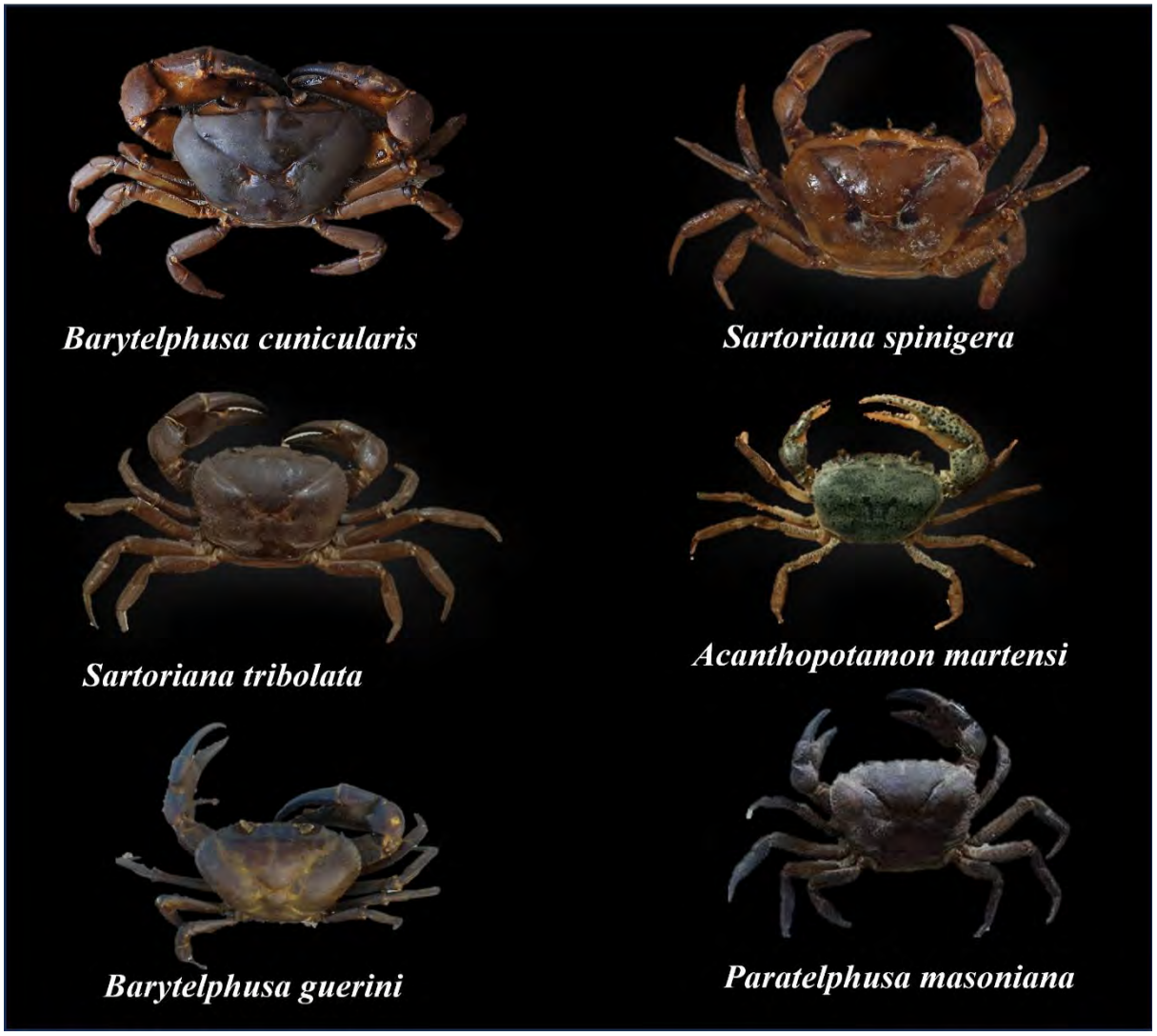

Fig 1. List showing Freshwater crabs of Bihar

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Night Owls of the Riverbank

Freshwater crabs are the ultimate night owls (Hill and O'Keeffe, 1992). As soon as darkness blankets their watery world, they emerge from their burrows. It's like they're on a mission, scouring the riverbed for tasty treats. But here's the catch: they're masters of timing. By the time the first light of dawn appears, they've already retreated to their burrows, safe from daytime predators. Their nighttime activities reveal just how smart and adaptable these crabs are in their natural habitats. They've figured out the best time to hunt and the best time to hide, making them true survivors of the night.

A Varied Diet

When it comes to food, freshwater crabs aren't picky eaters. They're omnivorous, meaning they'll feast on a variety of goodies. Plants? Sure! Live or dead creatures like fish, prawns, and molluscs? Absolutely! Sometimes, they even resort to cannibalism, munching on their own kind. Their diverse diet showcases their ability to make the most of their surroundings.

Crucial Players in the Food Chain

These crabs play a vital role in the river's food chain. They act as connectors, linking different parts of the ecosystem. By eating various types of food, they help keep the river's balance in check. It's a reminder that every creature, no matter how small, has a significant impact on their environment (Costa *et al*.,2016).

So, the next time you're near a river at night, keep an eye out for these nocturnal explorers. They're the mysterious creatures of the dark, showing us just how incredible nature can be, even under the moonlight.

Crabs: The Buffet of the River Ecosystem

Ever wondered who's on the menu in the river ecosystem? Well, one thing's for sure: freshwater crabs are like the grand buffet that keeps many hungry creatures coming back for more. Fish, turtles, birds, and even some mammals have these crabs on their list of favourite treats.

Secrets of Freshwater Crab Romance: Nature's Aquatic Love Story

Beneath the water's surface, freshwater crabs engage in a fascinating love story. Elaborate mating rituals, internal fertilization using specialized structures, and protective pouches for carrying eggs showcase their unique adaptations. Devoted mothers guard and nurture their offspring, which start as tiny planktonic larvae. Some crab species even migrate for better conditions, while males compete fiercely for mates. In a final act of devotion, some females moult to accommodate their growing eggs, ensuring a safe and comfortable space for the next generation. It's a tale of love, devotion, and survival in the dynamic aquatic world (Gangotri *et al*., 1978)

Freshwater Crabs: A Hidden Nutritional Gem Beneath the Surface

When we think of seafood, our minds often drift to fish, shrimp, or lobster. But let's not forget about the unsung heroes of the water world – freshwater crabs! These little critters not only add flavor to your plate but also pack a surprising punch of nutrition.

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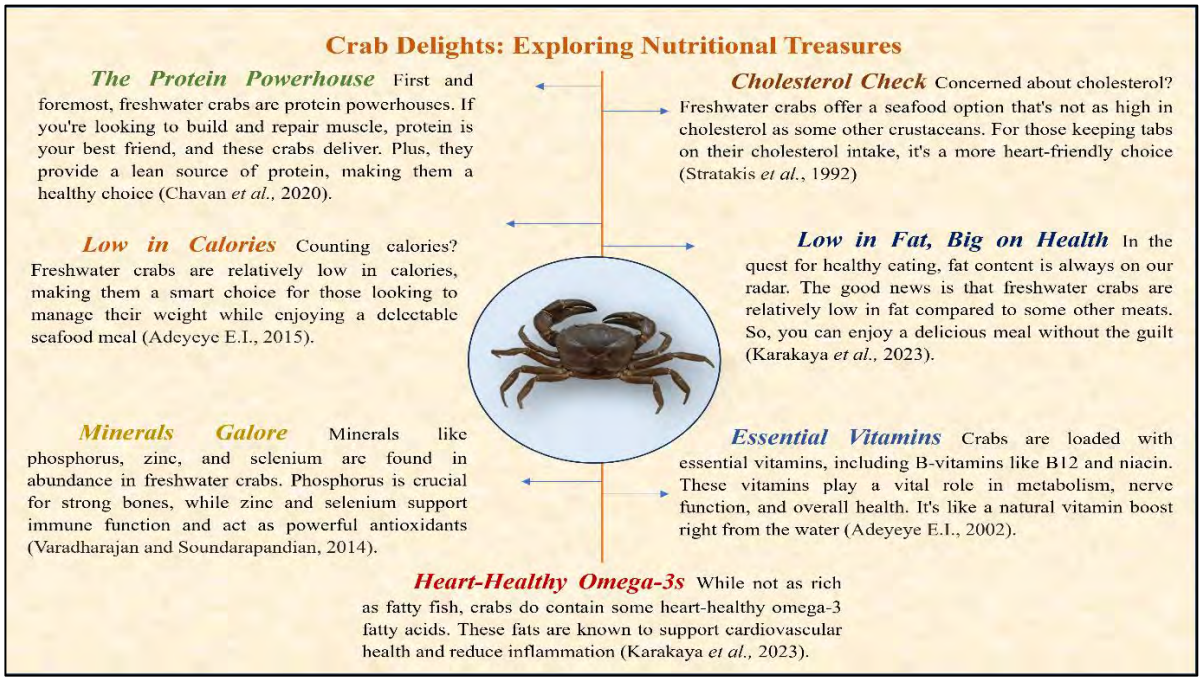

Fig 2. Nutritional values of Freshwater crab

Crabs Under Threat: Protecting Bihar's Freshwater Treasures

We don't really know much about these freshwater crabs (FWCs), which is a bit of a bummer. They're like the mystery creatures of the water world, and that's why they're labelled as 'Data Deficient' on the IUCN Red List. But here's the scoop: they're in trouble, big time. The places they call home are disappearing, thanks to stuff like deforestation, messing with drainage systems, and pollution. And speaking of pollution, these crabs are like the canaries in the coal mine - they can't stand it (Brook *et al*. 2003). It's a tough situation because we're at risk of losing them for good, and that's not cool. These crabs aren't just your average river critters; they're a big deal for nature, might have some healing powers, and can even put some cash in the local pockets. So, there is a need to conserve these freshwater crabs due to their ecological, medicinal, and economic importance (Padghane *et al*. 2016). We're talking about developing action plans, taking care of the forests they live in, and keeping their homes clean and tidy. It's time to roll up our sleeves and give these little guys a fighting chance."

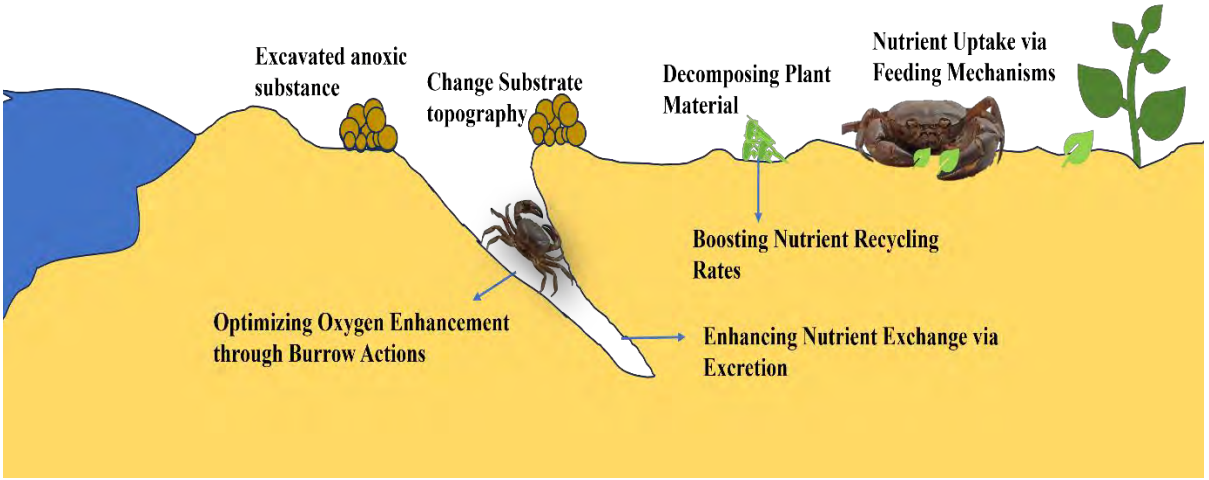

Fig 3. Ecological service of freshwater crab

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Conclusion

In conclusion, Bihar's freshwater crabs are hidden gems in its aquatic ecosystems. These resilient creatures have adapted to various environments, but they face a significant threat due to deforestation and pollution. Despite their small size, they play vital roles in the ecosystem's balance. Their unique diversity and importance, both ecologically and potentially medicinally and economically, call for urgent conservation efforts, including protecting their habitats and ensuring water quality. It's time to safeguard these remarkable river residents from the brink of extinction.

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Methodology To Study the Effect of Elevated Atmospheric Temperature and Carbon Dioxide Concentrations on the Quality of Groundnut Haulms as Livestock Feed

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Introduction

Climate change has become the main focus of social and scientific attention. It is one of the most critical threats facing the world today, with predicted increases in global mean temperature, length and severity of drought events, and atmospheric CO_2 concentration due to human activities (IPCC, 2014a). Rising atmospheric carbon dioxide (CO_2) concentrations along with increased ambient temperature are going to impact severely the food production systems including animal origin.

Greenhouse gases are the primary cause of rising temperatures in the atmosphere. The CO_2 level has risen at a pace of 1.9 ppm per year over the last twelve years and is expected to exceed 570 ppm by the middle of this century (IPCC, 2014b). As a result, the global surface temperature is expected to rise by 3-4.5˚C (IPCC, 2014). Such increases in CO_2 concentration are expected to have cascading effects on numerous aspects of plant biochemistry, since plant productivity is strongly tied to atmospheric CO_2 through photosynthesis (Dietterich *et al*., 2015).

In general, C3 plants are more responsive to elevated CO_2, which leads to greater main shoot length, elongation of branches, individual leaf area per plant, and dry mass. It is understood that the accumulation of sugars and starch in the leaves of elevated CO_2-grown plants reflects higher photosynthetic carbon assimilation (Cure and Acock, 1986).

There is limited information available on the influence of rising CO_2 levels and temperatures on the quality of groundnut haulms used as animal feed under the climate change scenario. Hence, an attempt has been made to investigate the effects of climate change, i.e., increased CO_2 and temperature, by cultivating groundnut crop in carbon dioxide and temperature gradient chambers (CTGC).

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Methodology

Groundnut crop was grown with recommended package of practices in Carbon dioxide and Temperature Gradient Chamber (CTGC) at four different environmental conditions.

a) Chamber with ambient temperature and carbon dioxide i.e., 27 ± 0.5ºC temp and 380 ± 25 ppm CO2 (T1; Control).
b) Chamber with elevated temperature of 5 ± 0.5°C more than control referred as eTemp (T2).
c) Chamber with elevated CO2 concentration of 550 ± 50 ppm referred as eCO2 (T3).
d) Chamber with elevated CO2 concentration of 550 ± 50 ppm with elevated temperature of 5 ± 0.5°C, over control referred as eCO2 + eTemp (T4).

At harvest stage, representative groundnut plants from each chamber were collected and haulms were separated and screened by chemical composition, energy content, mineral content, *in vitro* dry matter digestibility, *in vitro* gas production technique and digestibility of nutrients through a digestibility trial in Nellore Ram lambs.

1. Proximate Composition

The proximate analysis of groundnut haulms samples was performed as per the procedures described (AOAC, 1995). It includes the following:

1. Dry Matter (DM)
2. Total Ash
3. Organic Matter (OM)
4. Crude fibre (CF)
5. Crude Protein (CP)
6. Ether Extract (EE)
7. Nitrogen Free Extract (NFE)

2. Fibre Fractions Analysis

Fiber fractions in groundnut haulms samples were performed as per the method described by Van Soest *et al*. (1995). It includes the following:

1. Neutral Detergent Fibre (NDF)
2. Acid Detergent Fibre (ADF)
3. Hemicellulose
4. Cellulose
5. Acid Detergent Lignin (ADL)

3. Minerals Concentration

Minerals like Copper (Cu), Iron (Fe), Zinc (Zn) and Manganese (Mn) were estimated using di-acid digestion and Inductively Coupled Plasma-optical emission spectrometry (ICP-OES) method.

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6. *In Vitro* Dry Matter Digestibility (IVDMD)

In vitro DM digestibility of samples was determined by Tilley and Terry (1963) method using the instrument *Daisy incubator* by Ankom Technology.

4. Digestible Energy (DE)

DM digestibility values are used to estimate digestible energy (DE, MJ kg^{-1}) using the regression equation suggested by Fonnesbeck *et al*. (1984).

5. Metabolizable Energy (ME)

DE values are converted to ME using the formula reported by Khalil *et al*. (1986).

7. *In Vitro* Gas Production (IVGP)

In vitro gas samples were analysed using gas chromatograph (450-GC, BRUKER Daltonics, Bremen, Germany) with a stainless-steel column (80/100 mesh Porapak Q column) and a C-R3A integrator.

8. Digestibility trial

A digestibility trial with 2×2×2×2 Latin square design was conducted in Nellore ram lambs (8 No.s) with each group consists of 2 animals. 1st group served as control and the other 3 groups are the treatment groups where in the pooled groundnut haulms from each treatment was used for feeding the experimental animals.

Conclusion

The study indicated that the nutritive value of groundnut haulms in terms of CP and DE/ME would decrease under eTemp and eCO_2 + eTemp environmental conditions. Further, cultivation of groundnut crop at elevated temperature and carbon dioxide levels would result in lower digestibility in small ruminants.

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DNA Sequencing techniques: Sanger to Next Generation Sequencing

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Abstract

Numerous research applications require that the order of nucleic acid residues in biological samples be determined. Numerous scientists have worked hard over the past 50 years to develop the methods and tools necessary to accomplish this feat of sequencing DNA and RNA molecules. The sequencing of small oligonucleotides has given way to sequencing millions of bases and the struggle to deduce the coding sequence of a single gene has given way to whole genome sequencing that is quick and widely accessible. The sequence of the nucleotides in a DNA molecule is determined via sequencing technology. Each creature has a certain order that determines who we are, how we act, and how we respond to a changing environment. Next Generation Sequencing and Sanger are the two primary methods.

Introduction

"Knowledge of sequences could contribute much to our understanding of living matter."

Frederick Sanger

Deciphering a species' unique DNA sequence therefore entails comprehending the molecular underpinning of life. The polynucleotide chains' nucleic acid sequence ultimately determines the genetic and metabolic characteristics of terrestrial life. Therefore, it is crucial for biological research to be able to measure or infer such sequences. There are two primary methods of sequencing, Sanger sequencing and Next-Generation Sequencing (NGS). Long-read sequencing and short-read sequencing are two further NGS subsets.

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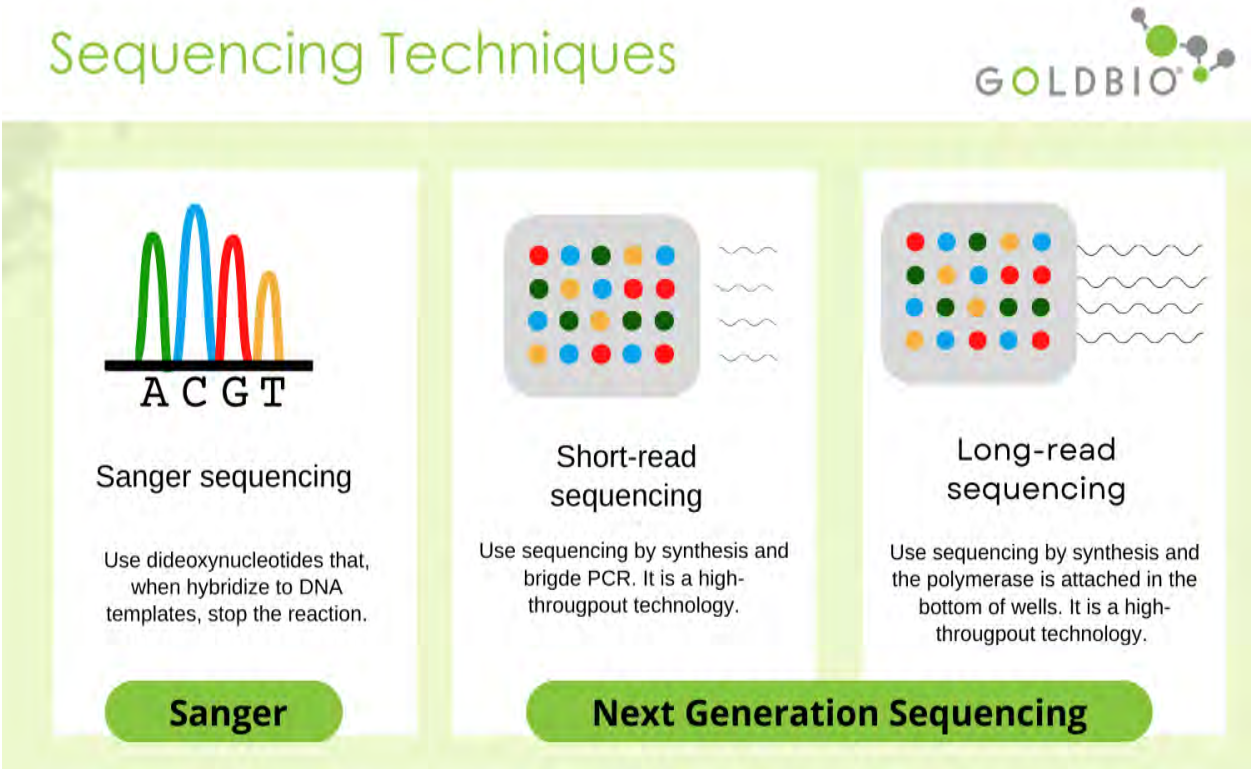

Figure 1. Illustrates the various sequencing strategies.

The generations it is classified into include:

First Generation

- Sanger Sequencing

Second Generation Sequencing

- Pyrosequencing
- Sequencing by Reversible Terminator Chemistry
- Sequencing by Ligation

Third Generation Sequencing

- Single Molecule Fluorescent Sequencing
- Single Molecule Real Time Sequencing
- Semiconductor Sequencing
- Nanopore Sequencing

Fourth Generation Sequencing

Aims conducting genomic analysis directly in the cell.

Sanger sequencing

Chain termination is another name for Sanger sequencing. This works by giving the DNA polymerase radiolabeled dideoxy nucleotides as substrates. In contrast to typical DNA nucleotides, dideoxy nucleotides have a H group rather than an OH group in the sugar molecule. This is essential for the Sanger sequencing method since the reaction comes to a halt once the polymerase uses one dideoxy nucleotide to hybridize with the DNA template. Or, to put it another way, the chain breaks.

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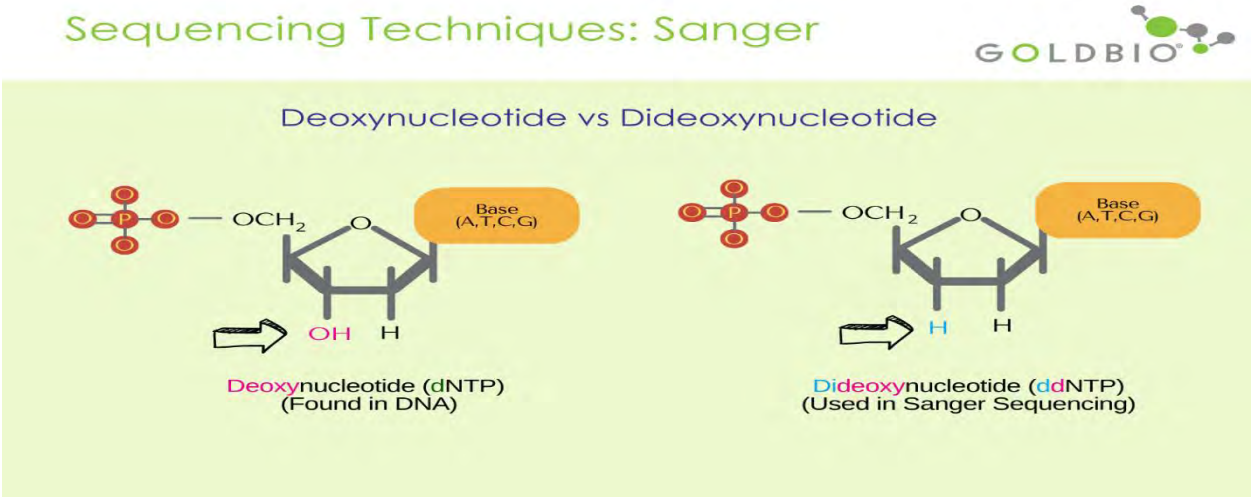

Figure 2. Differences between dideoxy nucleotide and deoxynucleotide

The order of the nucleotides in a DNA template was discovered by Sanger and colleagues using this fundamental idea. Sanger took over four years to decrypt the 5000 bases of the virus phiX174 using his own method! Three steps were employed in traditional Sanger sequencing. Making four separate reactions in various tubes was the first stage. A primer, dNTPs (standard nucleotides), DNA polymerase, and a little quantity of a particular radiolabeled dideoxy nucleotide were all mixed together in each tube. Adenine (ddATP), thymine (ddTTP), cytosine (ddCTP), and guanine (ddGTP) are examples of the dideoxy nucleotide (ddTP).

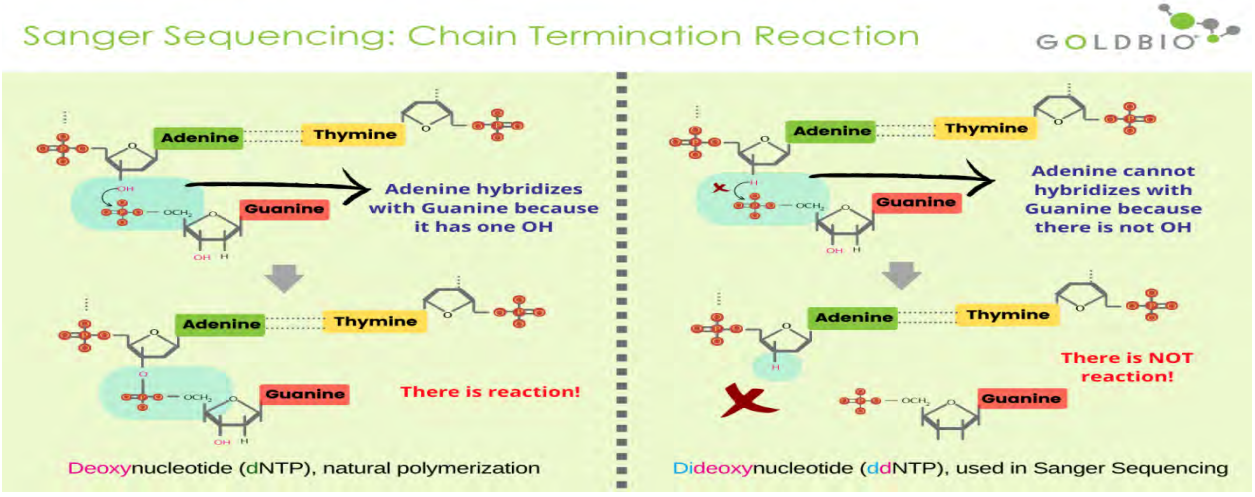

Figure 3. Chain termination reaction in Sanger sequencing.

Let's take ddATP as an example and look inside a single tube. Here, you'll find a number of varied length sequences that all terminate in the same radiolabeled ddATP. The position of adenines in the sequence can then be approximated if the size of the DNA fragment is known. Autoradiography and polyacrylamide gel electrophoresis were utilized in the second step. For each tube, this step displayed a different band. The third and last phase was determining the nucleotide order. Sanger sequencing, however, developed into a contemporary method. Modern sequencing eliminates the need for four separate reactions and allows for one reaction to be performed in a single tube by attaching a distinct fluorescent dye to each type of dideoxy nucleotide. Then, contemporary sequencing use microfluidics

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and potent computers to detect the nucleotide being sequenced in place of gels.

