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August, 2022
Vol 2 Issue 8

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THE SCIENCE WORLD

A Monthly e Magazine

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Vol 2 Issue 9

September, 2022

Visit official Website
https://www.thescienceworld.net

ISSN:2583-2212

THE SCIENCE WORLD

A Monthly e Magazine
ISSN:2583-2212

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Volume 2(5) May-2022

THE SCIENCE WORLD

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Volume 2(5) May-2022

THE SCIENCE WORLD

A Monthly e Magazine

ISSN:2583-2212

THE SCIENCE WORLD
A Monthly e Magazine
ÍSSN: 2583-2212
August, 2022; 2(8), 1259-1264

Popular Article

Mastitis A Global Threat to Dairy Heard and Farmers

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DOI: https://doi.org/10.5281/zenodo.6958844

Abstract

Bovine mastitis, an inflammation of the mammary gland, is the most common disease of dairy cattle causing economic losses due to reduced yield and poor quality of milk. The etiological agents include a variety of gram-positive and gram-negative bacteria, and can be either contagious (e.g., *Staphylococcus aureus*, *Streptococcus agalactiae*, *Mycoplasma* spp.) or environmental (e.g., *Escherichia coli*, *Enterococcus* spp., coagulase-negative *Staphylococcus*, *Streptococcus uberis*). Improving sanitation such as enhanced milking hygiene, implementation of post-milking teat disinfection, maintenance of milking machines are general measures to prevent new cases of mastitis, but treatment of active mastitis infection is dependent mainly on antibiotics. However, the extensive use of antibiotics increased concerns about emergence of antibiotic-resistant pathogens and that led the dairy industries to reduce the use of antibiotics and adopt the preventive measures to reduce the spread of mastitis and antibiotic use.

Introduction

Bovine mastitis (*mast* = breast; *itis* = inflammation), It is an inflammatory disease of cow and buffalo mammary gland caused by various infectious or non-infectious etiological agents. Mastitis must have been one of the first observed diseases of farm animals when cattle were domesticated over 5000 years ago. Since, then it has been an ever-existing problem for all those who kept and milked dairy cattle and buffaloes. Milk production alone involves more than 70 million producers in India, each raising one or two cows/ buffaloes primarily for their livelihood. bovine mastitis remains one of the important production diseases of dairy animals which directly or indirectly affect the economy of the farmers and ultimately affect the economy of the country. It is considered the most common disease leading to economic loss in dairy industries due to reduced yield and poor quality of milk.

The occurrence of disease is an outcome of interplay between the infectious agents and management practices stressing the defense of udder. According to Kennedy and Miller (1993), mastitis is expressed by tissue injury caused by tissue invasive or toxigenic organisms, which become dominant due to upset of balance in microbial population. It is a complex disease resulting from interplay between infectious agents and managemental practice andenvironmental factors. The most important changes in the milk include discoloration and presence of clots and large number of leukocytes.The disease leads to accountable economic losses by reduced milk yield (up to 70 %), milk discard after treatment (9%), cost of Veterinary services (7 %) and premature culling (14 %) of animal (Bhikane and kawitkar, 2000).

A number of factors affecting susceptibility to mastitis are: -

- Physiological status of cow.
- Level of milk production.
- Parity of cow.
- Inherent feature.
- Environmental condition

Etiology

Mastitis is a multi-etiological complex disease. More than 250 infectious causes of bovine mastitis are known to date and in large animals the most common pathogens are the mastitis causing bacterial species are *Escherichia Coli, Staphylococcus aureus, Streptococcus agalactiae, and Corynebacterium bovis* and also due to fungal, yeast or viral infection. Over use of antibiotics and poor sanitation leads to yeast mastitis (Ganguly, 2018). The infection is spread at milking time when bacteria contaminated milk from an infected gland comes in contact with an uninfected gland, and the bacteria enter the teat canal. CNS is a recently emerging pathogen causing bovine mastitis. The predominance of a bacterial species may varyaccording to the geographical region under scrutiny. S. aureus is one of the significant pathogens causing mastitis in dairy ruminants in many countries. Generally, the mastitis due tofungi and yeast is uncommon or rare. But a low prevalence of fungal mastitis of 2 to 7% has been reported. The prevalence of mycotic mastitis is usually very low (1-12% of all mastitis causes) but sometimes it can occur in enzootic proportions.