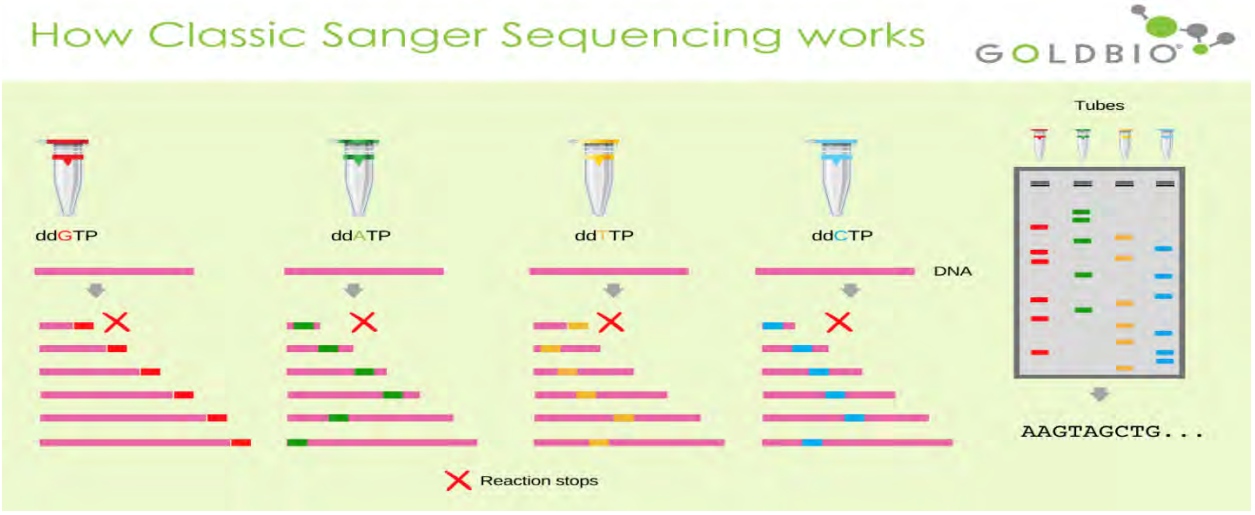

Figure 4. Conventional Sanger sequencing process.

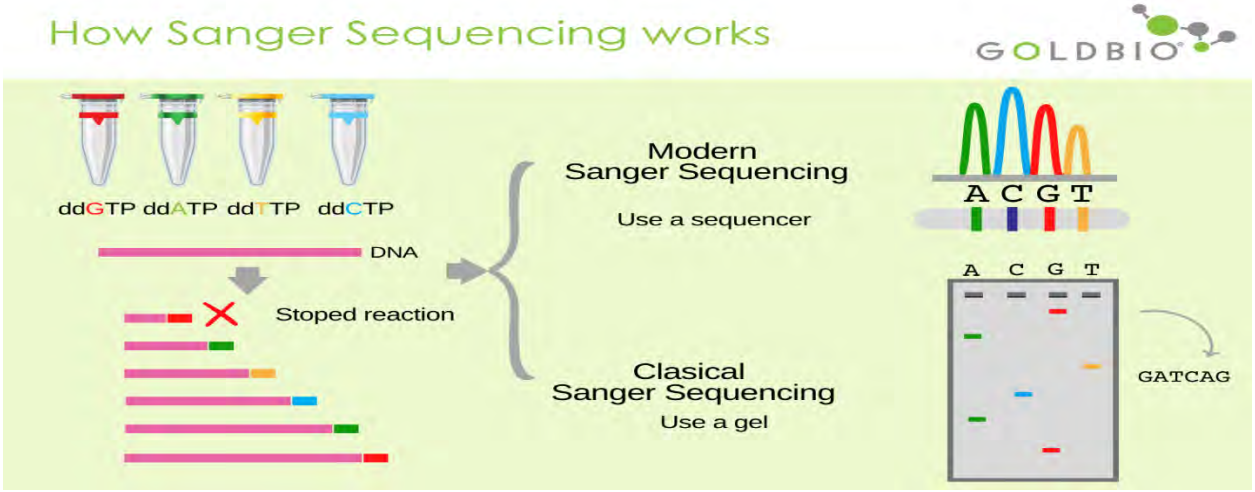

Figure 5. Overview Sanger sequencing.

Next-Generation DNA Sequencing

Sequence-based procedures, as opposed to microarray techniques, directly identify the nucleic acid sequence of a specific DNA or cDNA molecule. The Human Genome Project was the first significant attempt at DNA sequencing. Sanger sequencing, also known as the chain-termination method, was utilized in this research, which took 13 years, cost $3 billion, and was finished in 2003. The short read, massively parallel sequencing technique is fundamentally different from traditional Sanger sequencing using capillary electrophoresis. It revolutionized sequencing capabilities and gave rise to next-generation sequencing (NGS), which offers orders of magnitude more data at a significantly lower recurring cost.

The phrase "next-generation sequencing" (NGS), commonly referred to as "high-throughput sequencing," is used to refer to a variety of contemporary sequencing technologies. The study of genomics and molecular biology has been completely transformed by these technologies, which make it possible to sequence DNA and RNA considerably more swiftly and affordably than was previously possible using Sanger sequencing. These technologies consist of:

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Advantages of NGS

NGS is a common technology in functional genomics and can be used to analyze DNA and RNA materials. NGS-based approaches provide a number of advantages over microarray techniques, including:

- It gives single-nucleotide resolution, making it possible to find related genes (or features), alternatively spliced transcripts, allelic gene variants, and single nucleotide polymorphisms.
- It does not require a priori knowledge of the genome or genomic features.
- Higher dynamic range of signal.
- Less input DNA/RNA required (nanograms of materials are adequate).
- Higher reproducibility.

Next Generation Sequencing (NGS) is a robust platform that has enabled the sequencing of thousands to millions of DNA molecules simultaneously.

NGS: Short-read Sequencing (SRS)

Due to its high throughput capabilities, short-read sequencing (SRS), spearheaded by Illumina, is currently the most used sequencing method. Second Next Generation Sequencing is another name for short-read sequencing. SRS employs the chemical process known as sequencing by synthesis. Additionally, thousands of data are produced because of the numerous reactions that take place during the clustering process even though SRS also makes use of various fluorophores added to each nucleotide (similar to contemporary Sanger sequencing). Hundreds of DNA molecules are combined with fluorescent dideoxy nucleotides (ddTPs) and connected to a flow cell (a slide with numerous small lanes) to form clusters. A high-resolution computer then records the fluorescence of millions of simultaneous reactions. It is significant to note that, in contrast to sanger, NGS uses millions of sequences. In NGS, reassembling short sequences based on overlapping portions is the aim. Imagine that you need to read a book, but the pages have been torn, and you need to put them back together correctly. How does one create it? Comparable to NGS, overlapping words are utilized as hints to correctly reassemble the genome. The drawback of this is that, despite the employment of robust algorithms to automate the reassembling, they are not always precise. Better algorithms and perhaps even software powered by artificial intelligence will most certainly be developed in the upcoming years to assist us in improving the reconstruction of genomes and transcriptomes.

SRS can be carried out utilizing Illumina technology in two basic steps.

The clustering stage comes first, following the preparation of the library. An isothermal technique is used to amplify DNA molecules with attached adapters (temperature remains constant but volume and pressure may change). The DNA templates being sequenced can be amplified using this technique. **Thousands of oligos, or DNA short sequences, are present in each line of the flow cell and bind to the adapters at the ends of the DNA molecules by complementation. Some oligos**

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attach to the 3' and 5' extremities, whereas other oligos bind to both. Through a procedure known as bridge clustering or bridge PCR, the oligos amplify DNA templates. One side of the DNA attaches to the first kind of oligo in the flow cell during the initial step. DNA polymerases and nucleotides that hybridize with the DNA template are present in the process. The second stage involves the folding over of DNA templates and the hybridization of the second type of oligo to the other end of the DNA molecule. The polymerization process then repeats. Therefore, DNA molecules are amplified and cloned at both ends. Thousands of DNA molecules are created after clustering and are connected to the flow cell.

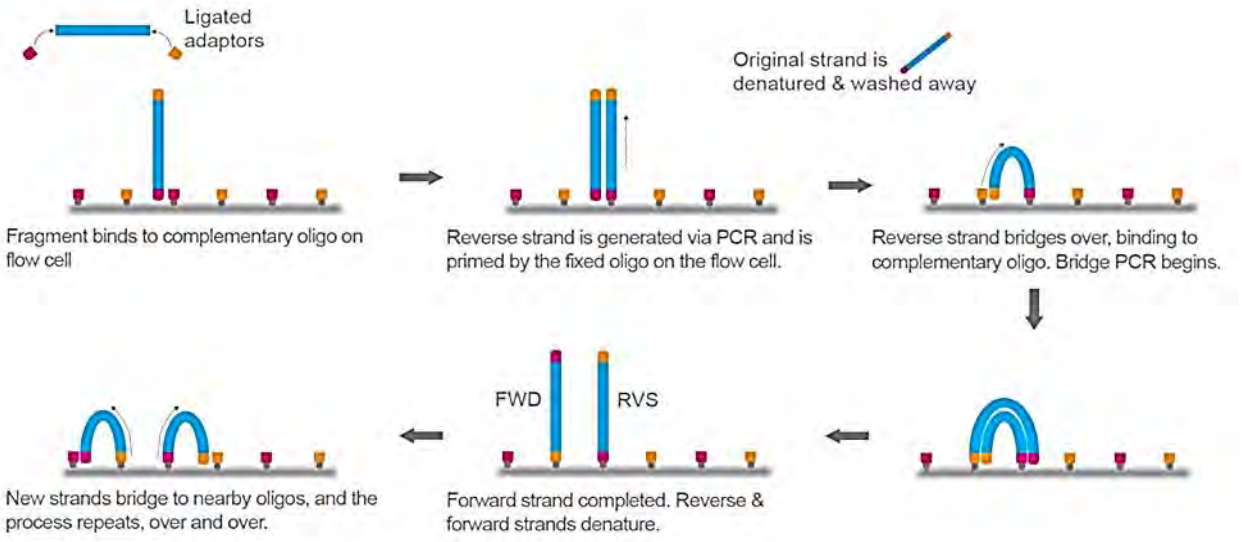

Figure 6. Bridge PCR used in short-read sequencing.

NGS Long-read DNA sequencing (LRS)

A contemporary technique called long-read DNA sequencing (LRS) is utilized to generate long and comprehensive DNA sequences. Third Next Generation Sequencing is another name for it. Although bridge amplification is not done, it uses the same sequencing by synthesis chemistry as short-read sequencing. Long-read sequencing, which differs from short-read sequencing in that it generates huge sequences from a single DNA template, has a larger error rate (defined as a lack of accuracy in the correct nucleotide order) than short-read sequencing (up to a 10% mistake). Long-read sequencing is the best method for determining the sequence of complex DNA regions like repeats (a region made up of numerous nearby copies of the same sequence), despite having a greater error rate in base calling. In cereals species where repeat regions are common; their genomes can include up to 80% repeats (Wicker *et al.,* 2001). The sequencing by synthesis process takes place in the second stage. Fluorescent nucleotides and DNA polymerases are combined in the flow cell in this instance, where they quickly hybridize with the many DNA molecules. A potent computer simultaneously records the fluorescence given out by the various processes to create millions of tiny simulated sequences known as reads.

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There are two main phases involved in long-read sequencing. In the first, a well plate with only 100 nm in height has thousands of DNA templates primed to polymerases. Each well has a fixed DNA polymerase in the bottom as well as a small camera.

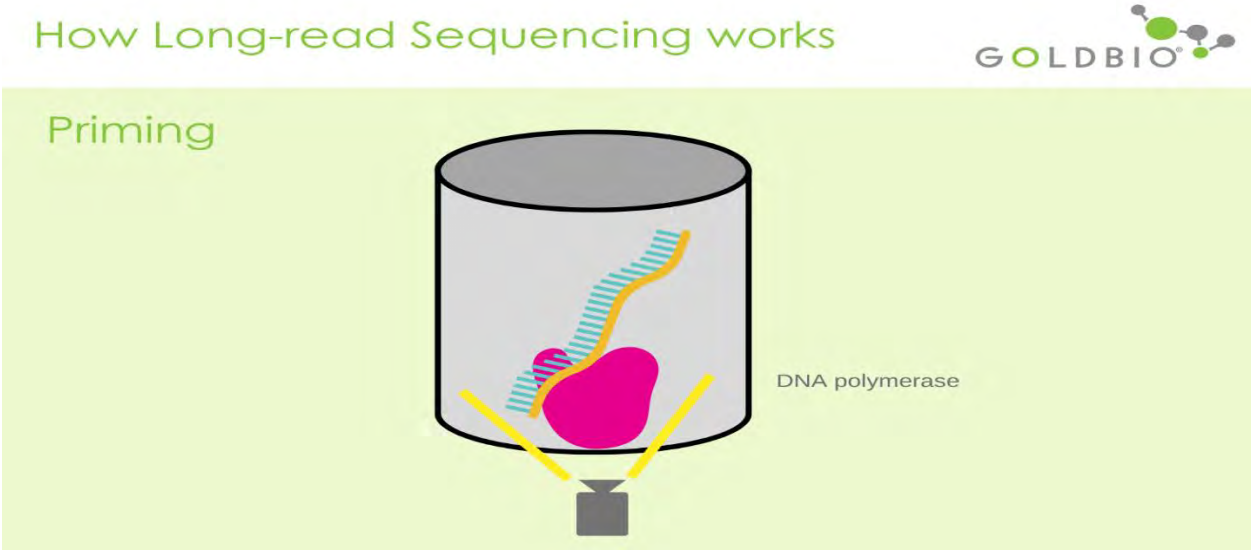

Figure 7. Priming process in long-read sequencing.

The second phase involves the ordered hybridization of fluorescent nucleotides with DNA templates, and the tiny camera records the fluorescence reactions. The signal becomes stronger and reveals the correct arrangement of the nucleotides when the right base attaches to the DNA template.

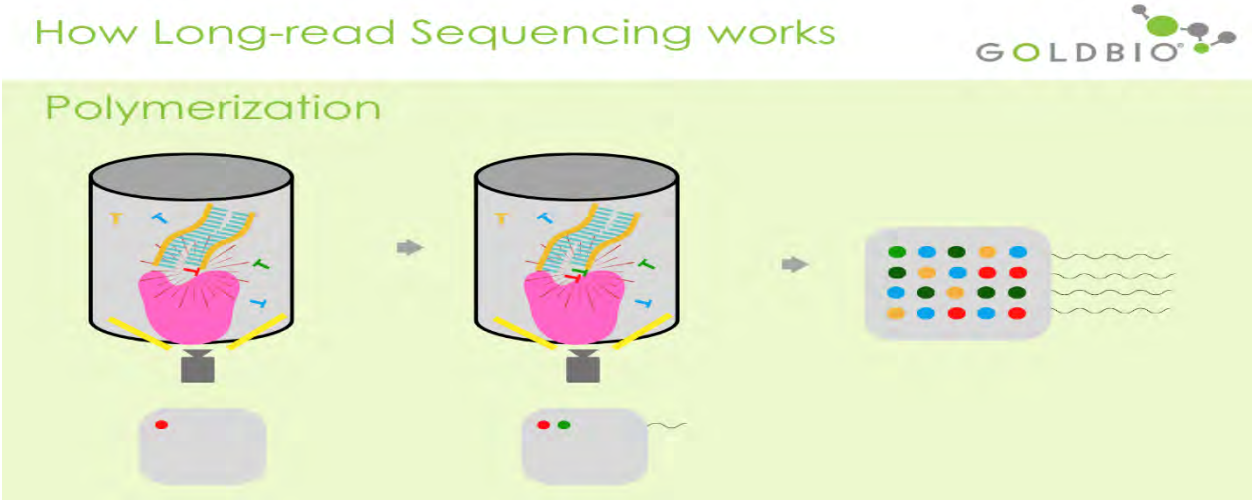

Figure 8. Hybridization of fluorescent nucleotides with DNA templates

Applications of NGS

The kind of questions that scientists can pose and receive answers to have been radically altered by next-generation sequencing technology. A wide range of applications are made possible by innovative sample preparation and data analysis techniques. For instance, NGS permits labs to:

- Utilize RNA sequencing (RNA-Seq) to find novel RNA variants and splice sites, or quantify mRNAs for gene expression studies.
- Rapidly sequence complete genomes. Deeply sequence target regions.

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- Examine epigenetic elements such DNA-protein interactions and genome-wide DNA methylation.
- Sequence cancer samples to learn more about tumour subclones, uncommon somatic variations, and other topics.
- Research the human microbiome.
- Find new pathogens.

Lynx therapeutics' massively parallel signature sequencing (MPSS)

It's regarded as the pioneering "next-generation" sequencing technology. At Lynx Therapeutics, a business established in 1992 by Sydney Brenner and Sam Eletr, MPSS was created in the 1990s. MPSS is a technology for extremely high throughput sequencing. When used to create an expression profile, it makes nearly every transcript in the sample visible and calculates its precise expression level. The MPSS bead-based method was prone to sequence-specific bias or loss of particular sequences since it used a complicated method that involved adapter ligation and adapter decoding while reading the sequence in increments of four nucleotides. However, the MPSS output's key characteristics, which included millions of small DNA sequences, were indicative of later "next-gen" data formats. For MPSS, these were typically applied to the sequencing of cDNA in order to quantify the levels of gene expression.

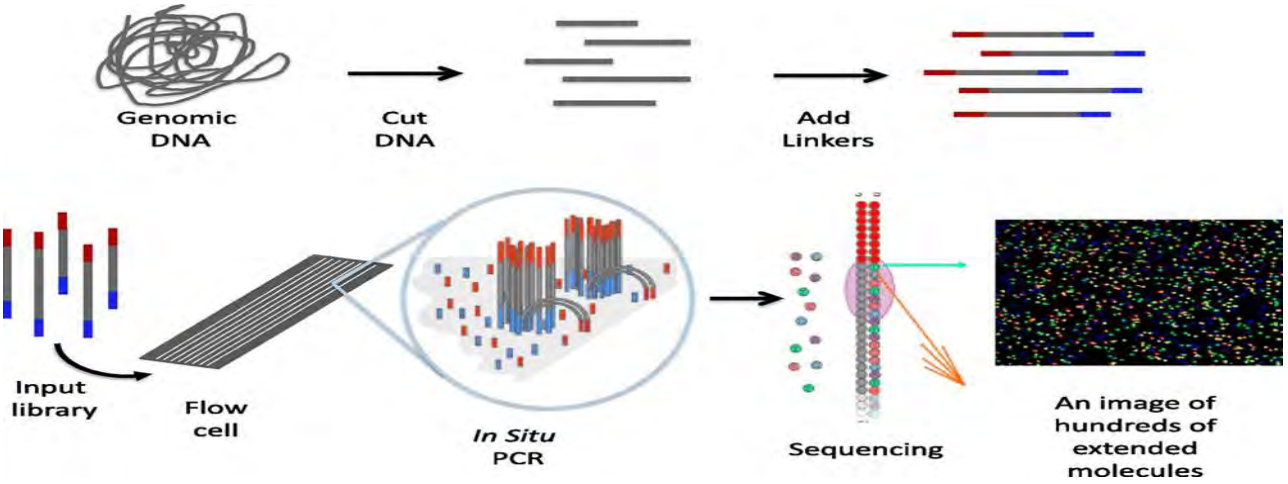

Figure 9. Lynx therapeutics' massively parallel signature sequencing (MPSS)

Polony sequencing

It is a cheap but very precise multiplex sequencing method that enables parallel reading of millions of immobilized DNA sequences. At Harvard Medical College, Dr. George Church invented this method first. It sequenced an E. coli genome with > 99.9999% accuracy at a cost of around 1/10 that of Sanger sequencing by using an in vitro paired-tag library, emulsion PCR, an automated microscope, and ligation-based sequencing chemistry.

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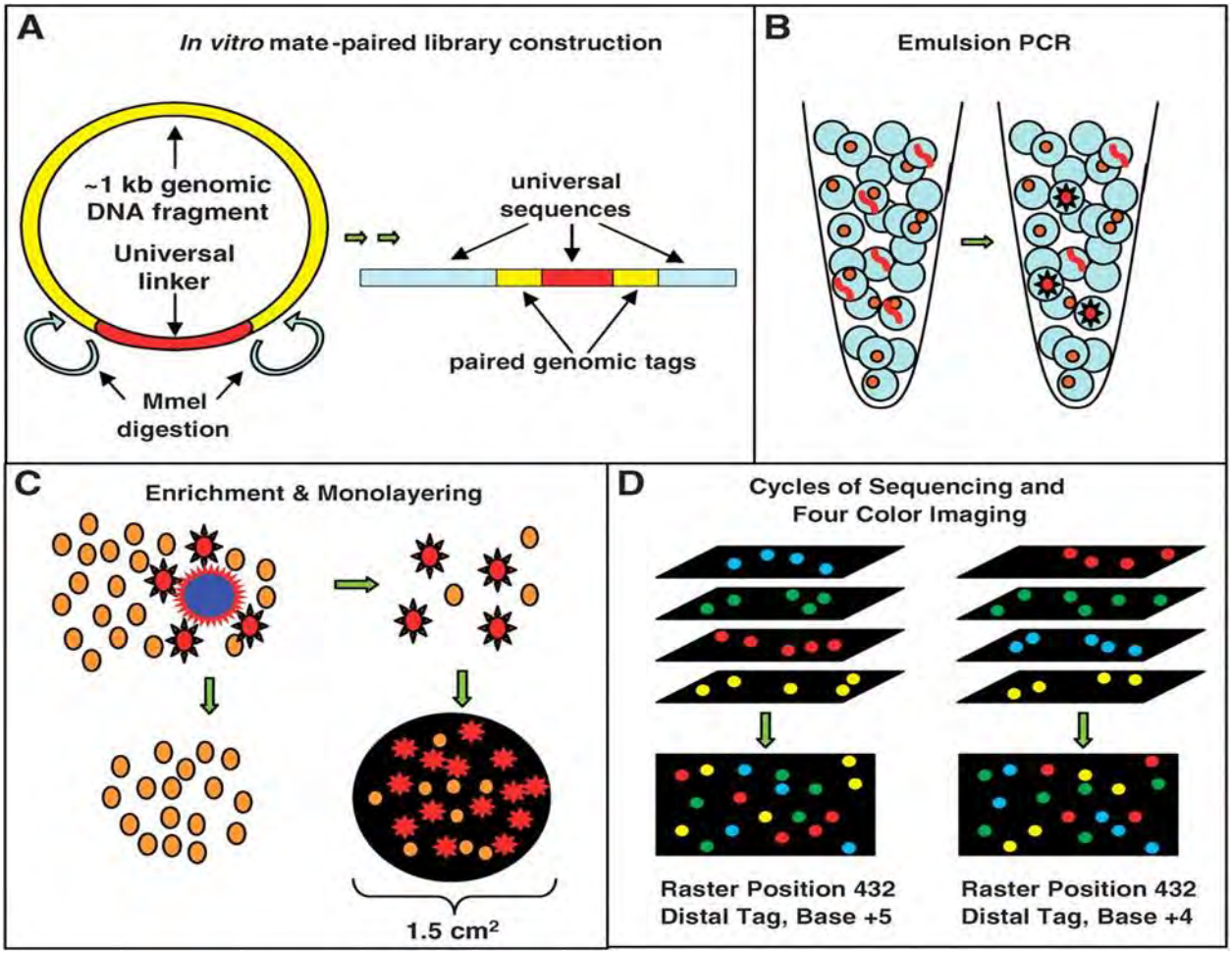

Figure 10. Polony sequencing

Pyrosequencing

Pyrosequencing was developed in parallel by 454 Life Sciences, which was later purchased by Roche Diagnostics. The technique, known as "emulsion PCR," amplifies DNA within water droplets suspended in an oil solution. Each droplet contains a single DNA template coupled to a single primer-coated bead, which subsequently establishes a clonal colony. There are several picolitre-volume wells in the sequencing machine, each housing a single bead and sequencing enzymes. Pyrosequencing makes use of luciferase to produce light for the purpose of detecting the individual nucleotides that have been added to the developing DNA. The resulting data are then merged to provide sequence read-outs. In comparison to Solexa and SOLiD on the other end and Sanger sequencing on the other, this method offers intermediate read length and cost per base.

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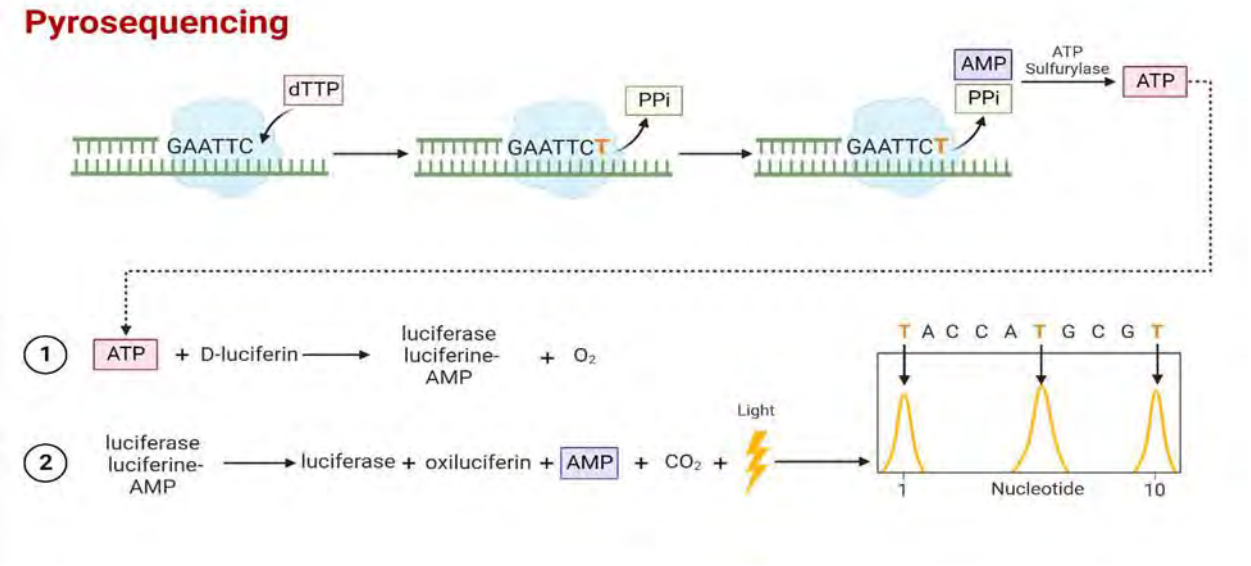
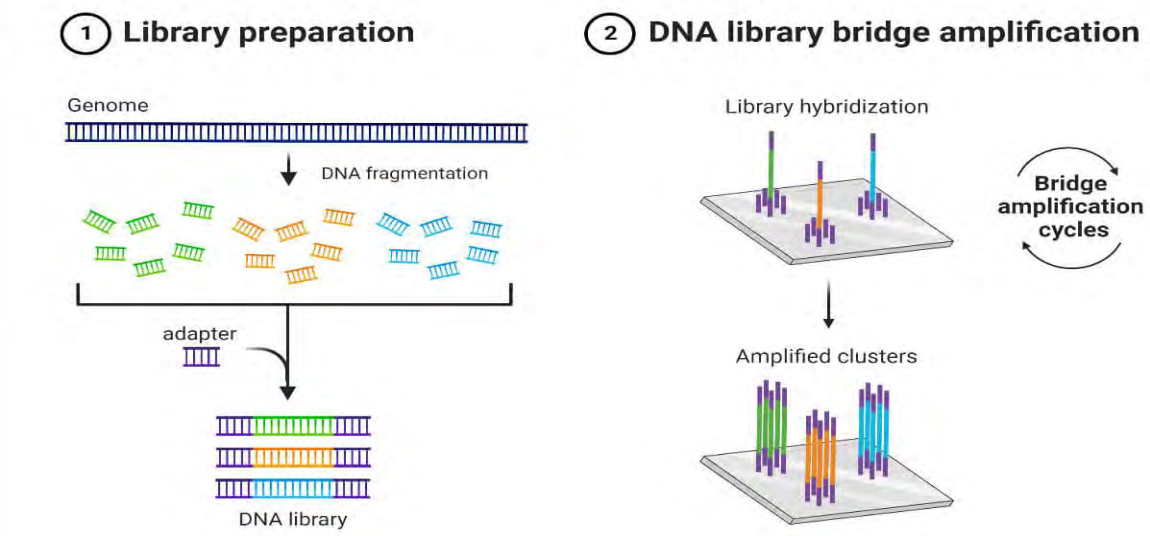


Figure 11. Pyrosequencing

Illumina (Solexa) sequencing

Solexa created a dye terminator-based sequencing method. In this technique, DNA molecules are initially amplified after being linked to primers on a slide. Bridge amplification is the term used for this. The DNA can only be stretched one nucleotide at a time, unlike pyrosequencing. The terminal 3′ blocker and dye are chemically removed from the DNA to start the next cycle after a camera captures photos of the fluorescently labelled nucleotides. Solexa created a dye terminator-based sequencing method. In this technique, DNA molecules are initially amplified after being linked to primers on a slide. Bridge amplification is the term used for this. The DNA can only be stretched one nucleotide at a time, unlike pyrosequencing. The fluorescently labelled nucleotides are photographed by a camera before the dye and terminal 3′ blocker is chemically removed from the DNA to start the



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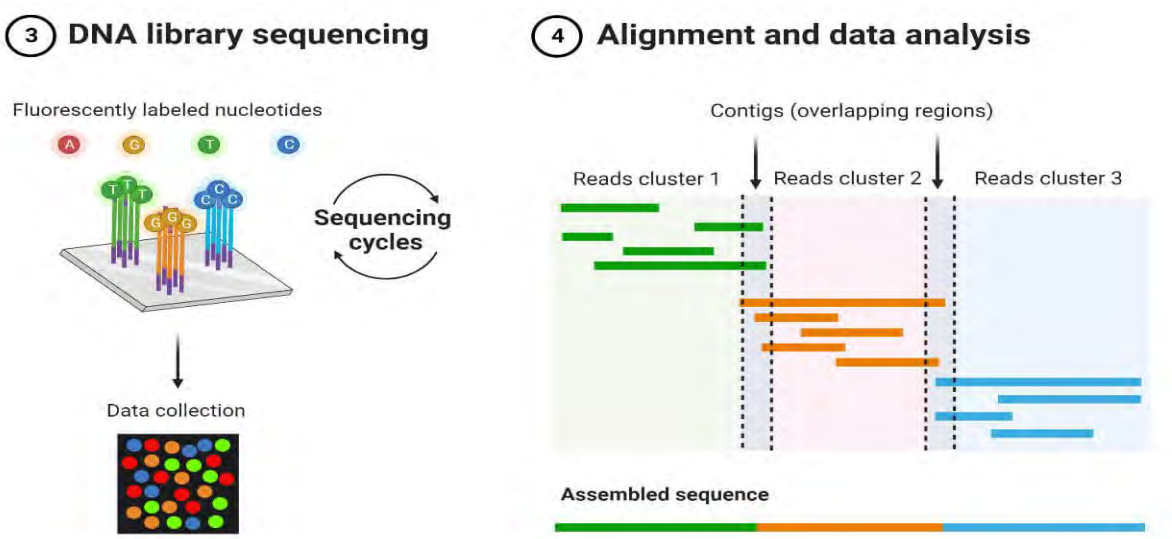
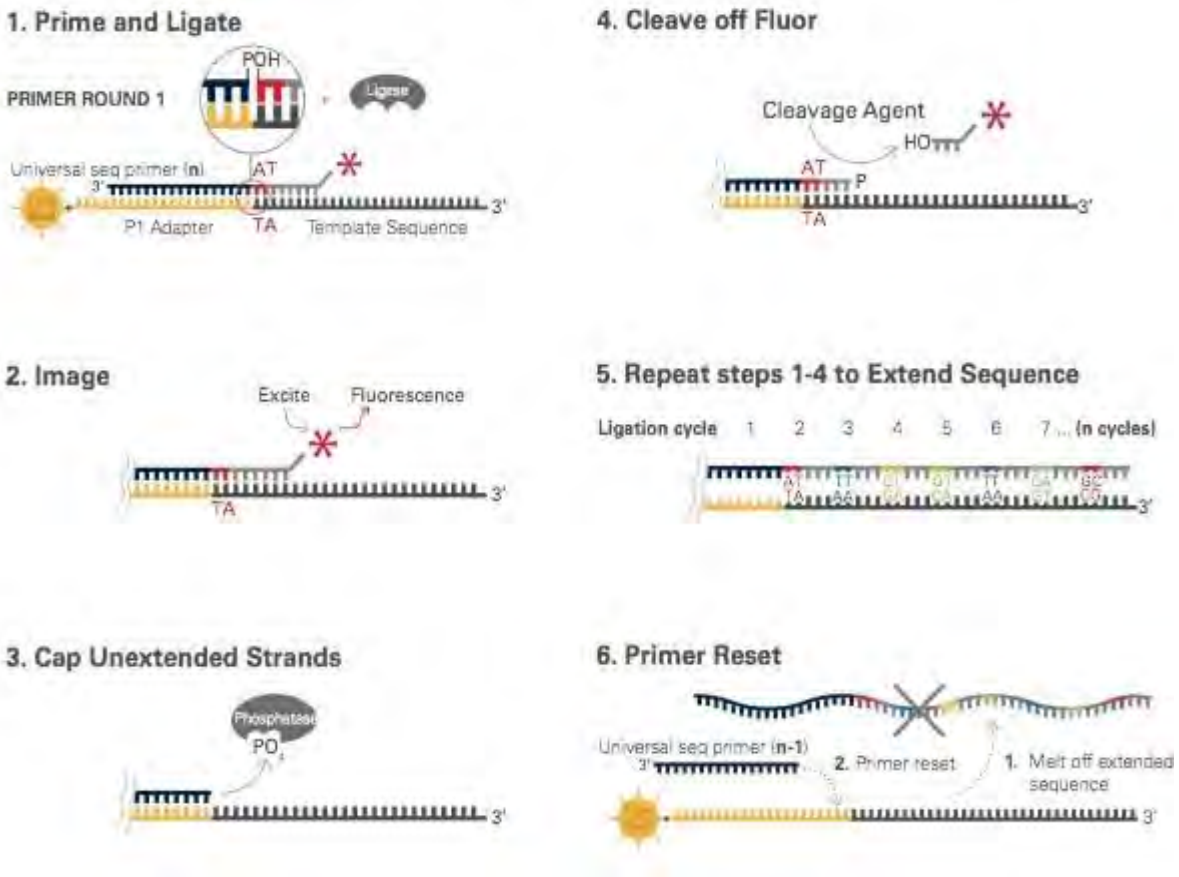


Figure 12. Illumina (Solexa) sequencing

SOLiD sequencing

Oligonucleotide ligation and detection is the sequencing method used in ABISolid sequencing.This involves labelling a pool of all potential oligonucleotides of fixed length in accordance with the sequenced position.Sequences produced by this sequencing are similar to illuminate sequencing in terms of quantity and length.



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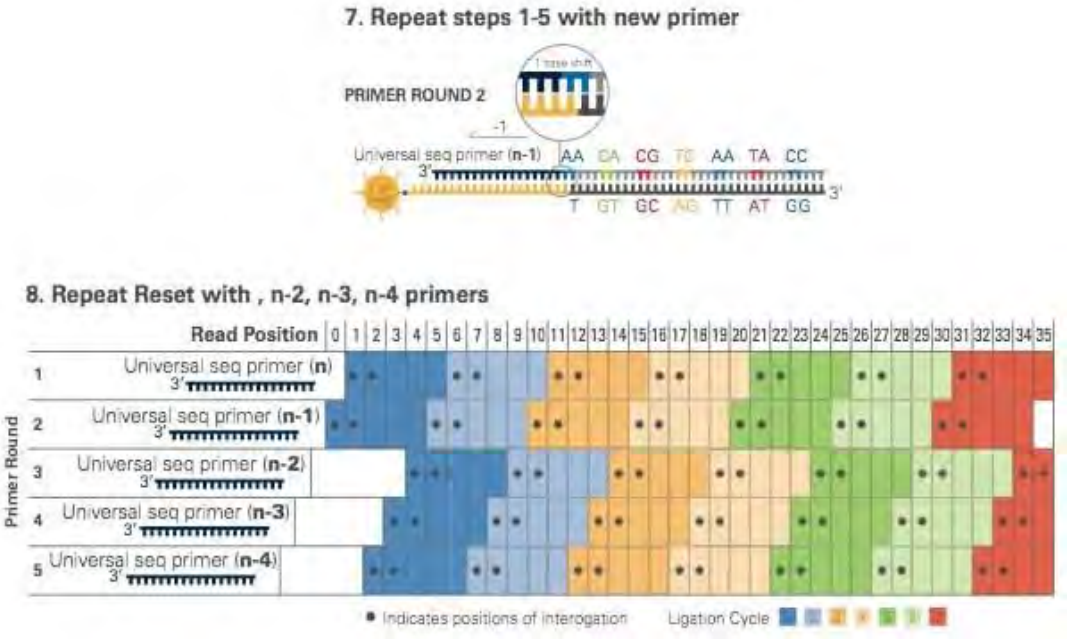

Figure 13. SOLiD sequencing

DNA Nanoball Sequencing

The full genetic sequence of an organism can be found using high throughput sequencing technologies. The technique amplifies genomic DNA molecule fragments via rolling circle replication. Compared to other next-generation sequencing platforms, this DNA sequencing method allows for the sequencing of a lot of DNA nanoballs in a single run at a low cost of reagents, but

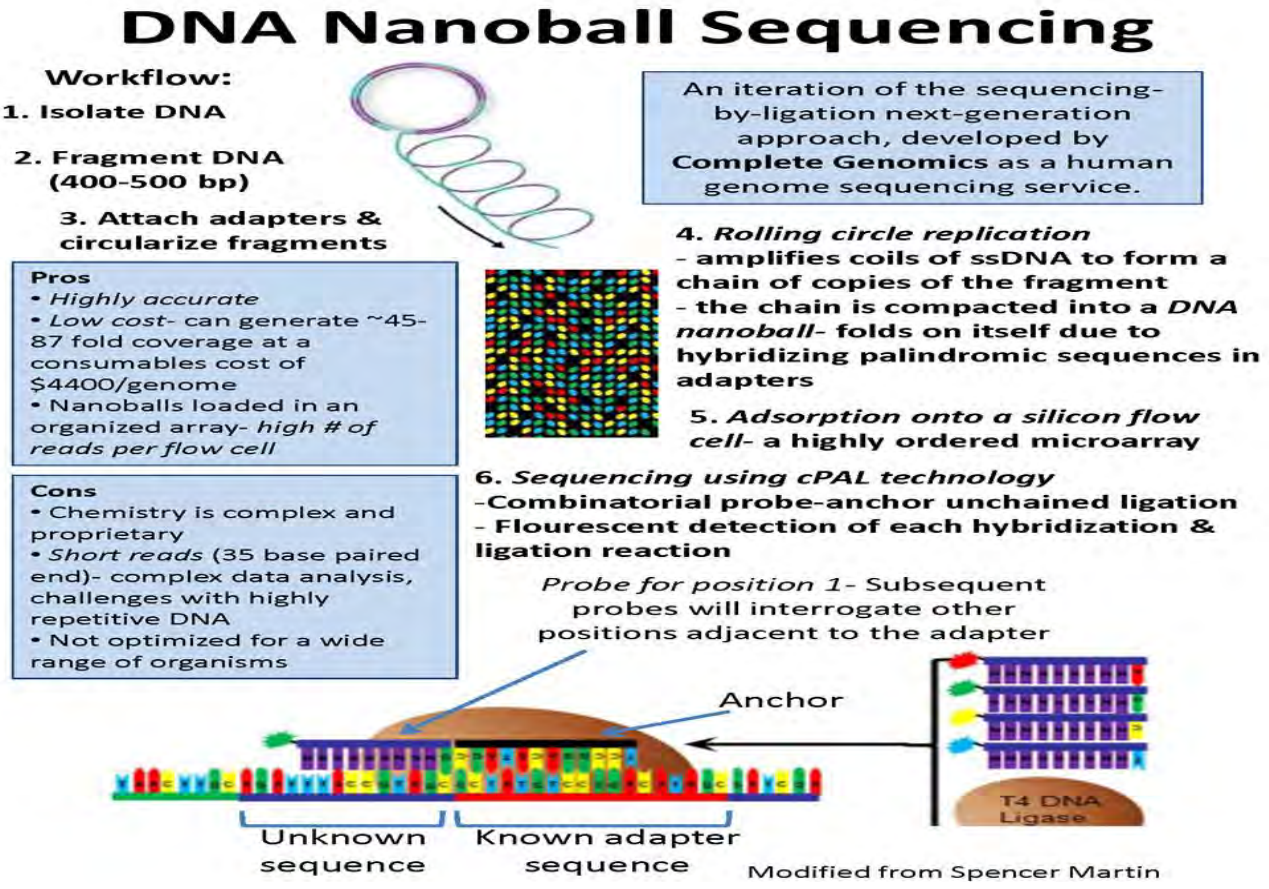

Figure 14. DNA Nanoball Sequencing

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because each DNA nanoball can only yield short DNA sequences, it is challenging to map the short reads to a reference genome. Several genome sequencing initiatives have already used this method, and others are planned.

Helioscope single molecule sequencing

Helioscope sequencing employs DNA fragments attached to the flow cell surface with polyA tail adapters added. The following steps involve cyclic washing of the flow cell with fluorescently labelled nucleotides and extension-based sequencing. The Helioscope sequencer generates the reads, which are brief (up to 55 bases each run), but subsequent advances in the methodology have enabled more precise reads of homopolymers and RNA sequencing.

Single molecule SMRT sequencing

The sequencing by synthesis method is the foundation of SMRT sequencing. The so-called zero-mode wave-guides (ZMWs), which are little well-like containers with the capture instruments at the bottom, are where the DNA is synthesised. Unmodified polymerase and fluorescently tagged nucleotides that are freely dispersed in the solution are used to perform the sequencing. The wells are designed such that only the fluorescence present at the well's bottom may be seen. When the nucleotide is incorporated into the DNA strand, the fluorescent label separates from the nucleotide, leaving an unaltered DNA strand. The SMTR technology enables nucleotide changes to be found. This is accomplished by watching the polymerase kinetics. This method permits readings of 1,000 nucleotides.

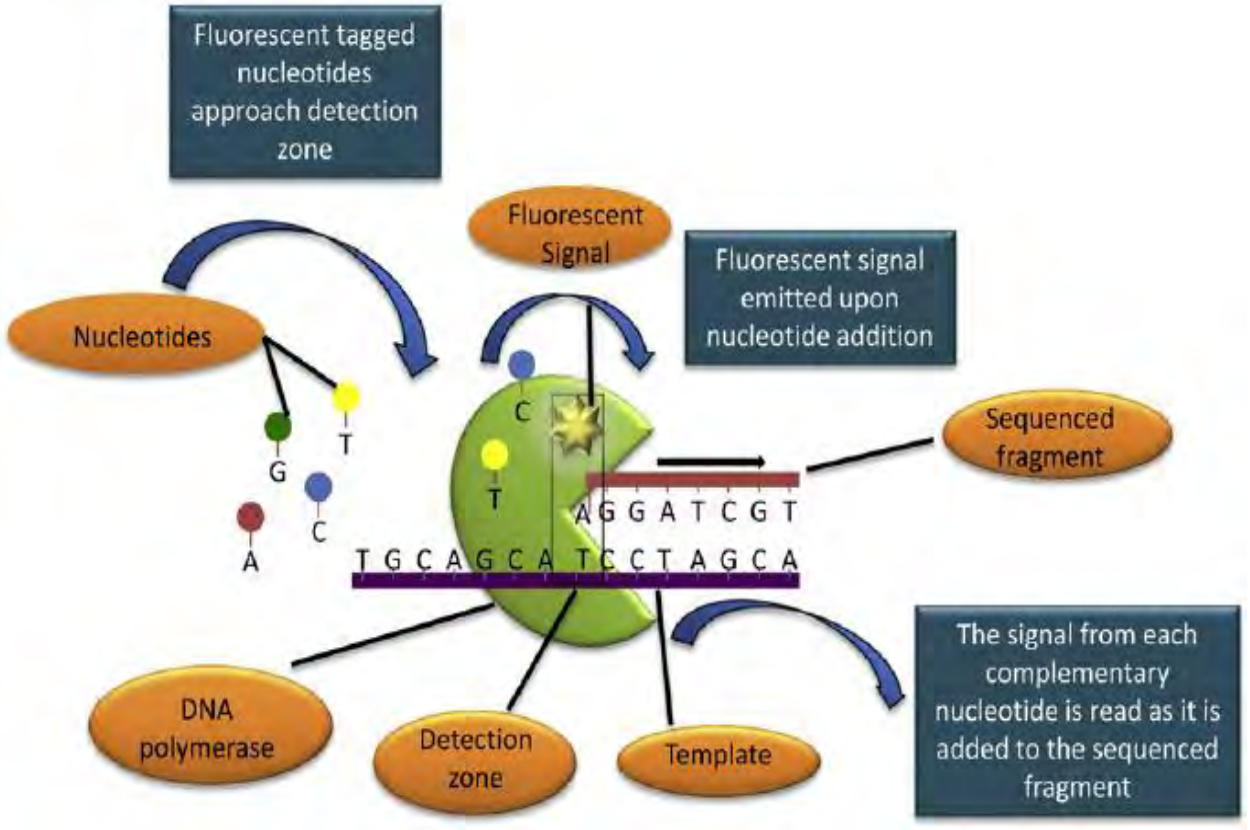

Figure 15. Single molecule SMRT sequencing

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Single molecule real time (RNAP) sequencing

This method is based on the attachment of RNA polymerase (RNAP) to a polystyrene bead, the distal end of sequenced DNA to another bead, and the placement of both beads in optical traps. The beads move closer to one another as a result of RNAP mobility during transcription, and this change in relative proximity can be captured at a single nucleotide precision. Based on the four readouts with reduced amounts of each of the four nucleotide types, the sequence is inferred.

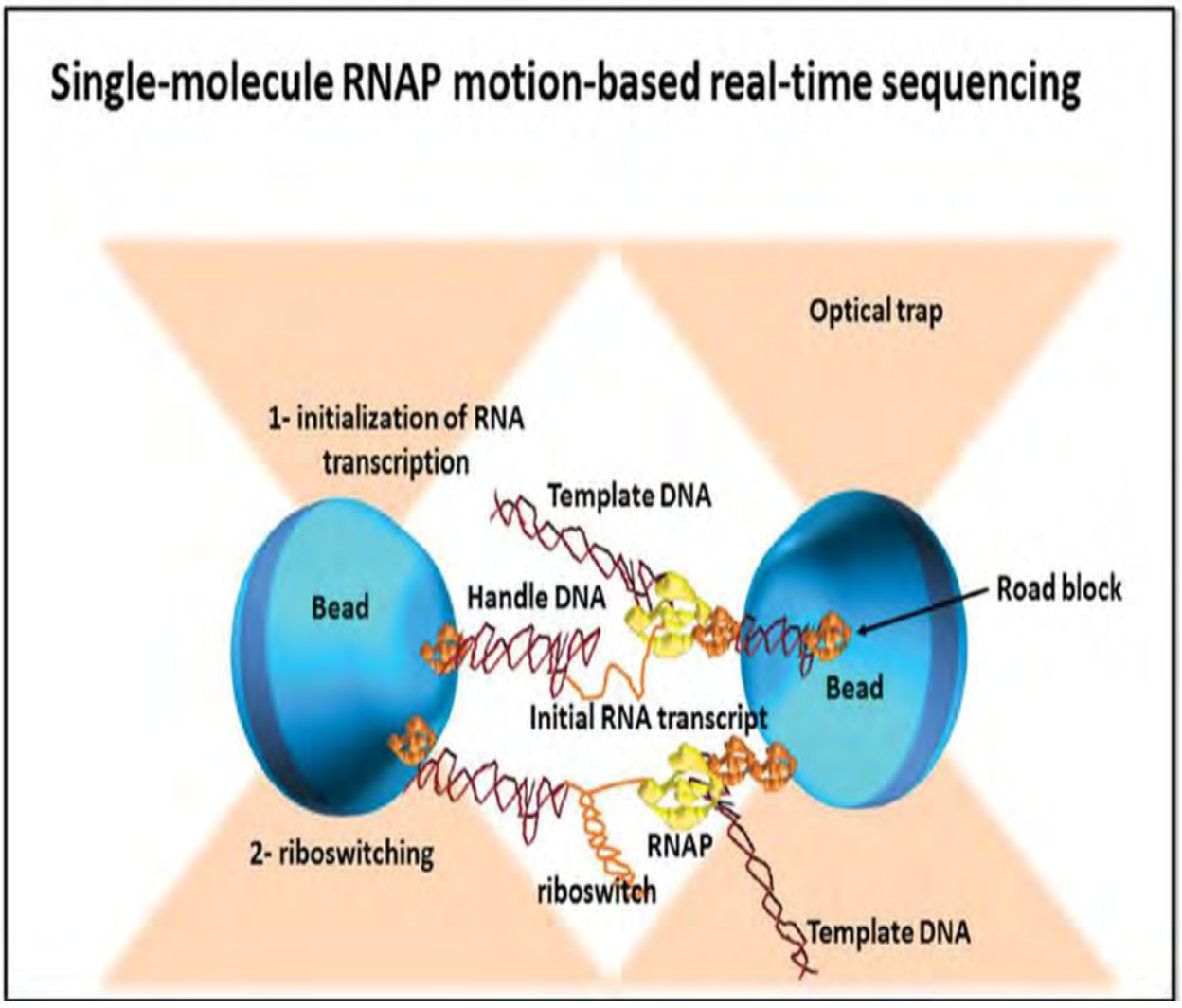

Figure 16. Single molecule real time (RNAP) sequencing

ROCHE 454 sequencing process

A) Building a system for micro-reactions. An adaptor is added to the ends of DNA fragments to create a DNA library. DNA fragments, enzymes, and dNTPs are coupled with magnetic beads and primers in the PCR reaction method. Emulsion PCR (B). By infusing water (the PCR mixture) into the oil, PCR micro reaction systems are created, and each system only comprised one template and one bead. Pyrophosphate sequencing, in (C). Pyrophosphate technology is a four-enzyme-catalyzed chemiluminescence process that takes place in the same reaction system. Only one dNTP is added to each circle of the sequencing reaction. If it only matches the following base in the DNA template, DNA polymerase will add it to the sequencing primer's 3 ′ end and release a molecular PPi at the same

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time. The PPi initiates an enzyme cascade chemiluminescence reaction that is mediated by ATP sulfurylase, luciferase, and apyrase. (D) Receiving a light signal.

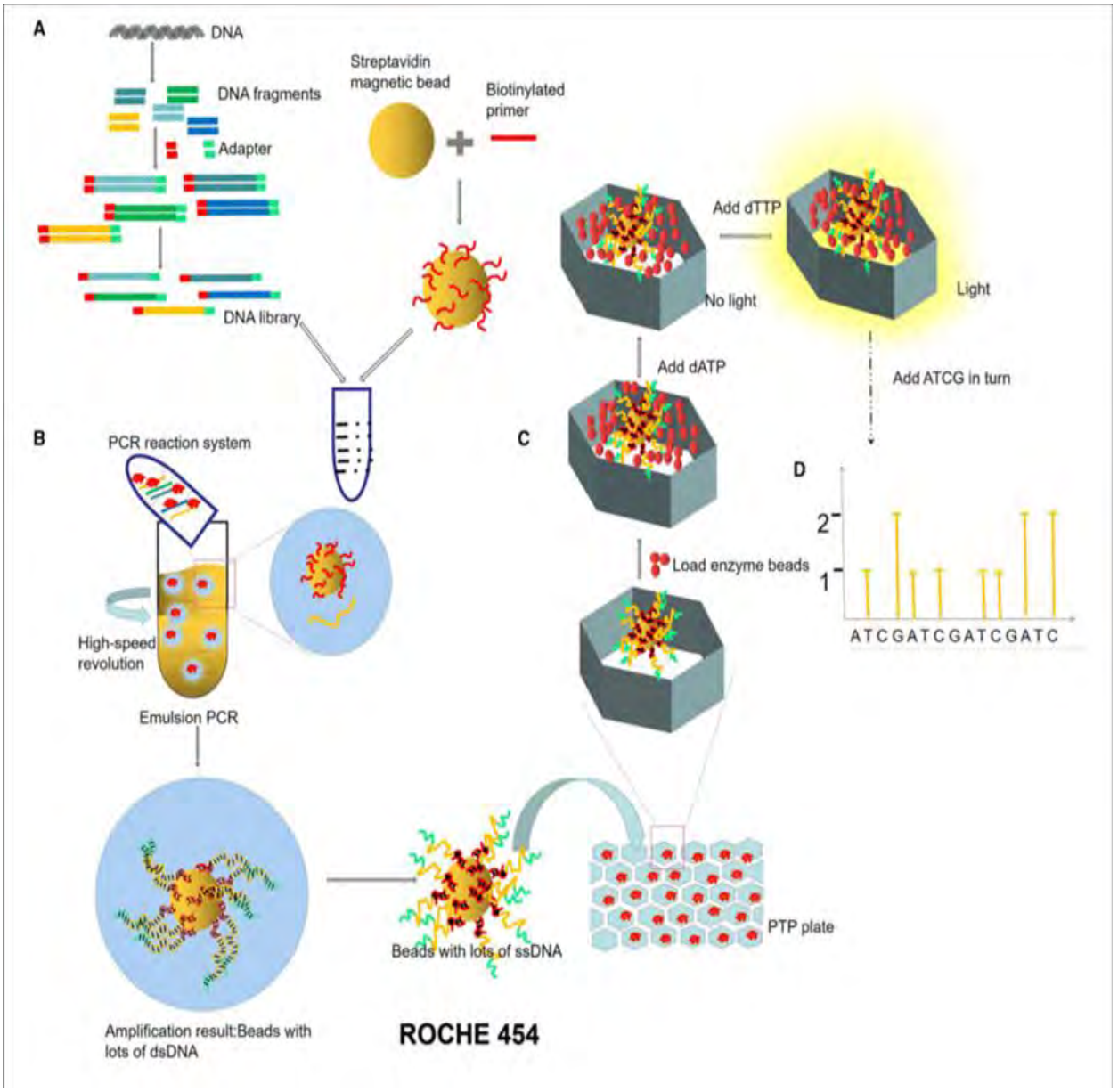

Figure 17. ROCHE 454 sequencing process

Conclusion

It is difficult to emphasize how crucial DNA sequencing is to biological study since, at its most basic, it allows us to gauge one of the key characteristics that allows terrestrial life forms to be identified and distinguished from one another. As a result, during the past 50 years, a large number of academics from all over the world have dedicated a lot of time and money to creating and advancing the technologies that support DNA sequencing. At the beginning of this field, researchers would laboriously spend years producing sequences that may range in length from a dozen to a hundred nucleotides, working mostly from accessible RNA targets. Sequencing technology has improved throughout time while also becoming more affordable thanks to advances in molecular biology, automation, and sequencing methods. This has made it possible to read DNA with hundreds of base

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pairs in length and create gigabytes of data in a single run. Instead, then pouring over gels in the lab, researchers switched to running code on computers. Repositories of DNA sequence data have been expanding as genomes have been decoded, studies have been published, businesses have been founded (and frequently afterwards shut down), and so on. Therefore, DNA sequencing has a rich history despite being in many ways a modern and future-oriented academic subject.