Mastitis can be categorized in two major groups:

- **Contagious mastitis:** - The causative organisms living on the skin of the teat and inside the udder. They can be transmitted from one cow to another during milking.
- **Environmental mastitis:** - The causative organism not live on the skin or in the udder but enter the teat canal when the cow comes in contact with contaminated environment. These pathogenic organisms found in faeces, bedding material and feed.

MODE OF TRANSMISSION

- Through teat canal.
- Fly and insects.
- Contaminated bedding materials.
- Contaminated milker's hands and cloths.
- Contaminated machine cup by affected

Quarter.Symptom:

The most obvious symptoms of clinical mastitis are abnormalities in:

- The udder such as swelling, heat, hardness, redness, or pain; and
- The milk such as a watery appearance, flakes, clots, or pus.

Other symptoms, depending upon the severity of the illness and how systemic it has become, can also include:

- A reduction in milk yield.
- An increase in body temperature.
- The lack of appetite.
- Sunken eyes.
- Signs of diarrhoea and dehydration.
- A reduction in mobility, due to the pain of a swollen udder or simply due to feeling unwell.
- Changes in milk composition even in cows with subclinical mastitis can result in significant changes in the protein composition in milk. While overall protein content may be unaffected, changes in the *types* of protein present may be affected by the leaching of (low-quality) blood serum proteins into milk; **casein**, an important protein found in healthy milk can be significantly reduced in sub-mastitic cows, and a further complication is that casein is closely linked with **calcium** levels in milk production.

According to symptom mastitis divided into two groups: -

1. Clinical Mastitis: -

It is characterized by visible change in milk, udder or teats. It is further classified as: -

• **Per acute mastitis:** –

Characterized by painful swelling of udder, fever(105-1060F) shivering, anorexia, depression,cessation of milk secretion and blood-stained exudates from teat canal.

• **Acute mastitis: –**

It is similar to Per acute mastitis but systemic sign like fever, depression is not seen, Udder become swollen and milk secretion changed to curdy yellow material or brown fluid with flakes or clots. Infection may be in one quarter or entire udder.

• **Sub-acute mastitis: –**

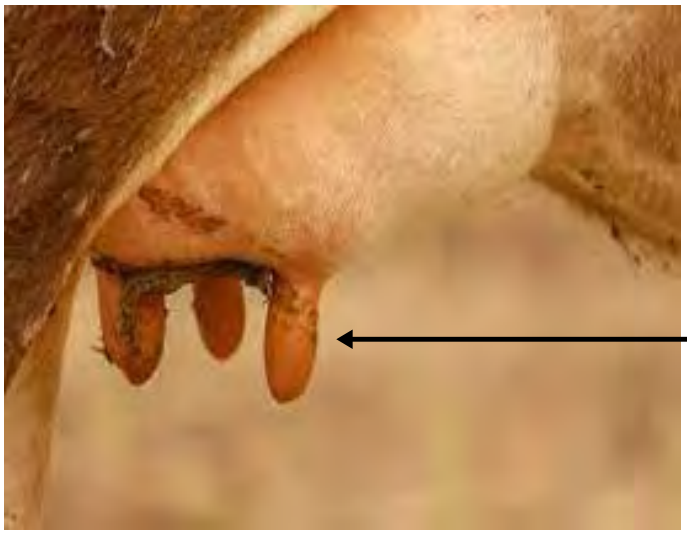
There is a variable change in the milk but no Practical changes seen in udder and visible systemic sign. Cultures of milk only show presence of pathogenic bacteria.

• **Chronic mastitis: –**

It occurs due to persistent infection of udder. Udder becomes hard due to fibrosis. The quartersmay become thickened, firm, nodular and atrophic.

2. sub-clinical mastitis: –

It is characterized as change in milk composition without any visible change in udder or milk. Sub-clinical mastitis reducing milk production, decrease milk quality and suppress reproductive performance. A high somatic cell count (SCC) is indicative of sub-clinical mastitis.



Mastitis affected teat

Diagnostic Technique

Observation and Physical examination of the udder.Test of milk by different test method like Strip cup test, PH test, Chloride test, California mastitis test (CMT), Bromothymol blue test (BTB), Bromocresol purple test, White side test, Hotis test, Biosensing, Isolation and identification of the organism, Cultural examinations, Biochemical test, Serological test, Electrical conductivity test (EC test), Somatic cell count(SCC)

Treatment

• Remove secretion as much as possible from affected quarter. Sterile test siphon may be used to drain out the milk/secretion

• Intramammary (IMM) antibiotic for 3-5 days.

(Milk should not be used for human consumption at least 72 hours after last infusion)

- Systemic antibiotics (IV, IM, SC) for 3-5 days.
- Systemic anti-inflammatory drug for 3-5 days.
- Antihistaminic drug.
- Corticosteroid may be given to check fibrosis.
- Enzyme like Serratopeptidase and Hylase to digest the pus.
- Immunomodulator preparation containing Vit.- E and Se for 4 days.
- Topical application of anti-inflammatory ointment twice a day for 5-7 days.
- Drying off quarters which do not respond to treatment by silver nitrate solution or coppersulphate solution.

Preventive Measures

- Washing the udder and hand of milker with antiseptic before and after milking.
- Infected cow/teat should be milked at last.
- First strip of milk should not allow falling on the floor. It should be stripped in separatecontainer.
- Mastitis milk should be properly disposed. 5% phenol may be added to the infected milk atthe time of disposal.
- Dipping of all teats following each milking with Iodophor solution containing 1% availableiodine or Hypochlorite solution.
- The animal should not allow lie down immediately after milking for an hour by engagingwith feed and fodder.
- Cleaning and disinfecting milking machine after each milking.
- Dry cow therapy to prevent occurrence of mastitis after parturition.
- Newly purchased cows should be kept and milked separately until screened formastitis (CMT).

• Cow should allow soft bedding following parturition.

• Concrete floor predisposed to mastitis. Bedding should be done with straw, saw dust or sand. Sand is the best, since it has lower bacterial content.

• The non-responsive quarter should be permanently dried up.

Vaccination

Vaccinating cattle can be deemed as a preventive mastitis treatment in herds. Most vaccines are designed to target *Staph. aureus*, *Strep. agalactiae*, and *E. coli*. However, vaccines are yetto provide reliable protection.

Conclusion

Mastitis remains one of the most economically devastating diseases in dairy cows. Vaccinationis one tool that could be used to prevent mastitis. However, regardless of the type of vaccine used, it alone is not necessarily effective or economical especially in dairy herds with high mastitis rates. The combination of vaccination and the application of other infection control procedures, such as excellent milking hygiene procedures, treatment of clinical cases, segregation, and culling of known infected cows are important preventative measures that usually result in a significant reduction in the incidence and duration of intramammary infections.

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THE SCIENCE WORLD
A Monthly e Magazine
ÍSSN: 2583-2212
August, 2022; 2(8), 1265-1267

Popular Article

Management of skin diseases in Dogs and Cats

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Introduction

What is dermatology?

Dermatology is defined as the branch of medicine dealing with skin, nails, hair, and its diseases. Veterinary dermatologists are veterinarians who specialize in the diagnosis, treatment, and management of skin, ears, hair, nail, hoof, and mouth problems in animals.