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A comparative analysis of fish production and consumption across different states in India

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Abstract

India's average per capita fish consumption is 8 to 9 kg which is only half of the global average. Fish consumption among high literacy rate states and low-income states is high irrespective of their fish production. Union territories and Northeastern states are found as better fish consuming states in India. The other states have to still improve their per capita fish consumption status.

Introduction

Fish is a healthy, balanced, and widely accepted diet worldwide due to its nutritional advantage viz., protein and essential fatty acids. Global average fish consumption has increased from 9.9 kg in 1961 to 20.5 kg in 2019 (FAO, 2022). The coastal countries of Iceland (92 kg) and Maldives (85 kg) are leading in per capita fish consumption. While landlocked countries such as Afghanistan, Ethiopia, and Tajikistan are the least in per capita fish consumption with less than 1 kg of fish per annum. Nevertheless, the leading fish producers China (39) and India (6.8 kg) could position only 7th and 15th place respectively in 2019 (World Economic Forum, 2022).

It has been estimated that 60 % of the Indian population consumes fish with varying consumption patterns. The annual per capita fish consumption among fish-eating population was found to be 8-9 kg (Shyam et al., 2015). To expand the supply, India produced 163 lakh tons of fish where 121 lakh tons from inland, and 42 lakh tons from the marine sector during 2021-22 (Handbook of Statistics, 2022).

Disparity of fish consumption across different states in India

Lakshadweep tops in fish consumption, there a person consumes around 125 kg of fish per year. Followed by Goa (78 kg), Andaman & Nicobar Island (77.8 kg), Tripura (26 kg), Chhattisgarh (19.7 kg), Puducherry (19 kg), Manipur (18 kg), Kerala (17.9 kg), Odisha (16 kg), and Karnataka

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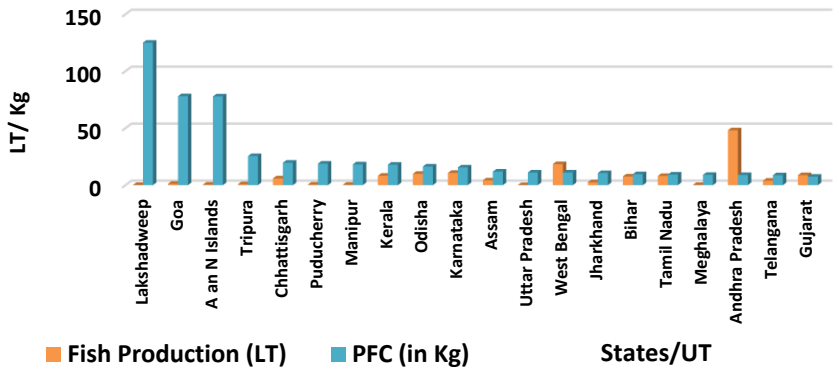
(15.5 kg). Interestingly, among the leading fish-consuming states, UTs and Northeastern states viz, Tripura, Manipur, Meghalaya, Nagaland are producing just nearly a lakh ton, and Assam produces 4 lakh tons of fish, however, leading in fish consumption due to their traditional consumption (Barman, 2012), and touristic activities that act as evidence for the global spread knowledge on eating fish. Whereas states like Andhra Pradesh (48 Lakh tons) dominate India's fish production, especially the shrimps but have only 9 kg of per capita fish consumption. Another fish-loving state West Bengal consumes only 11 kg of fish with a production of 18 LT. The states like Chhattisgarh, Kerala, Odisha, and Karnataka are having appreciable fish consumption with an average of 18 kg over its production (6 to 11 LT). While, Gujarat, Tamil Nadu, and Bihar are having balanced fish consumption with respect to their production (8 to 9 LT) with an average consumption of 8-9 kgs.

Fish production v$_s$ fish consumption in India (2020-21)



Source: Handbook of fisheries statistics, 2022

Other NE states viz., Arunachala Pradesh, Mizoram, and Sikkim are having less than 4 kg of per capita fish consumption with the production of 0.05 LT. Uttarakhand, Punjab, Haryana, Rajasthan, Delhi, and Ladakh are the least consuming states of fish with less than a Kg per year. It is predominantly due to the large vegetarian population (Kumar and Kumar, 2022).

Fish consumption Vs Literacy rate

According to the Ministry of Education – India's Census 2011, the Average literacy rate in India is 74.04 %. The high fish-consuming states are positively correlated with their literacy rate. Kerala has the highest literacy rate in India at 94%, followed by Lakshadweep (91.85%), Mizoram at 91.33%, Goa (88.7 %), A & N islands (87 %), Tripura (87 %), Puducherry (86 %), and states like Chhattisgarh, Orissa, Manipur, Meghalaya, Nagaland has the literacy rate between 70 to 80 %.

Bihar has the lowest literacy rate in India at 61.8%, followed by Arunachal Pradesh at 65.3%, Rajasthan at 66.1%, Jharkhand at 66.4 %, and Andra Pradesh at 67 % which are negatively correlated with the per capita fish consumption. However, Jharkhand and Bihar have better fish consumption than other states in this category.

Fish consumption Vs Per capita income

According to the MOSPI, 2023 India's annual per capita income at a constant price is Rs. 91,481 during 2021-22. Goa tops in per capita income with Rs. 3,10,201 and Bihar secured the last

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position with Rs. 30,779. The dominant fish-consuming NE states viz., Assam, Manipur, Meghalaya, Nagaland, Tripura, and other fish-consuming states viz, Bihar, Chhattisgarh, Jharkhand, Odisha, West Bengal has a moderate per capita income between nearly an Rs. 50,000 to a Lakh per annum. This would represent fish as a highly affordable and alternative commodity to other competitive non vegetarian food like mutton and chicken in these states.

Conclusion

The study would say by knowing the nutritional advantage, fish consumption has a positive relation with the high literacy and low-income states in India. However, India's per capita fish consumption is lower than the global average perhaps the second largest fish producer next to China. Unorganized domestic marketing in major parts of the states to supply quality products at a reasonable price is found to be the major constraint. The government and private institutions are working vigorously to further enlarge the fish supply through effective infrastructure development, awareness programs with fish stalls & exhibitions, fish price information system, and mobile apps viz., Fishwaale, Marine Fish Sales, Daily Fish India, and Healthyfish to make avail of fish at door steps in targeting the people in cities and high-income group who hesitates to buy directly from fish markets. Also, this rudimentary study found that many high-literacy states prefer fish irrespective of their fish production and income levels. Hence, improving the literacy level among low fish-consuming states and increasing fish production in high fish-consuming states would further improve the per-capita fish consumption in India.

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Popular Article

Drug Residues: Potential Threat to Public Health

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Abstract

The public is always on threat of getting illness on consuming drug residues from animal food products. Number of drugs are used to treat many livestock and aquaculture diseases and hence endangering consumer health. Illegal and excessive use of veterinary drugs in animals and marine life cause a serious adverse effect to public and other organisms. There are some factors that can be considered for drug residue, such as pharmacokinetic characteristics, physicochemical or the biological process through which animal deals with the drug. The reason could be improper drug usage and failure to keep withdrawal period, these drug residues majorly lead to development of drug resistance, mutagenicity, carcinogenicity teratogenicity and disturbance to intestinal microflora in human being. These are not a sudden clinical finding; these develops with time. It is necessary to develop fast analytical methods to effectively detect drug residues in animal products and familiarize all animal health professionals with the pharmacokinetic, pharmacodynamics and toxicological effects of veterinary drug to make it least public health concern.

Keywords: Food animal products, public health significance, Residues, Detection Methods.

Introduction

Veterinary drugs are used for treatment and prevention purposes in animals. In a recent times drugs are becoming so important to meet the challenges of providing sufficient amount of food for the continuously growing population, as many drugs are used to improve weight gain, milk yield, to increase feed conversion ratio and all in all to fasten the growth rate of animal. However, this increase in productivity do not come with some lacunas, i.e. drug residues and posing a public health hazard. Hence this is the major worldwide issue concerning food contamination.

According to European Union and Food and Drug Administration (USA), residues are "pharmacologically active substances (whether active principle, recipients and degraded products) and their metabolites which remain in foodstuff obtained from animal to which the veterinary medicinal preparation in question has been administered. In process of aquaculture use of drugs can easily lead

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to water pollution and drinking water. Usually, major part of the drug residue eliminates through urine and some from faeces but may also found in milk, eggs, meat and aquaculture bodies. According to protocol no animal product should be consumed before completion to withdrawal period mentioned on the drug label. So, by using high efficiency analytical methods, which shows that there is always presence of detectible residues, but these residues are at really low concentrations and nontoxic until gets accumulated in the body over a long period. This review put light on overview of the risk associated with the drug residues, global impact and consumer health and to provide a safety evaluation and control measures of drug residues in animal food products.

Risk Associated with Residues in Animal Food Product

Major contamination related to consumption of animal food product is drug residue contamination. On a normal basis an animal food product should not contain any residues. But as not following dosage instructions, not giving heed to withdrawal period, administering a single large dose on one site, use of drug contaminated equipment's, improper dosing, extending antibiotic dose without prescription, letting animals to feed on drug spilled feed and excessive use of pesticides.

Liver and kidney are two major detoxification sites in body. Drug residues accumulation is mainly related with human mismanagement such as use of banned drugs, giving antibiotics for periods longer than required. There is also, animal to animal drug transfer. Risk factor responsible for the development of residue are:

Age of animal

Weaning status and with little impact of age of the animal affect drug deposition. There were several studies conducted on different drug comparison between weaned and unweaned calves, between young and old age adults. For instance, norfloxacin nicotinate has longer clearance time in weaned calves; reason could be increase in weight due to ruminal fluid. Similarly, Sulfamethazine has shorter clearance time for grain fed calves than weaned ones. In the same way tindazole have shorter clearance time in unweaned calves than adults and apramycin have longer clearance time in calves. Reason could be immature drug clearance system.

Feeding

Bioavailability of drug can depend on diet. For instance, study conducted to check the effect of diet on orally administered fenbendazole bioavailability on cattle and buffalo, shows animal receiving feed containing green fresh herbage had lowered bioavailability of drug. As fenbendazole remains in rumen, released progressively with digesta, the presence of fresh herbage increases gut motility and flow of ingesta, this depletes the bioavailability of drug. With feed gut content can also affect drug uptake.

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Condition of animal

Animal condition can affect pharmacokinetics of drug administered, which can lead to potential residues. This can depend on whether animal having condition related to metabolism or infection and inflammation causing the drug to accumulate in affected tissues or organ. For instance, cattle with acute mastitis, apramycin penetrate the affected areas and drug residues have been found 10 times more than to not affected cow. It is also observed that level of ketoprofen increases during clinical mastitis. Calves with experimentally infected with faciolosis cause increase in elimination half-life of antipyrine but decrease in oxytetracycline. The mechanism given behind is the changes in the liver function.

Pharmacokinetics

Term refers to the movement of drug into, through and out of the body including its absorption, bioavailability, distribution, metabolism and excretion.

a) ***Absorption-*** Process by which drug/compound passes from site of administration into bloodstream. Absorption is influenced by many factors such as drug properties, route and physio pathological state of animal.

b) ***Distribution-*** process by which drug or absorb compound is distributed to all tissues and organs and then site of action. Only a part (fraction) of drug is delivered to exert activity at site of action. Parameter defining distribution is volume.

c) ***Metabolism-*** it is the principal mechanism of elimination for transformation of drug or xenobiotic into metabolites. Liver plays very important role in metabolism of drugs. Elimination is mainly done by kidneys. All though some drugs are eliminated and unchanged, mostly undergo metabolism by liver.

d) ***Excretion***- it is the process of elimination of drug are the metabolites. Elimination is mostly done through release in body fluids, so here kidney place very important role in the elimination of drug. Renal insufficiency generally affects rate of elimination of drug/metabolite. It is also noted that general ability to excrete drug largely varies with species variation, for example birds are good biliary excreters compared to sheep and rabbit.

Disturbed Withdrawal

It is the time period during which the drug residues, reaches safe concentration where there is no harm in consuming animal food products when people do not follow protocols according to withdrawal period, chances of retention of drug residue in animal product become high.

Public health concern

Generally low-level residues do not generate adverse effects of residues. But when present in higher level can cause antibiotic resistance and hypersensitivity reaction.

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Detection of residues

Usually, detection of veterinary drug residues in animal products require sample preprocessing, instrumentation, method establishment and data analysis to evaluate stability, precision and sensitivity of the method. Animal obtain food usually have complex matrix and many endogenous interfering substances, making it difficult to directly detect drug residue. Some pretreatment steps are required such as extraction, purification, evaporation, concentration and reconstitution.

Control and prevention from residues

Self-monitoring and control of residue are based on standardized analytical methods. Regulatory framework on force in EU (European Union) based on Directive 96/23/EC, which structures the networks of laboratory approved for residues control, laying down requirements in terms of quality and performance of analytical methods (Decision 2002/657).

There is two-way approach (1) Detection of residues using tests (2) followed by confirmation, requiring quantification against mean residual limit and identification with low rate of false positives. There are some prevention steps which can be taken to avoid drug residues (1) proper herd health management, maintaining clean healthy environment (2) use of licensed drug with proper drug dosage (3) making proper conversation between veterinarian client patient (4) maintenance of treatment records (5) following proper withdraw time period (6) creating awareness.

Conclusion and Recommendation

The use of veterinary drugs in food producing animals has the potential to generate residues in animal derived products and possess a health hazard to the consumer. Veterinarians are facing a dramatic change in attitude and behavior concerning drug residues because of the therapeutic and prophylactic use of drugs. Until recently, veterinarians did not pay sufficient attention to ensuring that the producers adhered strictly to the withdrawal period of milk, meat and egg and aquaculture product from animals treated with variety of drugs. The most likely reason for dug residues may result from human management, such as improper usage, including extra label or illegal drug applications. However, the most obvious reason for unacceptable residues might be due to failure to keep to the withdrawal period, including using over dose and long-acting drugs. There is also limited information on the magnitude of veterinary drug residue worldwide. Hence, an extensive work has to be carried out to prevent the occurrence of veterinary medicinal preparation residues and to familiarize all animal health professionals with pharmacokinetic, pharmacodynamics, and toxicological effects of drugs and their control.

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Popular Article

Induction of Abortion in Dogs

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Unwanted mating or mis mating is a common issue in veterinary practice, often resulting from dog owners not recognizing that their pet is in heat or underestimating the desire of a male or female dog to mate. Even well-informed and cautious owners can encounter mis mating problems with their female dogs. While spaying (ovarian hysterectomy) is the most effective way to prevent unwanted pregnancies after mis mating, some dogs may need to maintain their future breeding potential, making medical termination of pregnancy necessary.

Methods to prevent the birth of puppies after mis mating include those that prevent or interfere with implantation, those that alter the normal hormonal environment and induce resorption or abortion, or those that are directly embryotoxic.

Abortion Induction before Implantation

1. Administration of Estrogen Synthetic/Estrogen Derivatives

Mode of Action: Estrogens work by closing the utero-tubal junction, prolonging the retention of embryos in the oviduct and exerting a direct embryotoxic effect.

Treatment Protocols

Estradiol cypionate 0.5 - 1.0 mg administered once within 3 days after mis mating.

Estradiol benzoate 0.5 - 3.0 mg every other day for a total of three injections starting 4-10 days after mis mating.

Estradiol valerate 3.0 - 7.0 mg administered once 4-10 days after mis mating.

Note: High doses of estrogens can have adverse side effects, and their use is no longer considered ethical or recommended.

Abortion Induction after Implantation

2. Prostaglandins

Treatment Protocols

Safe and effective termination of pregnancy in both dogs and cats can be achieved by administering prostaglandin $F_2\alpha$ at 0.1 mg/kg subcutaneously three times a day for 48 hours, followed

by 0.2 mg/kg three times a day until all fetuses are evacuated (confirmed by ultrasonography). This may take 5-7 or more days.

3. Dopamine Agonists

Mode of Action: Prolactin is essential for progesterone production from the corpus luteum. Dopamine agonists like bromocriptine or cabergoline suppress prolactin secretion, leading to luteolysis and pregnancy termination.

Treatment Protocols

Bromocriptine 0.1 mg/kg orally twice daily for a minimum of 6 days (up to 9-10 days for complete termination of pregnancy).

Cabergoline 5 µg/kg orally twice daily for a minimum of 4 days.

A combination of oral cabergoline and low-dose cloprostenol (PGF2alpha analogue) injections can also be effective, starting around day 28 of pregnancy.

4. Antiprogestin Treatment

Mode of Action: Antiprotection, such as mifepristone, bind to progesterone receptors, preventing progesterone-induced changes in DNA transcription.

Treatment Protocol

Mifepristone 2.5 mg/kg orally twice daily for 4-5 days, starting after day 32 of gestation.

A combination of oral cabergoline and low-dose cloprostenol injections can also be considered, starting around day 28 of pregnancy.

5. Corticosteroids

Dexamethasone Injectable dexamethasone (5 mg twice daily intramuscularly for 10 days) and oral dexamethasone (0.1-0.2 mg twice daily with a decreasing dose for 5-10 days) have been used to terminate pregnancy in dogs when administered from mid-gestation onward.

Mode of Action: Dexamethasone can induce pregnancy termination in dogs by activating endogenous mechanisms similar to those involved in parturition.

Summary

Since a significant portion of the dogs brought in for abortifacient therapy after mis mating may not actually be pregnant, it is advisable to commence treatment only after confirming pregnancy, preferably through methods such as ultrasonography or relaxin estimation. It is highly recommended to employ ultrasonographic monitoring throughout the treatment to assess the success of the intervention and to determine the appropriate timing for concluding the termination protocol.

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Popular Article

An Overview of Scrub Typhus: A Re-Emerging Zoonotic Threat

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Introduction

Scrub typhus, also known as bush typhus or tsutsugamushi disease is an acute febrile, vector borne zoonotic disease caused by a bacteria called *Orientia tsutsugamushi*. The disease is spread to humans and animals by bites from infected chiggers (larval mites). Fever, headache, body aches, and sometimes a rash are the most common symptoms of scrub typhus. It is a major public health threat in India, other south Asian countries and around the tropics and kills an estimated 10 percent of the approximately one million people infected by it every year. As a result of increased prevalence of the disease in scrub or wasteland, scrub typhus was named. Anyone living in or traveling to areas where scrub typhus is found could get infected. Several factors can help determine the diagnosis of scrub typhus, including the patient's history of exposure, clinical features, and serological results. The use of doxycycline as empirical therapy can be lifesaving when clinical suspicion is high.

Epidemiology

Scrub typhus is endemic across extensive part of south Asia, Australia and the Pacific regions. It is found in India, Pakistan, China, Thailand, Malaysia, Taiwan, Tibet, Japan, Russia, South Korea and Nepal. These regions where scrub typhus is endemic is referred to as ‘‘tsutsugamushi triangle.’’ In India, the presence of scrub typhus has been known for several years. The disease is widely spread all over the country, and was reported in several states - Haryana, Jammu, and Kashmir, Himachal Pradesh, Uttaranchal, West Bengal, Assam, Maharashtra, Kerala and Tamil Nadu (1). During World War II, there was an outbreak of this disease in Assam and West Bengal, in the 1965 Indo-Pak war and in 1990 in a unit of an army deployed at the Pakistan border of India. These reports showed a resurgence of this disease in India. Recently 854 cases of scrub typhus have been reported in the states of Rajasthan between August 4 to September 8 2023. (2)

Etiology Of Scrub Typhus

Orientia tsutsugamushi is the causative agent of scrub typhus. It is a gram negative, obligate intracellular, non-flagellate small pleomorphic coccobacilli. They are 0.5 to 0.8µm wide and 1.2 to 3.0µm long. The organism is highly virulent and should only be handled in a biosafety level-3 laboratory. Their genome is approximately 2 Mb. They are found throughout the body but is present in the greatest number in salivary glands of mites.

Pathogenesis

Trans-ovarian transmission maintains the infection in nature through the larvae of trombiculid mites. The mite has four-stages in its lifecycle: egg, larva, nymph and adult. As only the larval stage (chiggers) can parasitize animals or humans, the mites are dangerous only at this stage. Larvae of this species feed on small rodents, especially wild rats of the subgenus Rattus. During the rainy season, man gets infected accidentally by encroaching on the zones of infected mites. In these zones, secondary 'scrub' growth often occurs after clearing of primary forest; hence the term 'scrub typhus'. Once the chiggers have grasped a passing host, they prefer to feed where the skin is thin, tender or wrinkled and clothing is tight. Chiggers do not usually pierce the skin when feeding, preferring to insert their mouthparts down hair follicles or pores. Once attached, they inject a liquid that dissolves the tissue around the feeding site. This liquefied tissue is then sucked up as sustenance for the chigger. As tsutsugamushi organisms are abundant in the salivary glands of chiggers, they are injected into their hosts when they feed. As soon as the engorged chigger drops off its host, it burrows into the ground and becomes a nymph (3). Proliferating organisms release cytokines, which damage endothelial integrity, causing fluid leakage, platelet aggregation, polymorphs, and monocyte proliferation, causing focal occlusive end-angiitis and microinfarctions. Skeletal muscles, skin, lungs, kidneys, brains, and cardiac muscles are particularly affected by this process. The condition can also lead to venous thrombosis and peripheral gangrene

Signs And Symptoms

Symptoms of scrub typhus usually begin within 10 days of being bitten. Signs and symptoms may include:

- Fever and chills
- Headache
- Cough, shortness of breath
- Body aches and muscle pain
- Rash
- Regional and generalized lymphadenopathy
- A dark, scab-like region at the site of the chigger bite (also known as eschar) is pathognomonic of scrub typhus.
- Mental changes, ranging from confusion to coma

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- Patients become delirious and may develop seizure
- The main pathologic change is focal or disseminated vasculitis caused by the destruction of endothelial cells and the perivascular infiltration of leukocytes. People with severe illness may develop organ failure and bleeding, which can be fatal if left untreated.
- Mortality from this disease is 7-30%.

Figure 1. Eschar at site of chigger bite

Diagnosis And Testing

Serological tests still remain an indispensable tool in the diagnosis. Micro immunofluorescence is considered the test of choice. Latex agglutination, indirect haemagglutination, immunoperoxidase assay, ELISA and polymerase chain reaction (PCR) are other tests available. Weil-Felix test (W-F) using Proteus OXK strain is commercially available sero-diagnostic test and is in use for many years. A new dipstick test using a dot blot immunoassay format has been developed for the serodiagnosis of scrub typhus. The dot blot immunoassay dipstick is accurate, rapid, easy to use, and relatively inexpensive. It appears to be the best currently available test for diagnosing scrub typhus in rural areas where this disease predominates.

Differential diagnosis can be done from typhoid, malaria, dengue, leptospirosis and meningococcal disease and HIV.

Treatment

Early treatment shows better outcomes and faster resolution than delayed treatment.

The recommended treatment regimen for scrub typhus is doxycycline (2.2 mg/kg/dose bid PO or IV, maximum 200 mg/day for 7-15 days) (4). For prophylaxis, 200 mg may be taken as a single dose. Doxycycline can be used in persons of any age. Some studies found that when both azithromycin and doxycycline were administered together to patients with severe scrub typhus, the bacteria were cleared away quicker and patients improved faster

Alternative regimens include tetracycline (25-50 mg/kg/day divided every 6 h PO, maximum 2 g/day) or chloramphenicol (50-100 mg/kg/day divided every 6 h IV, maximum 3 g/24 h, or 500 mg qid orally for 7-15 days for adults). If used, chloramphenicol should be monitored to maintain serum concentrations of 10-30 µg/ml. Therapy should be continued for a minimum of 5 days and until the patient has been afebrile for at least 3-4 days to avoid relapse. Chloramphenicol is best avoided during pregnancy and reduced doses should be given in hepatic impairment. Azithromycin can be given in

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case of pregnant women as doxycycline is associated with foetal risk and contraindicated in them. Jaundice, renal failure, pneumonitis, acute respiratory distress syndrome (ARDS), septic shock, myocarditis and meningoencephalitis are various complications known with this disease. Rapid defervescence after antibiotic is so characteristic that it is used as a diagnostic test for *R. tsutsugamushi*. Treatment with oral antibiotics can be undertaken in mild cases however injectable treatment is recommended for seriously ill patients.

Prevention

- No effective vaccine is available to prevent scrub typhus.
- Reduce the risk of getting scrub typhus infection by avoiding contact with infected chiggers. When traveling to areas where scrub typhus is common, avoid areas with lots of vegetation and bush where chiggers may be found.
- The disease is best prevented by the use of personal protective measures including repellents, people entering an exposed area wear closed footwear such as boots with socks, long sleeved shirts and trousers. Exposed areas of skin and clothing itself should be treated with mite repellents.
- Repellents containing DEET, dusting sulphur, dimethyl phthalate or benzyl benzoate have been suggested as suitable agents.
- When sitting around or camping, groundcovers and tents with closed floors should be used.
- Control of the rodent and marsupial reservoirs may also assist to prevent chiggers coming into areas where humans are living and working.
- Prompt removal of clothing and thorough cleaning of skin and clothes with detergent after work or travel and at the end of the day can reduce the risk of infection.
- Treat clothing and gear with 0.5% permethrin or purchase permethrin-treated items. Permethrin kills chiggers and can be used to treat boots, clothing, and camping gear. Do NOT use permethrin products directly on skin.

Conclusion

Scrub typhus is a growing and re-emerging disease, which is grossly under-diagnosed in under developed/ developing countries due to its non-specific clinical presentation, limited awareness, and low index of suspicion among clinicians and lack of diagnostic facilities, it should be differentially diagnosed from typhoid, malaria, dengue, leptospirosis and meningococcal disease and HIV. Early diagnosis and prompt treatment is essential to prevent severe complications. Diagnostic tools such as blood tests and immunological techniques can be used to confirm the disease. Antibiotics are most effective in the early stages of the disease. Scrub typhus should be treated with the antibiotic doxycycline which may be lifesaving when clinical suspicion is high. It is important to inform the public about the risk factors and preventive measures associated with the disease.

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Rabies: A zoonotic threat

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Introduction

Zoonoses are defined as those diseases and infections naturally transmitted between peoples and vertebrate animals. It is estimated that globally, about one billion cases of illness and millions of deaths occur every year from zoonoses and about 60% of emerging infectious diseases that are reported globally are zoonoses. Over 30 new human pathogens have been detected in the last three decades, 75% of which have originated in animals.

There are over 200 known types of zoonoses, which comprise a large percentage of new and existing diseases in humans. Rabies is a zoonotic disease which is 100 per cent preventable through vaccination and other methods. Zoonotic pathogens may spread to humans through direct contact or through food, water or the environment and represent a major public health problem around the world.

Etiology

Rabies is a zoonosis (disease transmitted to humans by animals) caused by a virus belong to family Rhabdoviridae that affects domestic and wild animals and spreads to people through contact with infected saliva through bites or scratches. The word Rabies is derived from the Latin word "**rabere**" which means "to be mad". Rabies is present on all continents except Antarctica, but more than 95% of human deaths are recorded in Asia and Africa. It causes tens of thousands of deaths every year, mainly in Asia and Africa, 40% of whom are children under 15 years of age. Virus is carried by warm-blooded animals (mammals) and collects in their saliva. Virus is most commonly found in bats, skunks, raccoons and foxes, but other animals including pet dog, cat and other animals.

Mode of Transmission:

Rabies virus (RABV) is transmitted through direct contact (such as through broken skin or mucous membranes of eyes, nose, or mouth) with saliva or brain/nervous system tissue from an infected animal. It can spread to people and pets if they are bitten or scratched by a rabid animal. However, in many other countries dogs still carry rabies, and most rabies deaths in people around the

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world are caused by dog bites. Rabies is one of the 17 chief discounted tropical diseases. Hence it is a discounted zoonotic sickness so its regulation is tougher and is widespread in most of the world.

Symptoms- Rabies developments in five different stages:

1. Incubation
2. Prodrome
3. Acute neurologic period
4. Coma and death.

1. **Incubation:** This is the time earlier than signs appear. It normally persists from three to twelve weeks; however, it can take as low as five days or extra than 2 years. The nearer the chew is to the brain, the earlier the outcomes are probably to appear. By the time signs appear, rabies is normally fatal. Anyone who may also have been uncovered to the virus ought to be seeking clinical assist at once, without awaiting signs.
2. **Prodrome:** During the prodrome level of rabies, someone might also additionally revel in coughing and fever. Early, flu-like symptoms, including a fever of 100.four stages Fahrenheit (38 stages Celsius) or above headache, nervousness, feeling normally unwell, sore throat and a cough, nausea, and vomiting and soreness might also additionally arise on the web website online of the bite. These can close from two to ten days, and that they get worse over time.
3. **Acute neurologic period:** Neurologic signs and manifestations create, including: disarray a lot, halfway loss of motion, compulsory muscle jerking, and unbending neck muscles, spasms, hyperventilation, and issue in breathing, hyper salivation or delivering a whole part of salivation, and likely foaming at the mouth, the worry of water, or hydrophobia, because of issue swallowing, mental trips, bad dreams, and sleep deprivation, priapism, photophobia, or a dread of light. Around the apex of this stage, breathing turns quick and conflicting
4. **Coma and death:** If the person enters a coma, death will occur within a matter of hours, unless they are attached to a ventilator. Rarely, a person may recover at this late stage.

Treatment and Control

There's no approved treatment for rabies. After a potential exposure of people to a rabid animal, they can seek post-exposure prophylaxis (PEP), which consists of immediate, thorough wound washing with soap and water for 15 minutes, a series of rabies vaccinations and if indicated, administration of rabies immunoglobulin or monoclonal antibodies, which can be life-saving. If an individual is bitten or scratched by an animal that may have rabies. This may limit the quantity of viral particles.

Post-exposure prophylaxis (PEP)

Post-exposure prophylaxis (PEP) is the emergency response to a rabies exposure. This prevents the virus from entering the central nervous system, which would invariably result in death. PEP consists of cleaning the wound gently but thoroughly with foamy water, povidone iodine, or

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cleanser for 15 minutes and local treatment of the wound as soon as possible after a suspected exposure a course of potent and effective rabies vaccine that meets WHO standards and the administration of rabies immunoglobulin or monoclonal antibodies into the wound, if indicated.

Certain people with a higher risk for rabies exposures, such as those who work with potentially infected animals, are recommended to receive vaccine to help prevent rabies if an exposure happens.

If they are at higher risk of exposure to the rabies virus:

- They should receive 2 doses of rabies vaccine given on days 0 and 7.
- Depending on their level of risk, they may be advised to have one or more blood tests or receive a booster dose within 3 years after the first 2 doses.

Rabies vaccine can prevent rabies if given to a person after an exposure. After an exposure or potential exposure to rabies, the vaccine should be given as soon as possible after an exposure but may be effective any time before symptoms begin. Once symptoms begin, rabies vaccine is no longer helpful in preventing rabies. If people have not been vaccinated against rabies in the past, they need 4 doses of rabies vaccine over 2 weeks (given on days 0, 3, 7, and 14). They should also get another medication called rabies immunoglobulin on the day they receive the first dose of rabies vaccine or soon afterwards. If they have received rabies vaccination in the past, they typically need only 2 doses of rabies vaccine after an exposure. Rabies vaccine is available under the following different brand names: HDCV, Imovax, and rabies vaccine human diploid cell culture.

Human rabies immune globulin

Human rabies immune globulin (HRIG) is the Ig G fraction of plasma from human donors who have received multiple doses of rabies vaccine and have high levels of anti-rabies antibody. HRIG is administered once to previously unvaccinated individuals exposed to a rabid animal to provide rabies virus neutralizing antibody coverage until the patient responds to vaccination by actively producing virus-neutralizing antibodies. HRIG is administered once on day 0 at the time post exposure prophylaxis (PEP) is initiated, in conjunction with human rabies vaccine. If HRIG was not administered when vaccination was begun on day 0, it can be administered up to and including day 7 of the PEP series. If anatomically feasible, the full dose of HRIG is infiltrated around and into any wounds. Any remaining volume is injected intramuscularly at a site distant from vaccine administration. HRIG should not be administered in the same syringe or at the same anatomic site as the first vaccine dose. However, subsequent doses (i.e., on days 3, 7, and 14) of vaccine in the 4-dose PEP vaccine series can be administered in the same anatomic location in which HRIG was administered.

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Popular Article

Cytology of lymph nodes, spleen and thymus in commonly prevalent pathological conditions of companion animals

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Cytology is a simple, rapid, and widely used technique. Fine-needle aspiration biopsy or non-aspiration fine-needle biopsy procedures can be used to obtain samples for cytology from peripheral and internal lymph nodes or other lymphoid organs. Imprints or scrapings of tissues that are removed surgically or obtained during necropsy can also be used as samples for cytology. Cytology involves examining cells from various tissues and fluids for diagnosing the diseases. Cytology is essential for identifying cancerous cells, differentiating between benign and malignant tumors, detecting infections, and assessing inflammatory conditions. Furthermore, it provides rapid and minimally invasive diagnostic insights, thereby aiding veterinarians to provide timely and accurate diagnoses, leading to more effective treatment and improved outcomes in animals.

Lymph Nodes

In normal lymph nodes, lymphocytes accounts for 75-90% of the total cell population. These lymphocytes typically measure 7 to 10 µm in size, which is roughly 1 to 1.5 times the size of red blood cells. Their nuclei are usually spherical to oval in shape and is surrounded by a thin border of cytoplasm. Their nuclei contain dense clumps of dark chromatin and lack a visible nucleolus. Normal lymph nodes also contain a small proportion of intermediate (medium) lymphocytes, that makes up around 5-10% of the cell population and have diameter of approximately 9 to 15 µm. Additionally, less than 5% of the cell population in normal nodes consists of lymphoblasts, which typically have more than 15 µm diameter, roughly 2 to 5 times the size of red blood cells and appears larger than neutrophils. Lymphoblasts have moderate amount of basophilic cytoplasm, that appears granular due to dark-staining protein-rich areas and lighter-staining regions associated with some organelles. The nuclear shape of lymphoblasts varies, ranging from round to irregular, and often displays a stippled chromatin pattern. Single to multiple nucleoli are commonly found within lymphoblasts. In normal

lymph nodes, small numbers of plasma cells, macrophages, neutrophils, and mast cells can also be found but in very low quantities.

a) **Reactive Lymph Node or Reactive lymphoid hyperplasia:** In a reactive lymph node, small and well-differentiated lymphocytes form the predominant cell type but cats can have high number of intermediate lymphocytes and lymphoblasts. Lymphoblast population typically do not exceed 10 to 20% of the total lymphoid cells in a reactive node. Dogs have plasma cells in reactive lymph nodes. These plasma cells are round to oval in shape and of medium size, with a single round nucleus eccentrically located. The nucleus of a mature plasma cell has more cytoplasm but have same size and color as that of a small lymphocyte. The cytoplasm appears deeply basophilic and contains a visible golgi apparatus, which can be seen as a clear area located between the nucleus and the plasma membrane.

b) **Inflammation of the lymph node (lymphadenitis):** In cases of inflammation of lymph node, the main population of non-lymphoid inflammatory cells determines the type of inflammation. Suppurative inflammation is characterized by an increased number of neutrophils that surpass the expected number due to blood contamination. In this situation, more than 5% of nucleated cells are neutrophils. Typically, this arises from a bacterial infection either within the lymph node (resulting in an abscessed lymph node) or in the lymph node draining area. Eosinophilic inflammation is characterized by an inflammatory response that includes eosinophil infiltration, often accompanied by a slight increase in neutrophils. Allergic dermatitis is the most common cause of eosinophilic lymphadenitis that mainly affects the inguinal or popliteal lymph nodes. Other common causes include parasitic diseases, non-dermatologic allergic/hypersensitivity reactions, eosinophilic granuloma complex, eosinophilic gastroenteritis, mast cell tumors, and hypereosinophilic syndrome. Pyogranulomatous inflammation involves a significant macrophage component, either with or without the presence of neutrophils. This type of inflammation usually results from fungal infections like coccidioidomycosis, cryptococcosis, blastomycosis, and sporotrichosis, protozoal infections including toxoplasmosis, cytauxzoonosis, or leishmaniasis, mycobacterial infections, *Nocardia*/*Actinomyces*, and *Bartonella* infections in dogs.

c) **Lymphoid neoplasia (lymphoma):** Lymphoma is typically suspected when lymphoblasts makes up around 30% of the cell population in a lymph node aspirate, although the normal lymphoid population usually ranges from 50% to 90%. When more than 50% of lymphoblast cells are present, cytological diagnosis of lymphoma can be reliably established. Lymphomas can be categorized based on their tissue of origin e.g., renal, thymic, intestinal, etc. Multicentric lymphoma is most commonly seen in dogs. However, determining the "cytologic type" of lymphoma offers insight into the degree of malignancy, the likelihood of responding to chemotherapy, and the potential causes of paraneoplastic syndromes such as hypercalcemia.

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The most accurate method for typing lymphoma involves the use of lymphocyte markers to identify the specific subset of lymphocytes involved in the neoplastic process, such as T-cells like CD4 or CD8, B-cells, or Natural Killer cells.

d) **Metastatic disease:** To know about specific lymph nodes draining a particular area is crucial for detecting metastatic disease. However, the absence of obvious metastatic disease in a cytology does not rule out the potential for early metastasis because many tumors can enter the nodes through afferent or subcapsular vessels or can start as focal accumulations. Metastatic disease is characterized by the presence of a uniform cell population that is not typically found in a lymph node. These cells often appear anaplastic and exhibit clear signs of malignancy. While the remaining lymphoid population may seem reactive, the neoplastic cells can completely replace the lymph node parenchyma, therefore making cytologically identification of lymph node hard. The absence of lymph node enlargement does not necessarily rule out the existence of metastatic disease. Some neoplastic processes, like mast cell tumors, are known to metastasize without causing lymph node enlargement. Conversely, the presence of swollen lymph nodes in an area draining a tumor does not indicate that metastasis has occurred. Lymph nodes that drain regions with tumors often become reactive due to the regional inflammatory response triggered by the neoplasm.

Spleen

In aspiration samples taken from the spleen, the cellular components consist of splenic blood, stroma (referred as red pulp), and lymphoid tissue (known as white pulp). A splenic aspirate sample will inevitably contain a significant amount of blood due to the high hematocrit levels (80% to 90%) in the spleen. The white pulp of the spleen appears clearly defined as a variable number of lymphocytes scattered throughout the smear. When there is a predominance of lymphocytes in an otherwise blood-filled smear, it suggests the presence of splenic tissue. A typical lymphoid population consists mainly of small lymphocytes, with moderate numbers of intermediate lymphocytes, and variable but usually low numbers of plasma cells and lymphoblasts.

a. **Splenic hyperplasia:** Splenic hyperplasia refers to the proliferation of the spleen's normal cellular components, which occurs in response to cytokines, antigenic stimulation, and angiogenic factors triggered by various inflammatory, reactive, and neoplastic conditions. Hyperplastic lesions can manifest as either generalized or nodular and may predominantly affect the red pulp (characterized by histiocytic and stromal hyperplasia), the white pulp (exhibiting lymphoid hyperplasia), or both regions simultaneously. In cases of generalized hyperplasia, the cellularity of a splenic aspirate typically shows a high count, with numerous hypercellular stromal clusters. Alongside increased reactive lymphocytes and plasma cells, elevated numbers of macrophages, mast cells, stromal cells, and capillaries are also observed. Eosinophils may also be present in higher quantities, and reactive spleens often show

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significant increase in hemosiderin, with large dark clumps of iron associated with stromal clusters. Occasionally, it is necessary to assess peripheral blood and other hematologic organs to distinguish marked benign hyperplasia from neoplastic conditions involving lymphoid, histiocytic, or stromal elements.

b. **Splenic inflammation:** Both septic and non-septic inflammation can affect the spleen. The spleen is frequently implicated in systemic or multicentric inflammatory conditions due to its significant role in phagocytosis and immune regulation. In some cases of inflammation, necrosis can also be observed. Eosinophilic inflammation occurs in variety of situations, including infectious conditions like fungal infections, reactive responses, neoplastic disorders (like T-cell lymphoma), and immunologic diseases, including hypersensitivities and hypereosinophilic syndromes. However, infectious causes of inflammation are more common than non-septic causes. In most cases, the causative agents can be readily identified through examination of splenic aspirates. Examples of pathogens that can affect the spleen in dogs and cats include bacteria (e.g., tularaemia, salmonellosis), fungi, protozoa (e.g., cytauxzoonosis, leishmaniasis), and systemic yeast (e.g., histoplasmosis). The type of inflammation (purulent, granulomatous, mixed) and the characteristics of the inflammatory cells depends up on several factors like the type of organism involved, the extent of necrosis, the production of toxins, and the duration of the inflammation.

c. **Splenic neoplasia:** Neoplastic conditions affecting the spleen includes hemic neoplasia, mesenchymal neoplasia (involving non-hemic connective tissues), and, less frequently, metastatic carcinoma. Hemic neoplasia is often diagnosed through cytological examination. The absence of neoplastic cells in splenic aspirate does not exclude the possibility of neoplasia, particularly in cases involving connective tissue. Additionally, haemorrhage, necrosis, and extramedullary hematopoiesis are frequently associated with neoplastic conditions and complicate the diagnostic process. Hemic neoplasia is the most commonly reported splenic disorder in cats.

d. **Hemosiderosis:** Splenic hemosiderosis is the increased deposition of iron in the spleen occurring due to excessive erythrophagocytosis and the breakdown of haemoglobin. It can be observed in both benign and malignant splenic conditions. Hemosiderosis can occur from hemolysis due to extravascular destruction of red blood cells, or it may result from bleeding associated with conditions like haemangioma, hemangiosarcoma and hematoma. In splenic aspirates, hemosiderin is visible within macrophages as dark blue-black granular pigment. Large golden brown or black clumps of hemosiderin may be seen outside the cells and are often mixed with the clusters of splenic tissue. The distribution of macrophages containing hemosiderin is commonly diffuse, although in older dogs, focal siderotic plaques may develop

beneath the splenic capsule. Prussian blue stain is frequently used to assess the distribution and severity of hemosiderin in the spleen.

Thymus

Thymus consists of two distinct cell populations: lymphocytes and reticular epithelium. The cell composition of the cortex resembles that of a lymph node, primarily consisting of small, densely staining lymphocytes, with occasional mast cells present. Among these small lymphocytes, large stellate cells having round vesicular nuclei form dense aggregations, and are referred to as Hassall's corpuscles. These compact clusters of the epithelial cells appear similar to epithelioid macrophages, characterized by abundant pale-blue cytoplasm and cellular connections between them.

a. **Thymoma:** Thymomas are the tumours that originates from thymic epithelial cells. They are most commonly found in older dogs with few cases reported in cats. They are typically located in the cranial mediastinum but can develop in any area through which thymic progenitor cells pass during embryonic development, such as the cervical region or the pericardial sac. Cytologically, thymomas consist of three main components: (i) A mixed population of predominantly small lymphocytes. (ii) A small number of loosely aggregated epithelial cells. (iii) Well-differentiated mast cells. The individual thymic epithelial cells can vary in size and shape, ranging from round and oval to polyhedral or spindle-shaped. They have round to oval nuclei, indistinct nucleoli, moderate amount of basophilic cytoplasm with unclear cell boundaries. In cases of malignant thymomas, there may be overtly malignant epithelial cells with increased nuclear-to-cytoplasmic ratios, cytoplasmic basophilia, anisocytosis, and anisokaryosis. Sometimes, malignant forms can also be present without significant cytological abnormalities.

b. **Thymic Lymphoma:** Thymic lymphoma is most commonly observed in dogs, young cats between the age of 6 to 18 months are positive for feline leukaemia virus with over 85% of cases located in the mediastinum. These lymphomas originate from T lymphocytes and involve the clonal expansion of large lymphocytes, which can be readily identified through cytological examination. However, there are also cases with small cell and mixed cell lymphomas, which may require additional diagnostic methods like flow cytometry and PCR for Antigen Receptor Rearrangements (PARR) testing for confirmation. In dogs, mediastinal lymphoma primarily manifests as a CD4+ disease.

Conclusion

In conclusion, cytology serves as a rapid and effective diagnostic tool for evaluating various conditions in lymph nodes, spleen, and the thymus. It allows the identification of normal cellular components and their alterations, including reactive lymph nodes, inflammatory responses, lymphoid neoplasia like lymphoma, and metastatic disease. In the spleen, cytology aids in detecting hyperplasia,

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inflammation, neoplasia, and hemosiderosis. Further, it plays a crucial role in diagnosing thymic disorders such as thymoma and thymic lymphoma. Overall, cytology provides valuable insights into these tissues, thereby facilitating early diagnosis and appropriate management of a wide range of pathological conditions.

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Popular Article

Dystocia in a Graded Murrah Buffalo due to Hydrocephalic fetus: A Case Report

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Introduction

Hydrocephalus is a condition characterized by the abnormal accumulation of cerebrospinal fluid (CSF), resulting from an imbalance between its production and drainage within the ventricular system or subarachnoid space. This condition leads to a distinctive enlargement of the cranium, causing deformities in the frontal, parietal, and temporal bones. Typically, hydrocephalus in fetuses either leads to demise before delivery or shortly after birth due to increased pressure on vital brain centers. Although instances of live fetal delivery in such cases are exceedingly rare, they have been recorded. While hydrocephalus is well-documented in cattle in India, it remains relatively uncommon in buffaloes. The origins of hydrocephalus are believed to stem from disturbances in the normal circulation of cerebrospinal fluid, which can result from alterations in its production or absorption. An autosomal recessive gene has been identified as a contributor to this condition, and its effects can be exacerbated by concurrent vitamin deficiencies. In some cases, hydrocephalus may coincide with various malformations affecting the mouth, eyes, or even the vertebral column. Infectious agents, nutritional factors, and various environmental elements are among the potential causes, in addition to genetic factors. The volume of accumulated fluid can vary significantly, ranging from 500 mL to as much as 8 liters. In instances where the fetus presents in a cranial position, an enlarged fetal head can be palpable within the birth canal, and a surgical incision on the cranium can facilitate a reduction in head size, enabling vaginal delivery. Although some reports mention cesarean section deliveries, there appears to be no specific breed or age predisposition for the occurrence of hydrocephalus in buffaloes.

Case History and Clinical Findings

A Graded Murrah buffalo, approximately 7.5 years old and in its third parity with a full-term pregnancy, was brought to the mobile ambulatory veterinary clinic in Tuni, Kakinada district, Andhra pradesh. The owner reported that the buffalo had been experiencing labor pains for the past 15 hours, but there had been no progress in the birthing process even after the rupture of the first water bag.

Upon obstetrical examination, it was observed that the cervix was fully dilated, and the fetus was positioned longitudinally with both forelimbs extended within the birth canal, and the head was laterally deviated. Further examination revealed significant swelling and tenderness of the skull, and it was noted that the head was slightly deviated to the left and obstructed at the level of the pelvic brim (Figure 1). Several other clinical parameters were assessed, including rectal temperature, pulse rate, and respiratory rate. The buffalo's temperature was elevated and recorded at 103ºF. The mucous membranes appeared pink, the size of the pre-scapular lymph nodes was normal, and the respiratory rate was decreased.

Figure 1: Hydrocephalic fetus

Diagnosis

Tentative diagnosis: Dystocia due to hydrocephalus

Treatment and management

To address the buffalo's condition, intravenous fluids containing Normal saline and Ringer's lactate were administered in sufficient quantities. Following this, caudal epidural anesthesia (5 ml; 2% lignocaine hydrochloride) was administered, and the birth canal was carefully lubricated using liquid paraffin. Subsequently, a small incision was made on the soft, fluctuating portion of the skull using a guarded knife. After the evacuation of fluid, the size of the fetal head was reduced, and with gentle manipulation, the position of the fetal head was corrected. The delivery of the fetus was facilitated by applying a hook to the inner canthus of the eye and securing both forelimbs with a chain, along with mild traction. Following the successful delivery of the fetus, the dam was examined per vaginally for any potential injuries resulting from the handling. The dam gave birth to a hydrocephalic male fetus weighing approximately 25 kg. The fetal head was collapsed, and the frontal, temporal, and partial bones were thin, perforated, and deformed. The ventricles of the head were distended with the accumulation of straw-colored excessive cerebrospinal fluid, totaling approximately two liters. To manage pain and prevent secondary bacterial infections, the buffalo received a five-day course of antibiotics (injection of Enrofloxacin 2g), along with anti-inflammatory (injection of Melonex 20 ml)

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and antihistamine (injection of Anistamin 10 ml) medications via intramuscular injection. The buffalo made an uneventful recovery within three days.This successful intervention and treatment effectively resolved the challenging case of dystocia resulting from fetal hydrocephalus in the buffalo.

Conclusion

In conclusion, managing cases of fetal hydrocephaly during per-vaginal delivery in buffaloes can present significant challenges. However, this report highlights that in select cases, performing a surgical incision on the enlarged fetal cranium to drain excess fluid can be a viable approach to reduce head size, ultimately enabling a successful vaginal delivery. This article has presented and discussed a notable case of dystocia resulting from fetal hydrocephalus in a buffalo.

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Popular Article

Uterine Prolapse in buffalo: A Treatment and Management

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Introduction

Uterine prolapse is a condition observed in nearly all species, but it is most frequently encountered in pluriparous dairy cattle and buffaloes. Several factors have been implicated as contributing causes, including invagination of the uterine tip, excessive traction during difficult births or when dealing with retained fetal membranes, uterine atony, hypocalcemia, and lack of physical activity. Complications tend to arise when there is laceration, tissue necrosis, or infection. Furthermore, delayed treatment can lead to serious consequences. Shock, hemorrhage, and thromboembolism are potential complications that may arise if a uterine prolapse is left unattended for an extended period. In some cases, the stretching of the uterine artery due to the weight of the prolapsed uterus can lead to uterine artery rupture, resulting in sudden death. It is essential to recognize that uterine prolapse is a genuine emergency, and immediate treatment is imperative to safeguard the life and future reproductive potential of the affected animal.

Case history and physical examination

An eight-year-old graded murrah buffalo from kodada village, tondangi district was presented to the mobile ambulatory veterinary clinic, tuni on January 10, 2022 with a history of uterine prolapse through the vulva since 5 hours after parturition. The buffalo had given birth to female calf. The prolapsed mass was soiled, inflamed and edematous (Figure 1). On physical examination, the cow was weak, recumbent, with hind quarters lower than forequarters, excessive traction, and the uterus prolapsed from the vulva with the attached placenta. The mucous membranes were pale, the respiratory rate was 18 beats per minute, and the pulse rate was 90 beats per minute, while the temperature was 39.5 degrees Celsius.

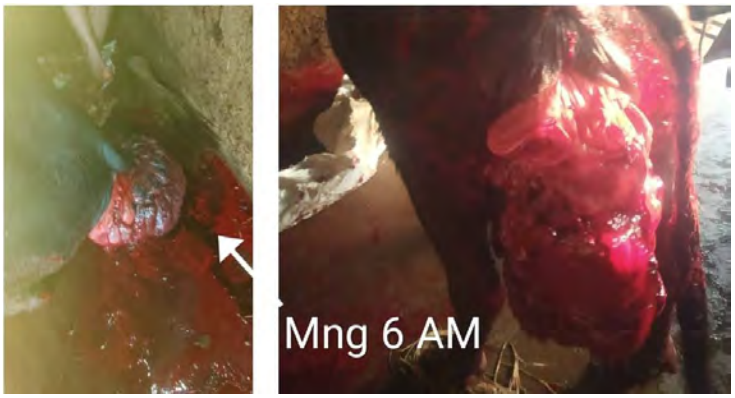

Figure 1: Uterine Prolapse

Diagnosis

Tentative diagnosis: Uterine prolapse

Differential diagnosis

Uterine prolapse needs to be differentiated from vaginal prolapse and rectal prolapse. Vaginal prolapse occurs before parturition and rectum prolapse through anus.

Treatment and Management

A buffalo was administered 7 ml of 2% lignocaine hydrochloride through the first intercoccygeal space to prevent straining and pelvic sensation, which would facilitate further manipulation of the vaginal area. The still-attached placenta was carefully separated, with utmost care taken to avoid damaging the maternal caruncles and causing bleeding. After allowing 4-5 minutes for the anesthesia to take effect, the prolapsed part was thoroughly cleaned with water to remove any soil, dust, or dirt adhering to the mass. Superficial necrotic tissues were gently trimmed, and the mass was washed with a potassium permanganate lotion. Since the buffalo was in a recumbent position, the prolapsed mass was lifted by hands, which were gloved and lubricated, to the level of the vagina. Powdered sugar was applied generously on the prolapsed mass to reduce the oedema. After the reduction prolapsed was then gently pushed into the vagina with moderate force. Initially, the cervical portion closer to the vagina was pushed while an attendant lifted the uterus. Alternatively, the ventral and dorsal portions of the prolapsed organ were repositioned into the pelvic cavity. Finally, the terminal part of the pole was guided through the vagina and cervix into the uterine cavity. Upon examination, no mass was found posterior to the cervical ring, indicating the successful replacement of the everted organs. The animal displayed relief, indicating a successful procedure. To prevent a recurrence of prolapse due to tenesmus, Buhner's suture was applied (Figure 2). Supportive therapy was administered, including Enrofloxacin at a dose of 5 mg/kg body weight intramuscularly, Flunimeg at a dose of 1.1-2.2 mg/kg body weight intramuscularly, 1.5 liters of DNS (Dextrose Normal Saline) intravenously, and 450 ml of calcium borogluconate intravenously on the first day. Enrofloxacin and flunimeg were continued for an additional 3 days. The suture was removed after 14 days, and the cow

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recovered without any complications. The farmer received advice to elevate the hindquarters of the cow to minimize discomfort and ensure the animal's well-being.

Figure 2: After application of Buhner's suture

Conclusion

Uterine prolapse can occur during the periparturient period, and it is crucial to manage these cases promptly for a better prognosis. Diagnosis and treatment are of utmost importance in such situations. This study suggests that using epidural anesthesia in large ruminants like buffaloes can be an effective method for successfully repositioning an everted uterus. Additionally, this technique has the added benefit of reducing edema by alleviating passive venous congestion. Furthermore, the Buhner suturing technique is found to be more suitable for large ruminants, as it allows for easier re-examination when necessary. Delayed correction of uterine prolapse can lead to severe complications, including edema, fibrosis, necrosis, and septicemia. This case report highlights a positive outcome in the treatment of uterine prolapse in a buffalo with a favorable prognosis. The fact that the farmer sought veterinary assistance within five hours of the prolapse occurring underscores the importance of early intervention. This timely response can save the buffalo from a life-threatening situation, emphasizing the need for both farmers and veterinarians to be vigilant in managing such conditions promptly.