Components of skin:

Epidermis: The outermost layer of skin, provides a waterproof barrier and creates skin tone
Dermis: present beneath epidermis contains tough C.T, hair follicle, and sweat glands.
Deeper subcutaneous: made up of fat and C.T

Skin diseases in Dogs:

Black skin disease
Seborrhoeic dermatitis
Atopy
Demodectic mange
Pyodermatitis
Cutaneous streptothicosis
Fungal infections etc.

Skin diseases in Feline:

- Ringworm
- Eosinophilic granuloma
- Pyoderma
- Cat scratch disease
- Urticaria
- Ectoparasite infestation etc.

Diagnosis of skin diseases:

- Examination of skin scrapings for mite: 1. Direct KOH method. 2. Sedimentation method. 3. Sugar floatation method.
- Examination of a skin scraping for fungus: 1. Direct examination 2. cultural examination.
- Microbiological examination for identification of bacteria spp.
- Blood smear examination for the presence of protozoa.
- Allergy testing to detect the type of allergen causing skin disease.
- Examination under woods light for detection of fungus.

General management of skin diseases in canine and feline:

- Don't keep pet animals in a wet area or don't allow them to sit on wet soil places.
- Maintain overall body health by shampooing with antifungal shampoos once a week.
- Grooming of the hair of the pets is also important to prevent an infestation with ectoparasites.
- Agents or vaccinations used to kill mites should be used annually.
- Oral preparations to prevent skin infections should be given periodically.

How to avoid occurrences of skin diseases in Canine and Feline:

- Feed a high-quality diet to help prevent skin problems in dogs and cats.
- Keep your dog or cat at a proper weight to help prevent skin disease.
- Prevent canine and feline disease by terminating fleas and mites.
- Keep your pet well-groomed to prevent skin problems.

Home remedies for skin diseases and hair loss in canine and feline:

- Apple cider vinegar: Healing property reduces infection and provides quick relief.
- Coconut oil: The lauric acid in coconut decreases the development of yeast growth on dogs' skin.
- Lemon water: reduces inflammation and provides relief from skin infections.
- Benadryl: Benadryl is a common human antihistaminic and can be given to dogs suffering from allergic reactions.
- Flaxseed oil: it is another home remedy for hair shedding in pet dogs.
- Aloe vera: this helps to soothe skin and prevent hair loss and itching.

- Supplements: omega 3 and fatty acids can be very beneficial to hair coat and hair loss.

Conclusion:

- While preventing the occurrence of skin disorders is difficult, with correct care and treatment, we can reduce the risk of disease occurrence to a minimum. Animal owners should be aware of the different types of skin infections that their dogs might have and how to prevent them. They should be advised to maintain their animal's hygiene and sanitation, as well as to get regular vaccinations to keep their cherished pets healthy.

THE SCIENCE WORLD
A Monthly e Magazine
ÍSSN: 2583-2212
August, 2022; 2(8), 1268-1273