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Popular Article

Therapeutic Management of Fetal Mummification in Cow: A Case Report

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Introduction

The occurrence of fetal mummification typically takes place after the formation of the placenta and the fetal ossification process, which happens around the 70th day of gestation. This phenomenon is more commonly observed between the 3rd and 8th months of gestation in ruminant animals such as cattle, buffalo, sheep, and goats. Multiparous and polytocous species like swine have a higher incidence of mummification. In cattle, fetal fluid is reabsorbed, and the fetus becomes surrounded by a viscous, chocolate-colored material. The incidence of mummified fetuses in cattle is relatively low, ranging from 0.13% to 1.8%. This condition can affect both indigenous and exotic cattle breeds. Interestingly, if a cow has experienced fetal mummification in a previous pregnancy, the likelihood of it happening again in subsequent pregnancies increases, with a prevalence rate of around 30%.

Case presentation and clinical findings

A five-year-old crossbreed Jersey cow in her third parity was presented to a mobile ambulatory veterinary clinic in Tuni, Kakinada district, AP because she showed no signs of parturition even after completing a full-term pregnancy. The owner reported that the cow was inseminated 310 days prior, and pregnancy was confirmed at the 90th day after insemination. On clinical examination, the body temperature of cow was 39.5°C, respiratory rate was 33/minute, heart rate was 72/minute and the conjunctival mucus membrane was pink and moist. Vaginal examination revealed a tightly closed cervix. Per rectal palpation indicated the presence of a compact, firm, and immobile mass without fetal fluid and placentomes (Figure 1). The overall general condition of the cow appeared normal.

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Figure 1: Mummified fetus

Diagnosis

Tentative diagnosis: Fetal mummification

Differential diagnosis

Fetal mummification needs to be differentiated from fetal maceration. In fetal maceration intermittent straining with a foul, reddish grey vulval discharge and on per rectal examination distended, swollen fetus where fetal bones floating in pus or crepitating against each other noticed.

Treatment and management

The decision was made to induce parturition by using dilation therapy. The cow was administered synthetic prostaglandin PGF2α (Vetmate 2ml), inj. Epidosin vet (Valethamate bromide 50 mg), inj. Progynon depot 3ml (estradiol valerate 30mg), and inj. Betnesol 5ml (Betamethasone 20mg) through intramuscular injection and was closely monitored. Vaginal examinations were performed every 12 hours to assess cervical dilation. After 54 hours of post-treatment, cervical dilation was satisfactory, but the uterus and birth canal were dry. To facilitate delivery, liquid paraffin was applied for lubrication, followed by gentle traction on the approaching fetal parts. This resulted in the delivery of the entire fetal mass, covered by a thick, chocolate-colored membrane. The crown-rump length measured 38cm. To manage pain and to prevent secondary bacterial infections, the cow received a course of antibiotics (inj. Intacef 3 g), along with anti-inflammatory (inj. Melonex 20 ml) and antihistamine (inj. Anistamin 10 ml) medications via intramuscular injection for five days.

Conclusion

The preferred treatment for cases of fetal mummification is luteolysis achieved through the injection of PGF2α. However, some animals may not expel the dead fetus even with this treatment alone. Estrogens can stimulate regression of the corpus luteum, induce myometrial contractions, relax the cervix, and promote the expulsion of the mummified fetus in cows. Some reports suggest that a combination therapy of estradiol and PGF2α yields better results. In this case, a combination treatment involving prostaglandin, estradiol, valethamate bromide, and corticosteroid was administered. This approach mimics the hormonal changes that occur during natural parturition and resulted in cervical dilation and successful delivery of the mummified fetus through lubrication of the birth canal.

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Popular Article

Concept of Epigenetics in Livestock and Breeding

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Introduction

C.H. Waddington in 1942 described epigenetics as the study of the mechanisms by which genotype leads to phenotype (Satheesha *et al*., 2020). The field of epigenetics investigates how cells regulate gene function without altering the DNA sequence. In Greek, "epi-" means on or above, and "epigenetic" refers to elements other than the genetic code. Gene activation is controlled by epigenetic changes to DNA. These alterations are connected to DNA and do not alter the order in which the DNA building blocks are arranged. The epigenome, which is all of the changes that control how genes are expressed inside a cell's whole set of DNA, is referred to as the genome. By affecting the choice of which genes are turned on or off, epigenetic changes have an impact on the production of proteins in cells. This control ensures that each cell generates just the proteins required for its activity. For instance, muscle cells do not create the proteins that support bone formation. The patterns of epigenetic modification vary among individuals, between tissues within an individual, and even between individual cells within a tissue. Different epigenetic modifications have an impact on gene expression. The following are examples of epigenetic modifications: DNA methylation, histone modification and non-coding RNA.

Applications of epigenetics

1. Growth and development: Epigenetics plays a critical role in genome reprogramming and the expression of genes that affect animal growth and development. Several biological processes, including fetal growth and development, metabolism and behaviour are regulated by gene or genome imprinting.
2. Callipyge mutation in sheep: Callipyge, which means "beautiful buttocks," is a father-inherited genetic mutation that causes lambs to develop huge and muscular rumps.
3. Feeding system:

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a) Animals fed concentrate or unified diets are predicted to be methylated differently than animals fed a less intense system based on pasture feeding.

b) Significant changes in the expression of two histone acetyl transferases (HAT1 and HAT2), which influence milk fat synthesis, have been seen in dairy cows whose diets were supplemented with unsaturated fatty acids.

4. Nutriepigenomics
    a) The mother's nutritional state during pregnancy can cause drastic changes to the foetus through the programming of development raising the likelihood of obesity and type 2 diabetes.
    b) In pigs, it was discovered that excessive and restricted protein intake during pregnancy affected the epigenetic marks and the expression of vital metabolic genes in the progeny.
5. Epigenetics and milk production: miRNA expression in farm animal mammary glands, adipose tissues, and liver contributes to the establishment and maintenance of subcut fat tissue, mammary lipid synthesis, and lipid metabolism.

Limitations

1. In comparison to human epigenetics, there has been very little study done in the cattle industry.
2. Inadequate acknowledgment of the role of epigenomic contributions to the establishment of economically important cattle phenotypic and disease characteristics.
3. The tools and financing for epigenetics research in the cattle industry are limited.
4. The creation of epigenome maps in the cattle industry is limited due to the limited engagement of academics on a worldwide basis.

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Popular Article

Downer Cow Management: Overcoming Common Challenges for Optimal Recovery

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Abstract

Postpartum diseases in dairy cattle are a significant economic concern for Indian veterinary practitioners and producers. The transition period, spanning three weeks before and after calving, plays a pivotal role in determining the health and productivity of dairy animals. This critical phase encompasses various challenges and factors that require effective management. Common postcalving disorders, such as milk fever, metritis, ketosis, and mastitis, can substantially impact milk production and overall herd profitability. Therefore, managing the transition period, particularly focusing on the periparturient phase, is of utmost importance. Key aspects of successful transition cow management include maintaining adequate dry matter intake, optimizing nutrition, addressing environmental changes, and closely monitoring cow health and behavior. Furthermore, timely care for downer cows is crucial to minimize economic losses. During the three weeks postpartum, cows experience numerous changes, including calving, lactation initiation, dietary adjustments, and social adaptations. Ensuring a smooth transition during this period involves providing energy-dense rations, offering clean environments, and facilitating access to adequate space and water. In summary, effective transition cow management is essential for sustaining dairy herd health and productivity. By addressing various factors and implementing stress-reduction strategies, vigilant observation, and timely interventions, producers and veterinarians can positively influence dairy farming's profitability and success.

Introduction

Postpartum diseases are the most commonly treated problems by the Indian veterinary practitioner and is one of the single most factor causing significant economic losses to the producers, mainly landless and the poor. Generally, postpartum diseases are only symptoms or consequences of previous insults primarily occurring during the late gestation period. Many prepartum nutritional factors can be linked to an adverse disturbance of the metabolic processes in transition during this critical periparturient time period.

The transition period from prepartum (three weeks prior to parturition) to postpartum (three weeks after parturition) is a critical determinant of both productivity and profitability in a dairy animal as well as a herd. Nutrition and management programs during this phase directly affect the incidence of postcalving disorders, milk production and reproduction in the subsequent lactation.

The transition period imposes a number of abrupt changes on the cow. The cessation and initiation of lactation is one example (Kachhawaha *et al.,* 2010*)*. The cow will also experience as many as 4 ration shifts

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during this period. Rapid changes in both hormonal and metabolic systems must occur. All of these tend to increase the level of stress in the cow during this period.

The stress response mechanism in ruminants is a complex, multifaceted system. Nutrition and management alterations provide an opportunity to minimize the effects of stress. A key challenge for veterinarians is to educate dairy farmers to devote adequate resources in terms of labor, facilities and management to implement a structured transition cow program.

Critical control points to prevent periparturient metabolic disease and improve reproductive performance were identified as maximize dry matter intake, minimize negative energy and protein balance, stimulate rumen papilla, maintain calcium status and minimize immune dysfunction. If these factors can be controlled through proper nutrition and animal management then a decrease in metabolic and reproductive disease problems can be expected.

Why we fail often?

Downer or Non-ambulatory cattle are a medical emergency. **Every hour that a cow remains untreated laying on a hard surface dramatically reduces her chances of recovery. Timely care is the critical factor. However, in our farm animal practice, many a times, there is a time delay in giving immediate/earliest clinical care for downer cow.** Downer cows are expensive to maintain. In a study in well-developed dairy farm, the involuntary culling costs alone comes to $500 to $1,000 per cow, which does not include indirect costs such as reduced milk yield, labor and veterinary costs. Because non-ambulatory cattle cannot be marketed the cull price of $700 to $1,000 is also lost.

Common Disorders in Transition Cows

Post calving disorders commonly reported were milk fever, retained placenta, metritis, ketosis, displaced abomasum and mastitis. In such cows, the dry matter intake with any of the above said events was significantly lower than those cows with no problems. Cows with any of the above events produced lower milk, when compared with cows which had no problems. These differences in milk production represented only a fraction of the total economic cost of post calving disorders.

An additional consideration is the interactions which occur between disorders. A path analysis approach was used to examine these relationships were studied in detail in the past. Cows with milk fever had 4 times more risk of retained placenta and 24 times more ketosis than cows which did not have milk fever. The risk of complicated ketosis was elevated in cows which had a retained placenta, displaced abomasum or milk fever.

The challenge is to design a health management program for the transition cow to minimize post calving disorders, maximize dry matter intake and milk production. The transition dairy cow continues to be somewhat of an unsolved mystery. The veterinary communities across the world continue to learn that how cows are fed, handled and managed during the three weeks before through three weeks after calving can have a definite influence on production, health and reproductive performance.

It is known that the reproductive performance can be directly influenced by metabolic disorders, early lactation performance and nutrition. In the Indian veterinary practice, scenario, the dairy animal practitioners are responsible for helping the transition cows navigate a myriad of challenges leading up to calving through the initial weeks in the milking herd. And when properly handled, the returns in production, health and breeding

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pen performance can be great.

Three weeks leading up to Calving

Research continues to show that the dry period – especially the three weeks before calving – can directly impact milk production, incidence of metabolic disorders, and subsequent reproductive performance. The three weeks prepartum are especially important because a multitude of changes are occurring all at once. These changes include:

Dry matter intake

Dry matter intake (DMI) can decline by 30 percent or more in the weeks leading up to calving. Cows that go off feed prior to calving are at higher risk for metabolic disorders early in lactation. Metabolic disorders stunt early lactation performance, which can negatively influence production levels and reproductive abilities later in lactation.

Environment

Cows are often moved to cleaner areas or sheds (which are newer to them), prior to calving for careful watch for cows that will be calving or going off feed. Multiple sheds/ area or cow pen changes can be especially difficult for cows when they are introduced to a shed / pen of new animals. The reordering of animal hierarchy can take some time and animals often eat less during this transition.

Ration changes

The rumen is undergoing major changes, as cows move from a high-forage, low-energy diet to a high-energy, low-forage diet. These changes can directly influence the rumen microbial population, so it's essential to prepare the rumen for upcoming ration changes. While it may seem difficult, the three weeks before calving boil down to one word: consistency. Monitoring cows and changes in behavior or health can identify potential problems early and allow you to make the appropriate changes.

Monitor behavior:

Watch closely for cows going off feed or showing sudden shifts in behavior. If one can work to maintain DMI during this stressful period, cows can be more easily managed for their transition into the milking string postpartum.

Minimize change

As creatures of habit, keeping the environment and animals as consistent as possible can help smooth the transition period. Minimize the shed/pen moves and reduce overcrowding to maintain DMI. Milk production, time spent lying down and rumination time all decrease as the number of cows in a pen increases.

High-quality ration:

Prepare cows for the upcoming lactation with a high-quality ration they can't resist. It is better to work with the dairy cattle nutritionist to formulate an appetizing ration that will reduce the incidence of metabolic disorders and prepare the rumen for the upcoming lactation.

Three weeks postpartum

Just as cows, experience changes during the close-up period, changes surround cows at the time of and directly following calving. These changes in circumstances including having a calf, beginning to lactate, a new ration, a new group of cows to adjust to initiate the most frequent changes in cow health and performance.

The first 60 days in milk is often when we see the largest percentage of animals leave the herd. One of the main

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reasons cows leave the herd is because of metabolic disorders like ketosis, metritis, milk fever and displaced abomasums (Cox, 1982). Metabolic disorders can have a grave impact on future reproductive performance and cows that experience them will struggle to regain performance losses throughout the lactation. This often means that the additional energy from the ration is needed for daily maintenance rather than production and reproductive performance. Managing fresh cows for reproductive success should focus on providing a clean environment with a fresh, properly formulated diet in an environment with plenty of space and clean water.

Start with nutrition

By supplying an energy-dense ration that also provides rumen microbes with the nutrients they need to thrive, cows can successfully join the milking string. Because fresh cows spend at least some time in an energy-deficient state, helping to make up the difference with dietary energy is critical. Work with the experienced dairy nutritionists to formulate a ration to keep cows healthy and producing high levels of quality milk. Also ensure that this ration provides the nutrition cows need to get bred back.

Focus on environment

Much of cows' performance will depend on the environment they are placed in, which means minimizing pen moves, calculating stocking density and providing a clean, dry environment is critical for keeping cows healthy throughout the transition.

Critical Factors in the Evaluation of Transition Cows

1. Dry period length

The optimum dry period length for high producing herds is not well defined. Current recommendations are for a 50–70-day dry period. Average days dry for first lactation cows was 55 days while it was 65 days for second and greater lactation cows. First calf heifers also consistently have fewer dry days.

2. Dry matter intake

The depression in dry matter intake (DMI) in the late dry period and early lactation has been well documented. The reduction in DMI during the last week prepartum may be 30%. Feed intake post calving doesn't peak until 9-13 weeks of lactation. Dry matter intake in the first week post calving is about 65% of maximum DMI. These changes in DMI need to be accounted for in ration formulation to provide adequate nutrient intake. Adjustments in ration nutrient density will be needed to compensate for the depressed DMI in these periods. This low DMI in early lactation cows may limit the rate at which concentrate feeding can be increased post calving.

3. Feeding behavior

Feed bunk/trough space and social dominance both impact meal patterns and total DMI. The post calving cow moved into a new group needs to establish her ranking in the peck order. This move may be especially difficult for the first lactation heifers when they are put in groups containing older cows. At the same time, many of these cows may still be slightly weak and less able to compete. It appears logical to assume that any restriction in feed bunk space or availability of feed would be a negative factor in allowing the fresh cow to come on feed rapidly. Housing these cows in a special fresh cow group should minimize competition at this critical time.

4. Hormonal and metabolite shifts

The cow goes from lactating to nonlactating and back to lactating in a relatively short period of time.

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This requires major adjustments within the cow. As an example, glucose needs imcrease about 2.7 times between late pregnancy and the first few days of lactation.

5. Rumen mucosa

It has long been known that a relationship between feed types and rumen mucosal development exists. Propionic and butyric acids are keys to mucosal development and structure. A reduction in total absorptive surface area occurred as cows were moved to the high forage dry cow ration. When cows were shifted to a high energy ration 14 days before calving, a mucosal proliferation process began. It took 4-5 weeks for the mucosa to attain maximum absorptive capacity.

6. Immune system

A number of nutrients interact with the immune system in the body. Plasma levels of vitamin A, vitamin E and zinc all decreased in the last 2 weeks before calving. Similar trends in vitamin E and selenium were noted in un-supplemented dairy cows between dry off and calving. These trends indicate a lower immune system status as the dairy cow approaches parturition. Vitamin E has direct effects on the activity of both lymphocytes and neutrophils.

The information described above provides only a base for the development of a transition cow management program. Key points can be outlined for specific portions of this phase of the lactation cycle. However, there are 3 key words that sum up the overall approach for this period. These are STRESS MANAGEMENT, OBSERVATION and REACTION.

Factors to be considered during Dry-off:

- Abrupt changes may be needed here to enhance the cessation of milk synthesis.
- Most recommendations suggest discontinuing milking abruptly.
- Dry cow treatment should be done at this time.
- Observation of the cow and udder for the first few days is critical.
- The feeding program will normally shift to high forage.
- Restrict water only if necessary.
- A change of physical facilities or location may be beneficial.

Factors to be considered during early dry period:

- Provide a balanced ration.
- The goal is to maintain body condition in the dry period.
- The cow should gain weight due to fetal growth.
- Feed a bulky forage to keep the rumen expanded and working.
- Avoid high Potassium forages (> 2.5% Potassium).
- Limit corn silage to about 1/2 of the forage dry matter.
- Provide adequate feed bunk space, feed availability and water.
- Some exercise may be helpful to maintain muscle tone.
- Clean, dry environment.
- Close-up period (last 3 weeks)
- Adjust ration density for lower DMI.

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It may be good to bring in some of the post calving forages or feeds to minimize palatability problems.

- Limit grain to 0.5 - 1% of bodyweight.
- Vitamin E - selenium injection if needed.
- Avoid poorly fermented silages.
- Clean, dry environment.

Factors to be considered during Calving:

- Clean, dry environment.
- Be there to observe the calving process.
- Assist if needed but don't get over anxious.
- Don't use excessive force when assisting.
- Avoid smooth or slippery floors.
- Offer the cow water and a highly palatable feed (hay, calf starter).
- The key is to get the cow eating, drinking and ruminating.

Factors to be considered during Fresh cows:

- Observe chewing and rumination activity.
- Some producers are taking body temperatures once or twice a day on these cows.
- Make sure fresh, palatable feeds are available.
- Water should always be available.
- A separate area to house these cows is preferable. The primary reason for this is the ability to frequently observe these cows.
- Avoid crowded, competitive environments.
- Clean, dry environment.
- The first 1 - 2 weeks post calving set the stage for the entire lactation. Observation and reaction are the management keys during this time.
- Don't increase concentrate feeding too rapidly.

These suggestions are designed to minimize stress on the cow during the transition period. The goal is to get the post calving cow on feed as rapidly as possible. This requires a nutrition and management program which minimizes post calving disorders. The basics of stress management, observation and reaction are relatively simple. The ability of the farmer or manager or veterinarian in charge of the farms, to implement these will have a significant impact on profitability and productivity.

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Popular Article

Novel strategies to modulate cytokine action for therapy

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Cytokines are secreted or membrane presented, Signaling and immunoregulatory molecules that mediate broad cellular functions, including development, differentiation, growth, and survival. Accordingly, the regulation of cytokine activity is extraordinarily important both physiologically and pathologically. Various physiological functions of cytokines were described below (1).

Cytokines are secreted by variety of cell types (Fig 1). Based on the structure and function, cytokines are broadly classified into six families as depicted in Fig-2.

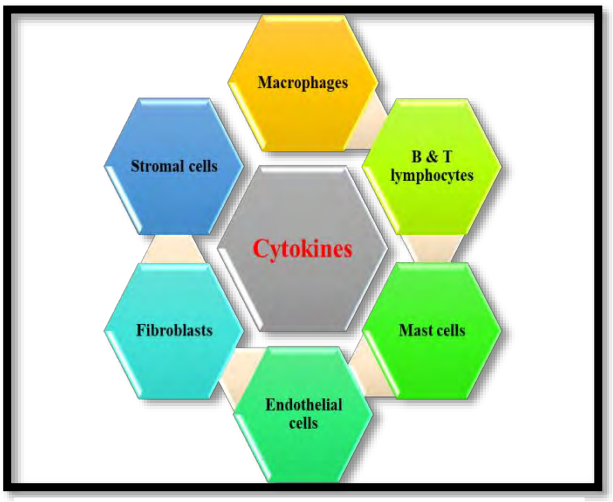

Fig 1: Cytokine secreting cells

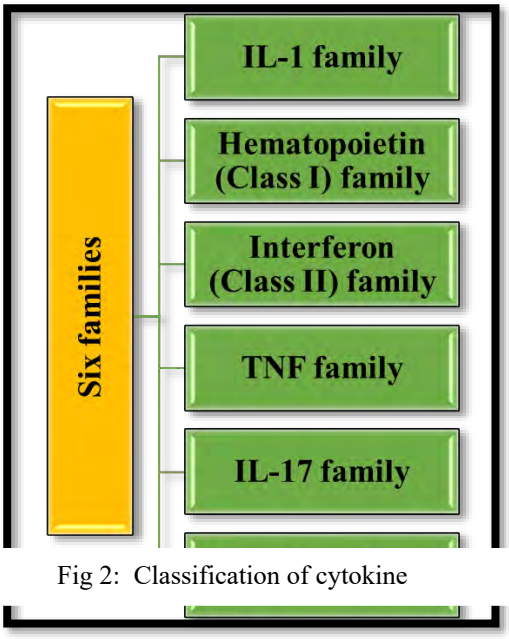

Fig 2: Classification of cytokine

Classification of cytokine receptors:

1. **Type I cytokine receptors:** The extracellular amino acid domain of these receptors contain conserved motifs, Fibronectin III and WSXWF motif.
2. **Type II cytokine receptors:** Structurally these receptors resemble type I receptors except a WSXWF motif.
3. **Immunoglobulin (Ig) receptors:** These receptors are structurally similar with immunoglobulins and distributed ubiquitously throughout various cells and tissues of the vertebrate body.

4. **Tumour necrosis factor (TNF) receptors:** These receptors have a cysteine-rich common extracellular binding domain (2).
5. **Chemokine receptors:** They are G-protein coupled receptors acting as binding proteins for HIV (CXCR4 and CCR5).
6. **IL-17 receptors:** IL-17 receptors contain the longest cytoplasmic tail with docking sites for numerous signalling intermediates.

Characteristics of Cytokines

1. Cytokines are different from hormones, their action restricted to specific area.
2. Cytokines are produced by a broad range of cells.
3. Cytokines act through mainly cell surface receptors.
4. Cytokines show pleotropic property, i.e., one cytokine may have many different target sites and its action depends on the type of target site.
5. Many cytokines produce the same action (redundancy) acting on the same type of receptor. Some produce synergistic and some promote antagonistic interaction among themselves (3).

Signal transduction mechanisms of cytokines

Most of the cytokines exert their action through JAK-STAT pathway. Cytokine receptors are tyrosine kinase linked receptors without enzymatic activity in its cytoplasmic domain. Dimerization is initiated by ligand (cytokine) binding, followed by phosphorylation of JAK proteins. Then JAKs recruit and phosphorylate other proteins such as STATs (Signal transducers and activators of transcription) which contain SH_2 groups, and this prompts dimerization and translocations of STATS into to nucleus. Finally, STATS bind to DNA and transcription of specific target gene takes place. There are 4 members in the JAK family: JAK1, JAK2, JAK3, and TYK2. The STAT family comprises of seven members: STAT1, STAT2, STAT3, STAT4, STAT5a, STAT5b, and STAT6 (4).

Apart from JAK-STAT receptor pathway some of cytokines exert their effects through pathways like Mitogen-activated protein kinase (MAPK) and phosphoinositide-3-kinase–protein kinase B/Akt (PI3K-PKB/Akt). Signaling mechanism is very much crucial to augment or inhibit the cytokine action (1).

Some proteins which negatively regulate the cytokine action, for example cytokine inducible SH_2 protein (CIS) and suppressor of cytokine signalling (SOCS)1 and 3 have an amino-terminal kinase-inhibitory region (KIR) that inhibits JAK tyrosine kinase activity and a carboxy-terminal SOCS-box that recruits the ubiquitin-transferase complex. Growth hormone, EPO and other cytokines stimulate the expression of these proteins (5).

The key functions of cytokines are:

1. Development of cellular and humoral immune responses
2. Induction of the inflammatory response
3. Regulation of haematopoiesis
4. Control of cellular proliferation and differentiation
5. Healing of wounds (tissue damage repair)
6. Control of cell replication and apoptosis
7. Anti-tumour activity

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The major challenges in cytokine therapy include-

- Inaccurate targeting due to pleiotropic and redundancy property.
- Any alteration in cytokine action leads to impaired immune response in the body.
- The isolation and production of cytokines require sterile conditions and multiple stages of purification.
- Cytokines have limited shelf life and require special/ controlled storage conditions.

Fig 3: Therapeutic challenges of cytokines

Even though cytokines have a wide range of therapeutic activities, clinical applications are limited due to above mentioned therapeutic challenges (Fig. 3). To address these issues, specific strategies for modulating cytokine activity are being developed.

Various approaches to therapeutically enhance cytokine activity

1. Prolonging cytokine half-life by protein fusions and PEGylation

A short in vivo half-life and toxicity of natural cytokines are two characteristics that may restrict their delivery (6). There are several methods for extending the half-life, including fusing to other proteins (such as albumin and immunoglobulin) (7).

PEGylation, which involves the addition of PEG polymers to proteins to lengthen their half-life in vivo, has been used for years to prevent immunogenicity and defend against protein breakdown (8).

2. Optimizing the delivery of cytokines

The delivery of cytokines can be influenced using a variety of technical strategies. The main components of these include polymeric matrices, microparticles such as polymeric microparticles, and nanoparticles. However, studies are lacking with these cytokine delivery techniques (9).

In the tumour microenvironment (TME), cytokines can also be selectively activated. As an instance, WTX-124 (Indukine), an IL-2 pro-drug, is activated after being broken down by certain proteases in the TME (10).

3. Immunocomplexes and immunocytokines

Creating an immunocomplex is an additional method of extending a cytokine's half-life and potentially biasing its receptor interaction with domain. For example, S4B6 mAb (monoclonal antibody) supports IL-2Rβ interaction by blocking IL-2α contact with IL-2R, which encourages the proliferation of cells with low IL-2Rα expression and T_{eff} cell expansion. In contrast, JES6-1 sterically blocks the ability of IL-2 to interact with IL-2Rβ, promoting expansion of cells expressing IL-2Rα (particularly Treg cells) (11).

4. Engineering cytokine receptors or cytokine–receptor pairs

Orthogonal cytokines are created altering the cytokine and extracellular domain of the receptor

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but retaining the cytoplasmic domain and thus the signal. Based on cytokine families that share common chains, cytokines likely evolve in concert with distinctive receptor chains (12).

5. Cytokine muteins

The creation of cytokine muteins is a technique that has been utilised for many years to produce molecules with changed activity, either increased or lessened or qualitatively altered, where mutagenesis can possibly boost or lower the affinity of a cytokine. When cytokines bind with many cytokine receptor chains, each contact can be selectively targeted and may have potentially differential effects (1).

6. Neokines

An innovative strategy for producing new molecules of potential therapeutic value is the de novo computationally generated proteins that imitate the binding sites of natural cytokines but have a more compact structure and show little resemblance to the native cytokines. For example, neo-IL-2/IL-15 (NL-201) has a topological structure that is considerably different from that of IL-2 or IL-15. With improved packing, NL-201's up-down-up-down structure still maintains the important surface interactions with IL-2Rβ and γ chains (13).

Various approaches to therapeutically suppress cytokine activity

1. Antibodies to cytokines and cytokine receptors

Several unique cytokine-blocking mAbs have been developed. Tocilizumab, one of them, targets the IL-6 receptor and is a treatment for cytokine release syndrome, rheumatoid arthritis, juvenile rheumatoid arthritis, and Castleman disease, in which IL-6 is overproduced (14).

2. JAKs and STATs antagonists

Tofacitinib was developed as a JAK3 preferably selective inhibitor, with less potent effects on JAK1 and JAK2. Tofacitinib blocks the Signaling of all six γc-family cytokines. Tofacitinib, which was first licenced for the treatment of rheumatoid arthritis, now has a variety of applications. In principle, selective STAT inhibition may be more specific than JAK inhibition (1).

Targeted protein degradation

The PROTAC (proteolysis-targeting chimeras) molecules are bifunctional, with one end binding to a protein of interest (POI) and the other end binding to an E3 ligase to form a ternary complex, in which the E3 ligase then affects the transfer of ubiquitin from an E2 enzyme to the POI, marking it for proteasomal degradation. Another approach to target degradation of extracellular and cell surface proteins uses a lysosomal degradation strategy, termed KineTACs for cytokine receptor targeting chimeras (15&16).

Conclusion

Cytokines are signalling molecules that play critical roles in a variety of biological processes

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that help to maintain homeostasis. Understanding the structure of cytokines and cytokine receptors, receptor biology, and intracellular signalling processes is essential for their therapeutic regulation. Cytokine deficiencies or storm may be readily regulated by replenishment or blocking, respectively, but overcoming the phenomena of cytokine pleiotropy is the key issue. Another significant area is the capacity to fine-tune the effects of cytokines; however, progress has been limited so far.

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Popular Article

Patentable invention of intestinal kitten cell lines a legal remedy for kitten killing tragedy in toxoplasma research

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KITTEN Act and scientific fact

Since 1982 the agricultural research services (ARS) division of the US Department of Agriculture (USDA) had been conducting experiments on toxoplasma involving cats as primary hosts. Toxoplasma is a zoonotic disease that affects all warm-blooded animals including human beings. In the experimental protocol, cats are infected with toxoplasma, those infected cats are ethically sacrificed and incinerated to restrict the spread of infection to man and animals. Surprisingly in 2018 when the project reached 36 years of its completion all the research documents were collected through the Freedom of Information Act (FOIA) by the watchdog group expert panel for investigation under the "White Coat Waste Project" and made public. The expert panel detected serious issues regarding killing healthy kittens after experimental infection. Lawmakers in both the House and Senate of the US raised their voices against the kitten killing abuse. The 14-page document, titled "USDA Kitten Cannibalism", argued that such research is "irrelevant to American public health and the USDA's mission". Therefore, legislators introduced an act known as KITTEN Act "Kittens in Traumatic Testing Ends Now" (Keen 2019). Eventually, on 2nd April 2019, (USDA) announced the closure of all kinds of research on toxoplasmosis involving kitten scarification (Kaplan 2019). With this tough decision, a well-acclaimed lab in Beltsville, Maryland involved in Toxoplasma research under leading scientist Professor Jitender Dubey fell victim to wind up all their research activity. Toxoplasma is a tinny unicellular microscopic creature distantly related to the malarial parasite known as *Toxoplasma gondii*; a cyst-forming apicomplexan parasite infecting virtually all warm-blooded species, with all true cats (Felidae) as definitive hosts. More than 60 million, people are infected with *T. gondii* and most of the infected cases are asymptomatic. In humans, mother-to-child transmission has been reported with *T.gondii* (Al-Malki 2021).Toxoplasma colloquially as Toxo can survive in several

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animal species but completes its sexual reproductive cycle only in cats (*Felis catus*) and produce environmentally resistant oocysts released in feces (Dubey *et al*., 1970). The life cycle of Toxoplasma involves both an asexual phase and a sexual phase of reproduction. Once the parasite gets entry into the stomach of a cat the pepsin and acid digestion facilitate the release of bradyzoites, subsequently, bradyzoites invade the intestinal epithelial cells and differentiate into morphologically distinct five different pre-gamete stages A to E, designated merozoites prior to gamete formation (Dubey & Frenkel 1972). Within the feline intestine, merozoites are known to differentiate into micro and macrogametes that fuse to become diploid oocysts. Oocysts represent the final product of sexual reproduction which occurs in the intestinal lining of the cat family. Diploid oocysts have thick impermeable walls and are relatively resistant to several chemical disinfectants and remain viable for up to 18 months in adverse environments (Dabritz *et al*., 2010). Sporulation is required for oocysts to become infectious and occurs within 1–5 days in the environment. Under a normal environment, the oocysts undergo mitotic as well as meiotic cell division to produce haploid sporozoites enclosed with an oocyst wall. Humans are accidental hosts but once ingested the parasite transforms into a tissue-infective stage and then walks through the intestinal wall to enter the bloodstream, for home to other tissues and the central nervous system (Jones *et al*., 2014). Once Toxo gets into mice and rats the parasite can alter the behaviour of the rodents so they become fatally attracted to the scent of feline urine (Vyas *et al.,* 2007). Once the infected mice get eaten, the cat picks up the infection, and Toxo makes more Toxo due to the completion of its sexual reproductive cycle. Research reports suggest about 40% of cats in the United States are infected with Toxoplasma; remain asymptomatic, but they can develop jaundice or blindness and experience nervous symptoms. In the domestic environment, cats and rodents are considered the most significant reservoirs of human infection.

Cat Killing Practice Is an Obsolete Device

As of now for in vivo study the kittens are fed in the lab with meat contaminated with toxoplasma in order to harvest parasite oocysts shed in the animals' feces. Abiding by the animal ethics guidelines those infected cats must be incinerated to avoid spreading the infection to humans for which there is no vaccine and no cure as antibiotic treatments may not completely expel the parasites. Scientists have observed that this widespread parasite is also most difficult to study without sacrificing kittens. It is arguably true that killing kittens is cruelty to animals, therefore such unethical practice has been debated and drawn criticism from animal welfare activists. The ban on kitten scarification by USDA, although caused a blow to Toxoplasma research labs throughout the world, yet the scientific community never remained silent, rather went back to their working bench to search for an alternative to replace the kitten with a modified in-vitro cell system.

The cellular mat can replace the live cat

Some ill-defined molecular determinants present in the intestinal cells of cats may be considered as a specific marker that categorizes these species as the definitive host for *T. gondii* . The

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role of the delta-6-desaturase enzyme (D6D) in the conversion of linoleic acid to arachidonic acid in a rate-limiting manner has been probed as one of the contributing factors in this aspect. Felines are the only mammalian species, lacking D6D activity in their intestines (Rivers *et al*., 1975), resulting in higher levels (25%- 40%) of the linoleic acid detected in cat serum (Trevizan *et al*., 2012) whereas rodents serum contains merely 3%–10% linoleic acid (Jelińska *et al*., 2017). It has been hypothesized that the absence of delta-6-desaturase enzyme in the intestinal cells allows the accumulation of linoleic acid from the dietary source, which acts as a positive signal for *T. gondii* sexual development. In order to break the species barrier a few years ago, Laura Knoll and her team at the University of Wisconsin, treated mice with drugs (SC-26196) to inhibit murine D6D activity, and dietary supplementation of their diet with linoleic acid (Di Genova *et al*., 2019). In support of it, an earlier report has shown that in vitro cultured feline intestinal cells supplemented with linolenic acid and a chemical SC-26196, which specifically inhibit the enzyme delta-6-desaturase, established high levels of linoleic acid in blood serum (Obukowicz *et al*., 1998). This has permitted animals' intestines more like those of felines that successfully pushed Toxoplasma from its asexual phase into the sexual phase of development (Offord 2023). As mentioned in the international patent submitted by patent holders Laura Knoll and her group has disclosed an in-vitro method to generate cell monolayer derived from foetal intestinal crypts of kittens that can sustain the sexual life cycle of *T. gondi*. The crypts comprising of enterocytes, goblet cells, paneth cells, endocrine cells, and stem cells villi (Knoll *et al*., 2019). As per the report published by this group, the cells generated from the intestinal crypt displayed polarization and tight junction bridging as naturally occur in animal intestines (Di Genova *et al*., 2019). Supplementation of those cells with linoleic acid at a desired concentration (200 µM) for 24 hours prior to *T. gondii* infection supported the development of bradyzoites to enter the pre-sexual stage called merozoites. Merozoites are known to differentiate into micro and macrogametes that fuse to become diploid oocysts. The development of merozoites in cell culture was confirmed by the detection of merozoite-specific antibody staining against GRA11B marker protein. Further induction of linoleic acid on 7th day of protozoal infection the infected cells expressed amine oxidase and copper-containing protein 2(AO2) considered to be a positive indicator of intracellular gamete formation. Confirmation of gamete formation through PCR and detection of intracellular oocyst wall biogenesis in this linoleic acid–supplemented cat cells was established by gamete-specific staining with monoclonal antibody(3G4). They have frozen down the cells and later expanded those to confirm the immortality character like that of the established cell line (Di Genova *et al*., 2019). Similarly, mouse intestinal monolayers supplemented with both linoleic acid and D6D enzyme inhibitor (SC-26196), approximately 26% of the *T. gondii* vacuoles expressing both BRP1 and GRA11B as marker for merozoites (Fig-1) have been recorded in their report (Di Genova *et al*., 2019). Further, inhibition of delta-6-desaturase can cause sexual development in live mice has also been confirmed by these groups. On the 6th day of the post-infection oocyst-like structure was detected in mouse feces and those

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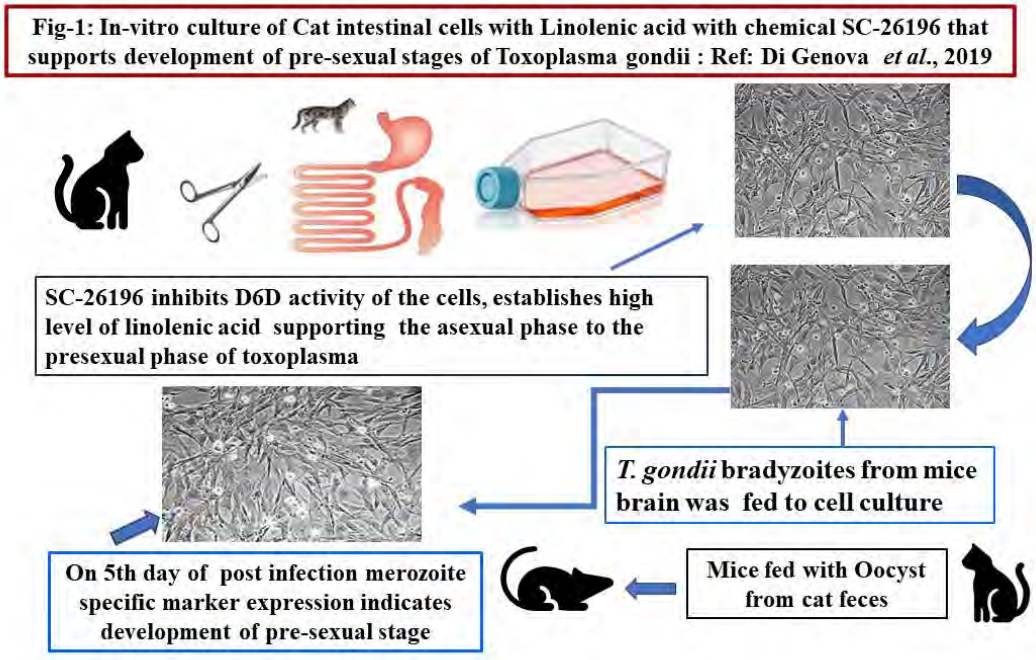
oocysts sporulate and were found to be infectious. In summary, we may conclude that the activity of delta-6-desaturase enzyme must be inhibited so that linoleic acid from extraneous sources should be sufficiently accumulated (without being converted to arachidonic acid) to induce development of pre-sexual stage of Toxoplasma gondii in nonfeline intestinal cells.



Conclusion

Hopefully, the preserved cell lines derived from the kitten/mouse intestine and the epigenetic programming of *T. gondii* will pave the way to study the sexual life cycle of the parasite, the future reality without animal cruelty.

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Popular Article

Emergence of Antibiotic Resistance in Cattle Acting as Silent Killer the Society

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Introduction

In 21st century, with advancement of science which leading to the discovery of new drugs for the betterment of animal and society there is also silently advancing shoulder to shoulder with advancing technology is ABR (Antibiotic Resistance). now a days due to increasing use of multiple drugs with inappropriate and no specific use of antibiotic in multiple aspect in cattle as majorly in therapeutic management of mastitis in cattle in the field condition. Many study claims that the spread of resistant strains of mastitis-causing bacteria, like *Staphylococcus aureus* and *Escherichia coli* to humans. The phenomenon occurs when pathogenic microbes are non-responsive to the standard doses of antibiotics (Acar *et al*. 2001). Large ruminants like cattle and buffalo take a substantial share of ABR for being the reservoir of resistant strains. Bacteria commonly associated with disease called mastitis, such as *Staphylococcus aureus*, Escherichia *coli*, *Pseudomonas* spp., *Proteus* spp., *Klebsiella* spp. etc., and antibiotic residues in milk after therapy can be led to resistance. Milk is an essential staple food in Indian households. The rising demand, driven due to high population growth, rising income, and urbanization. There exists a positive correlation between high milk yield and mastitis. Mastitis is predominantly a bacterial disease of the mammary gland of high-yielders. The most common treatment of mastitis is with antibiotics administered intramammary into the infected quarters of the udder and parental injection. The repeated use of antibiotics to treat bovine mastitis for a long period may cause multi drug resistance in causative organisms, which will require increased doses of antibiotics leading to the accumulation of large amount of antibiotics in milk and its products (White and McDermott, 2001). In the context of increasing multi drug resistance and the demand for organic products, the search of alternative drugs based on the pharmacological and phytochemical properties of plants became a priority in livestock health research (Rios and Recio, 2005). Medicinal plants can be used as an alternative therapeutic

option or as an adjunct agent in managing bovine mastitis. They can be used as an anti-bacterial, anti-inflammatory, and immunomodulatory agent for the treatment of mastitis (Mushtaq *et al*. 2018). Antibiotics are often used or misused in the dairy sector for therapeutic and prophylactic purposes. Antibiotics are also eliminated in the milk till 7 days post-treatment. However, there is an absence of compliance to milk withdrawal periods following antibiotic administration, which leads to antibiotic residues in milk. Hence, improper use of antibiotic therapy in milch animals poses a threat to the public, especially if milk is consumed unpasteurized. The consequences of ABR are speculated to be more severe in low-and middle-income countries like India, where the burden of infectious diseases and the use of antimicrobials thereof is high. The issue is further complicated by poverty, illiteracy, overpopulation, and starvation, all of which have contributed to developing drug resistance. Based on these facts, India is often considered the "antimicrobial resistance capital of the world.

A study shows a period between 2000 to 2010 there is about 76% significant increase in global antibiotic consumption in India, Brazil, Russia, China and South Africa out of which 23% increase was alone in India (Boeckel *et al*. 2014). The dairy sector is often considered one of the major drivers of agriculture-related ABR, the linkage between antibiotic use in the veterinary sector and ABR pathogens is not fully established. However, the data from such studies cannot be extrapolated to give a clear picture of ABR in India, a prerequisite to preparing a strong strategy to combat this life-threatening health issue. To use antibiotics appropriately and maintain the therapeutic arsenal, which ensures the medicines' long-term efficiency, it is important to estimate the level and trend of resistance in udder infections. In this context, a review was undertaken to assess the status of resistant bacteria and antibiotic residues detected in the milk of dairy cows across India. Milk often contains residues of antibiotics following its administration through intramammary and parenteral routes. According to the European Commission, antibiotic residues termed as "pharmacologically active substances and their metabolites which remain in foodstuffs obtained from animals to which the veterinary medicinal products have been administered." There is a milk withdrawal period that extends to 7 days following antibiotic therapy. However, it is rarely practiced by farmers due to ignorance about its adverse health impacts and financial losses associated with milk discard.

Conclusion

Antibiotic resistance is a global health hazard issue affecting humans and animals as a silent killer. Antibiotic resistance has proved more harmful to humans when it originated in food-producing animals as the residual antibiotic and the resistant bacteria spread quickly to multiple hosts, including humans, through milk. Thus, a universal strategy involving all farmers and stakeholders is essential to put break in the development of new strains and in reducing morbidity and mortality associated with Antibiotic resistance.

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Popular Article

Sexing of Semen in Bovine

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Introduction

Improving the genetic value of dairy and beef animals initially through traditional methods later improved by new technology. Artificial insemination plays a key role in improving dairy herds, as it requires the selection of an elite bull with good genetic potential and semen free of various diseases. A new technology has been introduced in artificial insemination, namely semen sexing. Sex determination of sperm depends on the amount of DNA. The DNA concentration in the X and Y chromosomes varies both within species and between species of different breeds. There are a number of methods for semen sex determination, of which flow cytometry compares favorably with other methods. Many researchers have attempted to manipulate the sex of offspring before conception (Garner et al., 2008). By sexing the semen, farmers can obtain the desired animals, such as dairy cattle or beef cattle, depending on their needs. Farm development depends on the genetic potential of livestock and genetic potential depends on several factors, of which desired sex may be one of the most important determinants. Recently, sex sorting of sperm using flow cytometry has enabled their inclusion in commercial reproductive management. The use of sex-sorted semen on farms presents several opportunities and challenges. Tubman et al. (2004) reported that sex-sorted semen showed no significant difference in reproductive and productive traits between calves produced with sexed and conventional semen. However, there are some limitations associated with sex-sorted semen: high cost of equipment, lack of skilled manpower, about half of the semen sample is waste, low sorting efficiency, low pregnancy rates, and the process is very slow. However, if the cost of sexing is low enough and fertility is close to normal, sexed semen programs will lead to more efficient milk and meat production.

Table 1. Difference between X and Y spermatozoa

Parameter	Difference
DNA content	Less in Y sperm
Size	X sperm is larger
Motility	Y sperm is faster
Surface charge	X sperm is negative
Cell surface antigen	H-Y antigen on Y sperm

Basic principles of sexing of semen

Sex-specific sorting of sperm is based on information about the content of DNA genetic material in X and Y chromosomes. The DNA concentration in the X chromosome is higher compared to the Y chromosome. In this way, flow cytometry associates the laser, the different staining of viable and non-viable spermatozoa, and the hydrodynamic force that guides spermatozoa at the moment of reading during the process of separation of X and Y spermatozoa. In addition, the amount of DNA content in the X and Y chromosomes differs in different breeds of cattle (Garner, 2006). The percent difference in X-Y DNA content of sperm nuclei is 4.22 for Jersey, 4.07 for Angus, 4.01 for Holstein, 3.98 for Hereford, and 3.7 for Brahman. These differences are not able to determine fertility after sexing the semen, but they increase the speed and efficiency of sexing semen and must be considered when using flow cytometry. Day-by-day advances in the form of the tip of flow cytometry the positioning of sperm at the moment of passage through the laser, as well as changes in pressure and the type of staining cells, have significantly improved the separation process of gametes X and Y (Garner, 2006). The separation of X and Y spermatozoa is slow, i.e., it moves between 300,000 to 400,000 cells per minute. A sex-sorted sperm straw (0.25 cc) contains only 2.1 x 10^6 cells because sperm are damaged during sex sorting, which impairs fertilization (Garner, 2002).

During sorting, sperm are exposed to laser light and various physical forces, e.g., they exit the sorter at nearly 90 km/h before entering the collection medium. The sorting process results in an extremely dilute sample of 800,000 sperm /ml, and then the sperm is carefully centrifuged to obtain a concentrated sample suitable for packaging and cryopreservation.

Sperm concentration for sex-sorted sperm in reproductive programs

There is commercial availability of sexed semen straw that contains 2.1 x 10^6 cells/dose which is much lower than that from conventional semen (~20 x 10^6 cells/dose). But there is no difference in conception rate in both the cases. However, there is an increase in conception rate when AI is performed with conventionally processed sperm (15 x 10^6 sperm/dose) as presented on table. 2

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Table 2. Sex-sorted sperm (dose) and non sex-sorted sperm (dose)

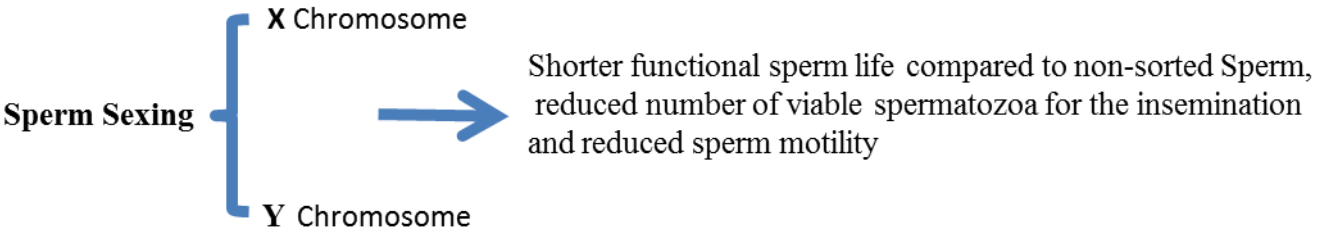
	Sex-sorted sperm (dose)		Non sex-sorted sperm (dose)
	2.1 x 106	3.5 x 106	15 × 106
Heifers (%)	43.9[a] (2,752/6,268)	45.7[a] (2,864/6,268)	60.7[b] (3,805/6,268)
Cows (%)	23.0[a] (1,257/5,466)	25.4[a] (1,388/5,466)	31.5[b] (1,722/5,466)

Different superscript letters ([a, b]) in row indicates statistical difference (P < 0.01), (Dejarnette *et al*., 2011) Conception rates Holstein heifers and cows after artificial insemination with 2.1 or 3.5 × 106 sex-sorted sperm or 15 × 10^6 non-sex-sorted sperm.

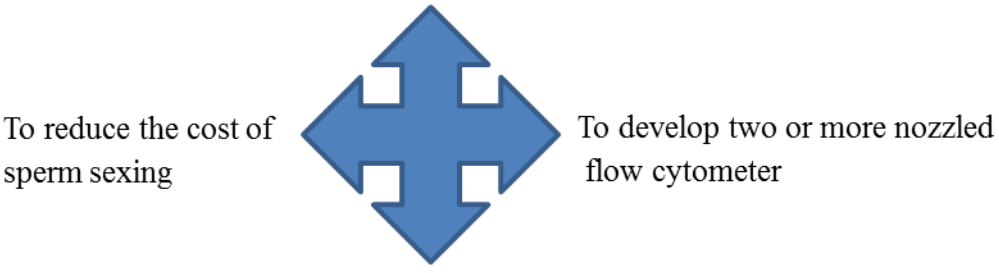
Constraints with Sperm Sexing

The cost of equipment and maintenance is high, and as well a number of skilled persons are required to handle it about half of the sperm sample is un-sexable, sorting efficiency is low, pregnancy rates are low, and the procedure is very slow. In the thermoresistance test, the result for sex-sorted semen was also not good compared to non-sorted semen, because motility decreases faster in sex-sorted semen compared to non-sorted semen.

In addition, part of the effect associated with samples from a particular bull and insemination dose is sex-sorted semen, and some samples from particular bulls may tolerate the stress of sorting in a desirable manner (Seidel and Schenk, 2008). During this process of separating X and Y chromosomes, shorter sperm longevity compared to non-sorted sperm, lower numbers of viable sperm for insemination, and lower sperm motility are the most common problems that can lead to lower conception rates.



Future challenges and possibilities



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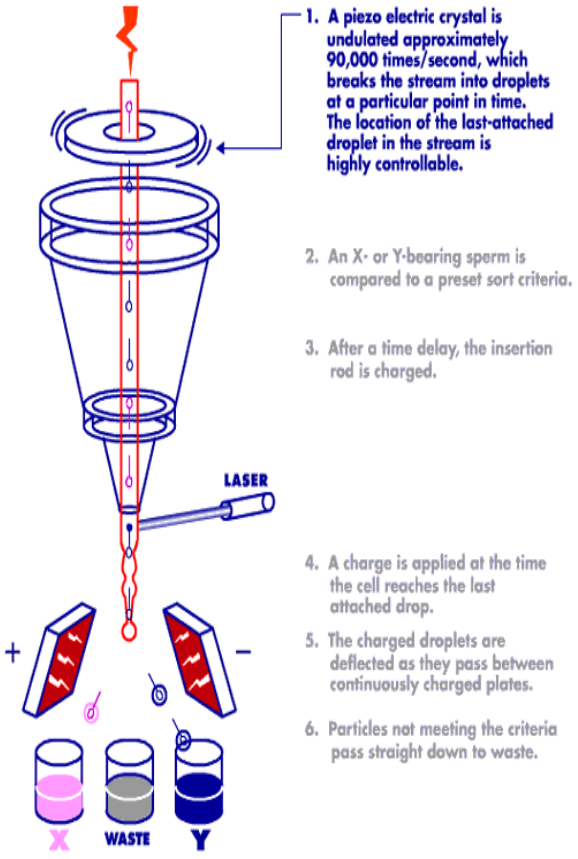
Economical aspect of sexed semen

Marketing of sexed semen has been already started in number of the country. Khalajzadeh *et al*. (2012), have hypothesized that sexed semen may be used to accelerate the rate of genetic gain in dairy herds by selecting only the highest-ranking cows to breed for replacements. Mc Cullock *et al*. (2013) reported economic effects of sexed semen can be used round the year whereas also in seasonal production systems (Hutchinson *et al*., 2013a and 2013b). The economic advantage of using sexed semen depends on function of interactions among the market environment, management practices and technological efficiency (Mc Cullock *et al*., 2013).

Applications sexed semen in Dairy Cattle

Sex-sorted semen increases number of female calves which is helpful to expand the herd or herd replacement as well as increases selection intensity by choosing genetically superior dams of replacement. It reduces the dystocia cases as it produces more number of female calves. For maintaining genetic gains in breeding farm, it is helpful in production of young proven bull. It also uses in *in-vitro* fertilization, superovulation, and embryo transfer programs. The first calves produced with accurately sexed semen resulted from *in-vitro* fertilization (IVF), which requires many fewer sperm than artificial insemination.



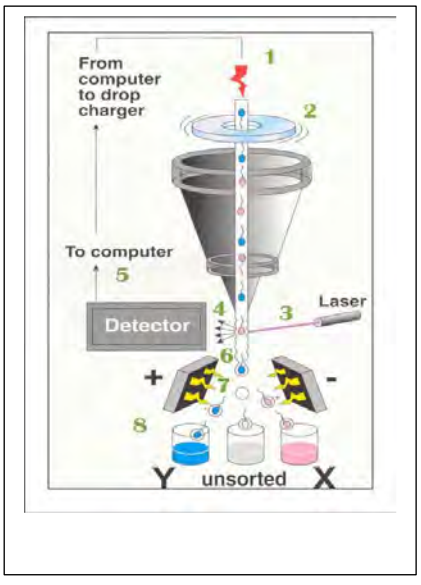


Fig 1 & 2: Flow cytometer (Source: Internet)

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Conclusion

In India, there are a large number of cattle and buffaloes, but not all animals have good genetic value, so the good genetic material is not passed on to the next generation in an appropriate way. Therefore, it is necessary to identify and breed animals with higher genetic potential. Now, there are a number of methods that can be used to maintain good genetic potential on a farm, with sex-sorted semen being the predominant method. Flow cytometry is currently the most reliable and validated method for sexing semen. Sexed semen should preferably be used in heifers because they have higher fertility compared to cows. Sexed semen can be routinely used for embryo transfer and IVF to produce more calves of the desired sex. If used systematically and judiciously, this technique can revolutionize animal husbandry and lead to greater success.

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Popular Article

Control of Reproduction By Hormones In Small Ruminants

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Abstract

Several strategies developed in recent decades can be used to regulate the reproduction of small ruminants. Some of these entail administering hormones that alter the physiological sequence of the sexual cycle's events. Progesterone or its analogues are used in methods that mimic the effects of natural progesterone produced by the corpus luteum after ovulation, which is in charge of regulating LH release from the pituitary, on the luteal phase of the cycle. By removing the corpus luteum and producing an additional follicular phase with ovulation, the use of prostaglandins is a different technique for managing reproduction. Given how challenging it is to detect oestrus in these species, the use of hormones to induce oestrus has permitted small ruminants to use artificial insemination at higher rates. At the commercial level, timing of oestrus permits management of kidding and lambing, followed by timing of weaning of young animals for slaughter. Additionally, it permits the more effective use of labour and animal facilities. Oestrus synchronisation and artificial insemination can also be used in multiple ovulation and embryo transfer regimens. Finally, ewe-lambs and doelings have been given hormone therapy to make them go through puberty.

Introduction

There are seasonal cycles of reproduction in several ruminant species, such as those of sheep and goats. The seasonal pattern of reproduction that these animals displayed in the wild, which was intended to guarantee that lambs and young were born at the best time of the year, typically in the spring, was not altered by domestication of these species. These species' reproductive season consists of a series of oestrous cycles, which typically start in the summer or early fall as a result of the dwindling day length and terminate in late winter or early spring. The transition phase extends from late spring to the beginning of the ovulatory period, while the anoestrous period spans from late winter/early spring to early or mid-summer. If animals are milked, this seasonal breeding pattern also produces a seasonal pattern of milk production and a distinct period of lambing or kidding. Due to this circumstance, product prices follow a seasonal pattern, with prices falling from late spring to early autumn, when the supply of meat and milk is at its peak, and vice versa. Inducing oestrous cycles during the seasonal anoestrus would allow farmers to produce crops "out-of-season," taking advantage

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of greater pricing for them throughout the winter.

Numerous techniques created in recent decades can be used to regulate the reproduction of small ruminants. Some of them entail administering exogenous hormones that alter the physiological sequence of the sexual cycle's events. Others solely use "natural methods," such as light control or exposure to a man, and do not use hormones. The luteal phase of the cycle will be altered by the administration of hormones like progesterone or its analogues (progestagens) and prostaglandins. Since the 1970s, artificial insemination has been used more frequently in these species due to the use of progestagens to induce oestrus, which is a huge benefit given how difficult it is to detect oestrus in these animal species. At the commercial level, synchronising oestrus enables control and expedited kidding and lambing, followed by synchronised weaning of young animals for slaughter. Additionally, it enables the more effective utilisation of labour and animal facilities. Oestrus synchronisation and artificial insemination are also used in multiple ovulation and embryo transfer (MOET) programmes. Finally, ewe-lambs and doelings have been given hormone therapy to make them go through puberty.

Progesterone and analogues (progestagens)

Progesterone or its analogues are used in methods that mimic the activity of natural progesterone produced in the corpus luteum after ovulation, which is in charge of regulating LH secretion from the pituitary, by acting on the luteal phase of the cycle. Oestrus and ovulation can therefore be regulated by changing the life of the corpus luteum or the levels of circulating progesterone. The initial course of treatment involved 14 daily subcutaneous injections of 10 mg of progesterone dissolved in 2 mL of maize oil; this decreased the animal breeding period to 8 days. In some following studies, progesterone therapy was combined with the administration of human chorionic gonadotrophins and pregnant mare serum. However, because of progesterone's lingering impact on the uterine and tubal environments, conception rates were low. Therefore, a progestational agent would yield superior results because its activity would end rather abruptly following the conclusion of the treatment. This was proposed by Southcott et al. (1962), who effectively induced oestrus synchronisation in sheep using the progesterone analogue 6-methyl-17-acetoxyprogesterone. Additionally, it was discovered that administering progesterone or analogues intravaginally made it easier for those hormones to be abruptly removed. Intravaginally inserted pessaries impregnated with progestagens have been used to coordinate sheep oestrous cycles since the early 1960s and have been discovered to be as efficient for synchronising oestrus in goats. Fluorogestone acetate (20 mg/sponge) and medroxyprogesterone acetate (60 mg/sponge) are the two progestagens that are most frequently employed in commercial settings. Both seem to be potent temporal oestrous cycle inhibitors. The inert silicone elastomer controlled internal drug release (CIDR) dispenser, which is often impregnated with natural progesterone, has also been employed. The gadget, which has 0.30 g of progesterone, was created in New Zealand in the late 1980s. Plasma progesterone concentrations increase quickly following device implantation, peaking 3 days later, and then progressively declining after that. The

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device's use accelerates the start of the typical breeding season and, when combined with the ram effect, can encourage out-of-season breeding. Progestagen-impregnated intravaginal sponges, also known as CIDRs, are placed intravaginally for 12–14 days in sheep. 48 hours or so after the removal of the device, ewes begin to display oestrus for mating or artificial insemination. In goats, CIDRs are left in situ for 18–21 days while progestagen-impregnated sponges are placed intravaginally for 16–18 days. After removal, the majority of does will go into oestrus 48 hours later. Equine chorionic gonadotrophin (eCG, also known as "pregnant mare serum gonadotrophin" or "PMSG"), a placental glycoprotein hormone made from the serum of pregnant mares, is given to animals at the time of removal.

The eCG exhibits concurrent FSH and LH-like activity. In order for progestagen therapy to be effective, there must be enough gonadotrophin on hand to start the preovulatory processes. This can be accomplished by boosting endogenous gonadotrophins with "exogenous" FSH provided via the FSH-like activity of the eCG administration. It should be used with caution during breeding season since it increases ovulation rates, which results in more lambs being born. eCG dosage in sheep varies from 250 to 750 IU depending on breed, age, and season. Higher doses (up to 1000 IU) might be necessary in goats. In the breeding season, a male to female ratio of 1:10 is advised for mating; however, during the anoestrus or transition period, the ratio should be between 1:5 and 1:7. After the device has been removed, insemination can be done between 47 and 55 hours later (intrauterine or intracervical). The synchronisation of oestrus and ovulation by a brief exposure to progestative treatment is a potential substitute for reducing the duration of permanence of vaginal devices. Briefly stated, the treatment involves inserting CIDR or sponges impregnated with progestagen for 6 days. Because this time frame is shorter than the half-life of any potential corpus luteum in the ovary, prostaglandin F2 or one of its equivalents must be administered concurrently with the insertion of the sponge in order to cause the lysis of the corpus luteum. The treatment's reaction is comparable to that of long-term therapy.

Prostaglandins and analogues

The induction of luteolysis, removal of the corpus luteum, and subsequent induction of a follicular phase with ovulation are alternate techniques for managing reproduction in sheep and goats. Prostaglandin F2 (PGF2) is the main luteolytic factor in ruminants, hence exogenous PGF2 or its analogues can be administered to induce luteolysis. The ability to administer by intramuscular injection is the main benefit of prostaglandin therapy. In contrast to intravaginal devices, animal management and welfare are enhanced. In addition, because the product is swiftly and almost entirely (99%) metabolised in the lungs, the output of chemical residues is lowered. The primary drawback of employing PGF2 is that it must be administered in the presence of an active corpus luteum and responding to exogenous PGF2 for the hormone to be effective. Animals in anoestrus or in the early, late, or follicular phases at the time of injection will not respond to treatment since the corpora lutea

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can respond to PGF2 as early as day 3 of the oestrous cycle and as late as the day of spontaneous luteolysis. Given that it is impossible to predict the oestrous cycle phase in a group of females, PGF2 must be administered twice, 9–10 days apart. This ensures that nearly all of the animals in the group will be in mid-luteal phase at the second dosage and will respond to therapy. In tropical breeds, where there is a continuous breeding season and no seasonal anoestrus, this technique can be used all year long; however, in temperate regions, it can only be utilised during the breeding season. However, the use of prostaglandins after establishing reproductive cyclicity by using the "male-effect," which entails reintroducing male animals into the female flock after a separation time, may provide a solution during the transition period. The second drawback is that while the 9–10-day procedure successfully synchronises oestrus, the ewes' first-mating fertility is only about 70%, which is much lower than it is following progestagen treatments and natural services. However, the presence of an active corpus luteum alters the functionality and final maturation of preovulatory follicles as well as normal luteogenesis (high progesterone concentrations during the mid-luteal phase of the oestrous cycle decrease LH secretion, which is crucial for final growth and maturation of preovulatory follicles). Treatment at either the early or late luteal phase of the oestrous cycle may help with the first issue, which is reduced follicular function and poor synchronisation of follicle growth during mid luteal stages. Due to the existence of developing follicles from the first wave of development, treatment during the early luteal phase appears to be the most effective course of action. When the corpus luteum of small ruminants is receptive to PGF2, which occurs on the third day of the oestrous cycle, the treatment can be started right away. The second dose of prostaglandin should be administered, however, at the hypothetical fifth day of the oestrous cycle (i.e., seven days after the first dose), from a practical standpoint. Treatment on the fifth day would prevent the possibility that animals would be on the first or second day of the cycle and not respond to PGF2. The luteolytic efficiency, percentage and timing of appearance of oestrus, preovulatory release of LH, ovulation, and functionality of subsequent corpora lutea are similar after administration at either the third or fifth day of the cycle. In addition, treating in the early luteal phase would promote follicle maturation and synchronisation of the preovulatory LH peak and ovulation because younger, less progesterone-secreting corpora lutea would allow for earlier restoration of LH pulsatile until reaching the preovulatory peak. As a result, the window of time during which a population of animals exhibits oestrus and ovulation would be reduced; this technique may even be applied for timed artificial insemination. Applying the "male effect" concurrently with the second PGF2 injection may further reduce the variability in ovulation timing after therapy. Although the "male effect" is frequently used to induce an LH surge and ovulation during seasonal anoestrus, it also increases LH secretion during the breeding season in ewes that are cycling. Therefore, in the absence of earlier oestrus detection, the combination of PGF2 during the early luteal phase with the "male effect" may be a sufficient substitute for synchronising oestrus prior to artificial insemination.

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Conclusion

The hormonal options for small ruminant reproductive control are well described; these are practical strategies for raising farm profitability. However, a novel strategy that proposes the use of "biostimulation" in place of exogenous hormones and drugs to regulate and enhance the productivity of sheep and goats may be worthwhile to consider in the future. Biostimulation is defined as the stimulatory effects on reproductive characteristics of females, such as the onset of puberty, oestrus expression, and ovulation induction, that are induced by the presence of a male. It makes sense for animal producers in all nations to start shifting towards clean, ethical, and sustainable practises as this might be a long-term phenomenon.

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Popular Article

Small but Mighty: Discover the power of millets

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Introduction

Millets are a group of cereal grains that belong to the Poaceae family, commonly known as the grass family. They are gluten free and rich in protein, fibre and several vitamins and minerals It's widely consumed in developing countries throughout Africa, Asia. and India, millets are a common food. Sorghum (Jowar), Pearl millet (Bajra), Finger millet (Ragi/Mandua), Foxtail millet (Kangani/Kakun), Kodo millet (Kodo) and Barnyard millet (Sawa/Sanwa/Jhangora) are just a few of the millets that are grown and eaten in India. They are rich in protein and, most importantly gluten-free. They are a rich source of phytochemicals with medicinal properties in the form of antioxidant activities, which helps lower many health diseases. While it may look like a seed, millet's nutritional profile is rich in all essential minerals.

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Importance of Millets

- Millet is a good source of protein, fiber, key vitamins, and minerals.
- The potential health benefits of millet include protecting cardiovascular health, preventing the onset of diabetes, helping people achieve and maintain a healthy weight, and managing inflammation in the gut. Millet is an adaptable grain.
- Millet is rich in dietary fiber, both soluble and insoluble. The insoluble fiber in millet is known as a "prebiotic," which means it supports good bacteria in your digestive system.
- This type of fiber is also important for adding bulk to stools, which helps keep you regular and reduces your risk of colon cancer.
- The potential health benefits of millet include protecting cardiovascular health, preventing the onset of diabetes, helping people achieve and maintain a healthy weight, and managing inflammation in the gut.

Why should we incorporate millets in our diet?

1. **Rich in fibre**:- Millets are high in fibre, which is one of the key factors in favour of including them in your diet. Additionally, it aids in weight loss and lowers cholesterol levels while regulating blood sugar levels. Millets are a wonderful option for anyone trying to improve their general health because they are a rich source of both soluble and insoluble fibre.
2. **Gluten free**: - Millets are naturally gluten-free, which is another chief reason you should add them in our diet. A protein called gluten, which is found in grains like wheat, barley, and others, may give some people digestive issues. Millets are a great alternative for people who are sensitive to gluten and can be used in place of wheat, barley, and other gluten containing grains in a variety of recipes.
3. **Rich in protein**: - Millets are also a great source of protein, which is essential for building and repairing tissues in the body. Millets are a great source of plant-based protein, making them a great choice for vegetarians and vegans.
4. **Good source of essential vitamins and minerals:** - Millets are also a good source of several essential vitamins and minerals, including iron, magnesium, potassium, and B vitamins. Iron is important for maintaining healthy blood cells, while magnesium and potassium are important for maintaining healthy bones, muscles, and organs. B vitamins are important for energy production and brain function. Millets are a great way to add these essential nutrients to your diet.
5. **Low glycemic index**: - Millets have a low glycemic index, which means they can help regulate blood sugar levels and reduce the risk of type 2 diabetes. A quick rise in blood sugar levels brought on by foods with a high glycemic index can result in insulin resistance and other health

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problems. Millets are a great alternative to high glycemic index foods like white rice and white bread.

How can we add millets in our daily diet:

There are many ways to incorporate millets into your diet. Here are a few ideas:

1. **Replace rice with millets**: - Millets can be used in place of rice in a variety of recipes, such as pilafs and stir-fries. They can also be used to make biryanis and other rice-based dishes.
2. **Use millet flour in baking**: - Many baked items, including bread, muffins, and cakes can be made using millet flour instead of refined wheat flour.
3. **Add millets to salads**: - Cooked millets can be added to salads for a wholesome and delicious meal.
4. **Make porridge with millets**: - Millets can be cooked and used to make porridge for breakfast. Fresh fruit and nuts can be added on top, and they can be sweetened with honey or maple syrup.

In conclusion, millet is an excellent alternative to be added in our daily which can somehow fulfill the nutritional content of the diet.

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Popular Article

Effect of Fertilizer Toxicity on Central Nervous System in Domestic Animals

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Almost all fertiliser products have an N-P-K, or nitrogen, phosphorus, and potassium (potash) ratio, which can be found on both organic and non-organic goods. The majority of ready-to-use fertiliser products marketed to the general public are not very toxic, although they can cause irritating effects such as skin irritation, vomiting, diarrhoea, and loss of appetite. Poisoning is more likely in companion animals exposed to industrial, concentrated, or undiluted products, while such incidents are infrequent. The following article goes over some of the more frequent and problematic fertiliser ingredients.

Bone Meal: This is made up of defatted, dried, and flash frozen animal bones that have been ground into a powder and then repurposed as a calcium or phosphorus-rich mineral supplement. Small amounts of the substance may cause vomiting and diarrhoea, while excessive amounts may cause an FBO as the product congeals in the GIT. To lessen the likelihood of blockage and the necessity for surgery, prompt emesis (within 60 minutes) is critical. Supportive therapy may include digesting diets, hydration supplementation, anti-emetics (only if the obstruction is minor), and, in rare cases, surgical removal of the FBO.

Blood Meal is a supply of nitrogen and phosphorus that is made up of dried, powdered, flash frozen blood. Vomiting, foetid diarrhoea, and pancreatitis may occur after ingestion.

Iron: Fertilizers containing iron can cause iron poisoning, depending on the type of exposure and dose, as well as the type of iron in the product. Iron toxicosis begins with vomiting and diarrhoea, mimicking the irritating effects of general fertiliser intake. Hematemesis, melena, fatigue, tachycardia, acidosis, and effects on the liver and kidneys may be more severe in advanced cases or massive ingestions.

Nitrates: Despite the fact that urea has essentially replaced ammonium nitrate in most household fertilisers, nitrate fertilisers are still widely used on farms, ranches, and commercial sites. Because nitrates are water soluble, they can contaminate both natural and treated water supplies. Intoxication is caused by the conversion of nitrate to the more toxic nitrite in the body, which causes vasodilation

and methemoglobinemia.

Urea: In many home fertilisers, urea is often utilised as a nitrogen source. Monogastric species, such as dogs and cats, tolerate ingestions well, with gastrointestinal symptoms being the most common. Methemoglobinemia can occur after a large meal.

Insecticides: Insecticide and/or fungicide chemicals may be present in some fertilisers. Among the most regularly utilised chemicals are imidacloprid and tebuconazole. Ingestion might cause minor irritability, as well as vomiting and/or diarrhoea.

UREA TOXICITY

In patients undergoing neurosurgical treatment, evidence has been given that intravenous injection of hypertonic urea solutions reduces intracranial pressure and causes brain shrinkage (Stubbs & Pennybacker, 1960). Because of the increased osmotic pressure of the blood plasma, urea may cause water to be withdrawn from the brain tissue. However, believing such an explanation in the case of urea is challenging due to the fact that this material is often believed to freely distribute itself throughout the human body's intracellular and extracellular fluids (McCance & Widdowson, 1951) and, in particular, it does not appear to behave as an osmotically active solute in relation to the membrane of the antidiuretic hormone receptor organs, which are thought to be located in the hypothalamus area of the brain (Verney, 1954).

AMMONIUM NITRATE TOXICITY

In childhood, the brain is more vulnerable to the harmful effects of ammonium than in maturity. Hyperammonemia causes irreversible damage to the developing central nervous system, resulting in cognitive impairment, seizures, and cerebral palsy due to cortical shrinkage, ventricular hypertrophy, and demyelination. Ammonium exposure impacts various amino acid routes and neurotransmitter systems, as well as cerebral energy metabolism, nitric oxide generation, oxidative stress, and signal transduction pathways, according to recent studies.

CADMIUM TOXICITY

Chronic cadmium exposure produces central nervous system problems, such as olfactory impairment. The mobility of cadmium in synapses was investigated utilising in vivo micro dialysis to elucidate cadmium toxicity in synaptic neurotransmission in the brain. The release of (109)CdCl(2) into the extracellular space was aided by stimulation with high K(+) one and 24 hours after injection into the amygdala of rats, showing that cadmium taken up by amygdalar neurons is released into synaptic clefts in a calcium- and impulse-dependent way. Furthermore, the amygdala was perfused with artificial cerebrospinal fluid with 10-30 microM CdCl to investigate the function of cadmium in synapses (2). During cadmium perfusion, the release of excitatory neurotransmitters such as glutamate and aspartate into the extracellular space was reduced, while the release of inhibitory neurotransmitters such as glycine and gamma-amino butyric acid (GABA) into the extracellular space was enhanced. These findings imply that cadmium released from amygdalar neuron terminals influences the degree

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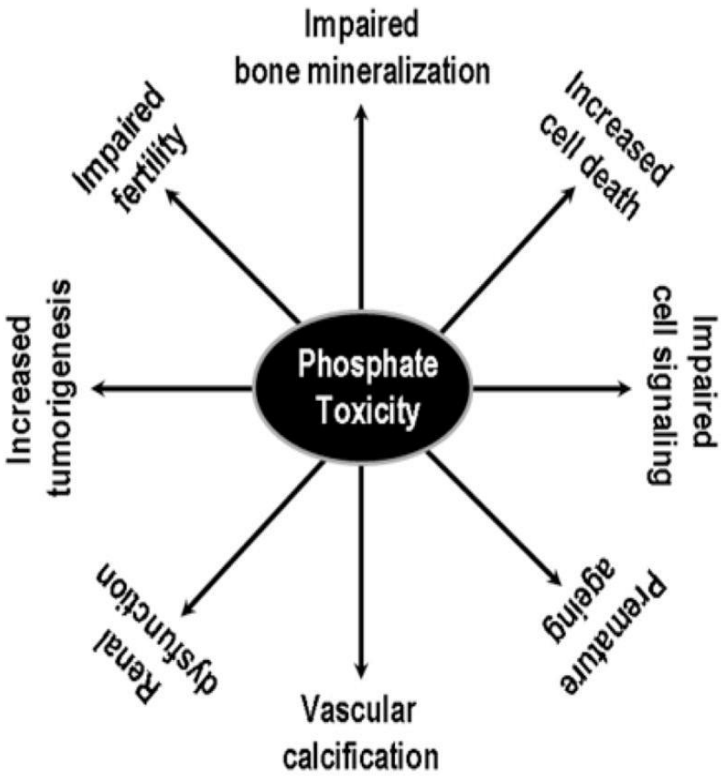
and balance of synaptic excitation-inhibition.

PHOSPHATE TOXICITY



Potash toxicity

In experimental settings, elevated brain potassium levels are linked to neuronal injury. Synaptic transmission and the normal functioning of the neuron-glia signalling network require brain ion homeostasis. Several mechanisms may contribute to transient or prolonged accumulation of brain extracellular potassium (K+) after aneurysmal subarachnoid haemorrhage (aSAH): erythrocytolysis, unspecific membrane breakdown due to parenchymal injury, dysfunction of the Na+/K+ pump, and, on the one hand, compromised glial buffering, and, on the other hand, activation of neuronal ATP–sensitive, or G protein–dependent, calcium-sensitive K. Both blood chemicals and ischemia can cause cortical spreading depolarization during aSAH (CSD). CSD causes a rise in brain extracellular Concentration ([K+]) of up to 60 mmol/L, considerably beyond its natural limit. Extracellular [K+] levels in the brain are only reached at such high levels during ictal epileptic episodes with spreading depolarization. Extracellular [K+] increases from 3 to 12 mmol/L during ictal epileptic seizures, by comparison.

Higher brain extracellular [K+] was linked to higher cerebral micro dialysis (CMD) lactate and CMD glutamate levels, increased intracranial pressure (ICP), and poor functional outcome in patients with severe traumatic brain injury (TBI), implying a link between higher brain extracellular [K+] and brain parenchyma dysfunction and/or damage. Plasma [K+] derangement is linked to muscle weakness, cardiac arrhythmia, and, to a lesser extent, cerebral symptoms like lethargy, irritability, confusion, and coma. Concomitant Na+ and acid-base abnormalities are more likely to cause

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neurological symptoms, suggesting that brain extracellular [K+] may be independent of plasma K+ levels. The results of animal investigations have revealed that a disturbed blood–brain barrier might be open to big molecules while maintaining the extracellular [K+] stability. The link between plasma and cerebral extracellular [K+] following acute brain damage in humans is poorly understood.

RADIOACTIVE ELEMENT TOXICITY

DU passes the blood-brain barrier and accumulates in the brain, concentrating in certain areas. At least with oral exposure, the hippocampus and striatum absorb DU more quickly than the cerebellum and cortex. When a dust exposure protocol is used, DU accumulates in the CNS in the olfactory bulb, hippocampus, cortex, and cerebellum, displaying rising DU concentrations in that order. DU not only accumulates in the CNS, but also has physiologic activity there. DU inhibits the development of spikes in the hippocampus of rats. DU also modifies the electroencephalographic architecture of the EEG in free moving rats, resulting in abnormalities in the sleep waking cycle and REM sleep, according to research. The behaviour of rats in the open field and the Y maze is affected by DU exposure, implying that DU has neurophysiologic consequences. A number of behavioural consequences associated with DU exposure have also been documented in this lab, including impaired development and maze activities. Others, on the other hand, discovered that neither DU nor enriched uranium exposure changed sleep wake cycles or spatial behaviour.

TREATMENT

Treatment involves symptomatic and supportive care. Small Ingestions Small ingestions can be managed by the owner at home. If the pet vomits, the owner can withhold food and water for 1 to 2 hours; then gradually reintroduce water to the pet. Only 1 or 2 episodes of diarrhea is expected; no antidiarrheal medication is needed. Large Ingestions When recent large ingestions of fertilizer (> 0.5 g/ kg) occur, emesis is recommended in asymptomatic animals. At Home. Owners can induce vomiting at home with hydrogen peroxide (2.2 mL/kg body weight PO). If a significant amount of fertilizer is recovered, further treatment may not be required.

In Hospital. In the hospital, Apo morphine (0.023 mg/kg IV) can be administered to induce vomiting. Activated charcoal is not recommended because it binds poorly to minerals and is unlikely to be benefi cial. If the elemental iron dose is greater than 20 mg/kg and the animal is asymptomatic, milk of magnesia, which complexes with the iron and decreases its absorption, can be administered (5–15 mL/dog Q 12 H).

Additional Therapy:

- Antiemetic, such as maropitant (1 mg/kg SC Q 24 H) or ondansetron (0.1–0.2 mg/kg IV Q 8–12 H), are recommended if significant vomiting develops.
- Gastrointestinal protectants may be used as needed, including sucralfate (0.25–1 g/kg Q 8 H for 3–5 days), omeprazole (0.5–1 mg/kg Q 24 H), and/or a histamine-2 blocker, such as famotidine (0.5–1 mg/kg Q 12 H).

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- Metronidazole (10–20 mg/kg Q 8–12 H for 3–7 days as needed) is recommended when large ingestions result in bloody diarrhea.
- Fluids are recommended if an animal seems to show signs of shock or has significant vomiting and diarrhea.

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Popular Article

Indolent Ulcer in Cats

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Feline indolent ulcers, also known as rodent ulcers or eosinophilic ulcers, are common dermatological conditions affecting cats. Only a few authors have reported the condition in dogs (Kim *et al.* 2010). It is a condition included among Eosinophilic Granuloma Complex which also includes two other forms, the eosinophilic plaque and eosinophilic granuloma. Manning *et al.* (1987) has reported the coexistence of all the three forms in one animal. The presentation of lesions are either unilateral or bilaterally symmetrical or asymmetrical and usually occur on the upper lip close to the philtrum. They also appear on other parts of the body. The ulcers are painless, non-pruritic and usually associated with submandibular lymphadenopathy. They are depressed, reddish, circumscribed lesions with raised borders. In some cases, ulcers are preceded by swollen lips.

Several underlying factors are identified that lead to eosinophilic ulcers including flea bite hypersensitivity, food allergy, atopy and insect bite hypersensitivity (Leistra et al., 2005). Power and Ihrke (1995) have also proposed a genetic cause for the condition. The lesion must be differentiated from other conditions such as squamous cell carcinoma, herpes virus infection, lymphoma and mast cell tumours (Miller et al. 2013). Oncogenic transformation and progression of indolent ulcer into fibrosarcoma and squamous cell carcinoma has also been reported (Manning *et al.* 1987). Cytological examination reveals predominance of eosinophils with or without the presence of neutrophils. Epidermal hyperplasia with eosinophilic infiltration of dermis on histopathological evaluation is highly confirmatory of the condition (Miller et al. 2013). Diagnostic workup is also aimed at addressing the primary cause of the condition. Hence tests such as dietary trial, intra-dermal allergy testing, identification of fleas, flea dirt are also performed. Therapeutic protocol includes anti-inflammatory drugs, corticosteroids and antibiotics along with controlling the underlying cause of the condition.

Fig 1a. Depressed, circumscribed ulcer with raised borders close to the philtrum; b. Predominance of eosinophils on cytology

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