Popular Article

Impact of Covid 19 on Livestock Sector in India

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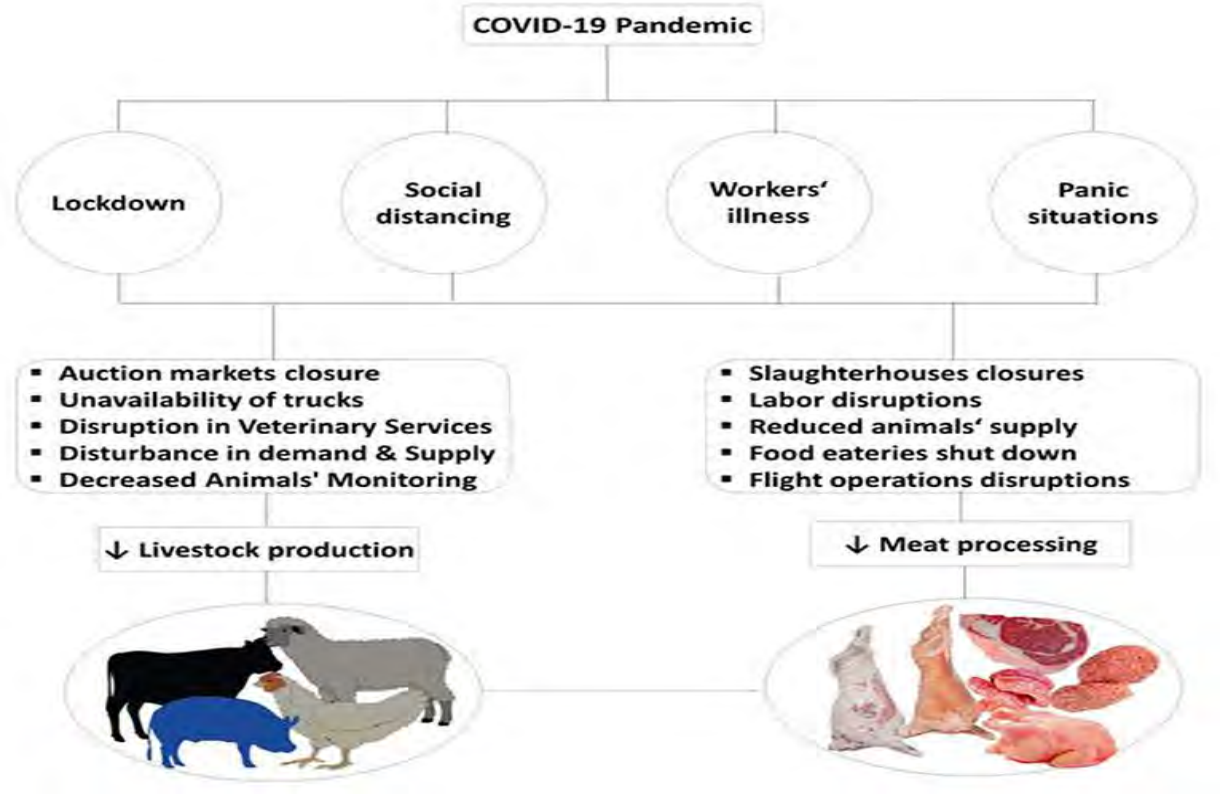
Introduction

Covid-19 has major impact on the global health and driven back the financial positions by taking lives, destroying livelihood etc. It has been a global emergency which created at multidimensional havoc in the society. Besides these, it also set off a great loss in our food chain system affecting the livestock sector apprehending its essence and how farmers and livestock industries are struggling. With a population of 536.76 million livestock and 851.81 million poultry, the sector has been the major contributor of animal protein in the country (DAHD, GOI, 2020) Lesson from the past influenza (1918) and swine (2009) flu pandemic which deranged livestock value chain with socio-economic consequences.

Background

In order to stop community transmission of the disease, India was put under national lockdown which affected the vulnerable groups and poverty stricken were at great risk. Farmers depending on others resources for such as land, bulk producers, laborers, wage earners etc. were worst affected due to this pandemic. Access of livestock feed in large commercial farms, bulk animal producers (seed farms) were highly affected due to disruption of transport connectivity. Livestock products being included in the non-perishable items, reduction of market access has affected the small-scale producers as well as large commercial dairy or livestock farmers as a whole. However, the dimensions of problems faced by the livestock farmers vary from feed scarcity, non-availability of roughages, lack of storage facility, absence of labor and proper marketing including the price of livestock produce.

When an infectious disease breaks out, the hungry population will increase, and workers will decrease accordingly. Since the virus can spread from person to person through the air, and workers (occupational) in meat and poultry processing plants need to work closely with each other, this increases the risk of virus transmission. As a result, meat and poultry processing plant employees become sick, putting livestock companies at risk of closing down, which as an obvious consequence reduces the supply of livestock products. As processing plants are blocked, many poultry producers have had to discard animals because they cannot supply them to meat processing plants. In addition, restrictions on social distancing and transportation have caused sales difficulties, and many dairy farmers have had to dump milk.



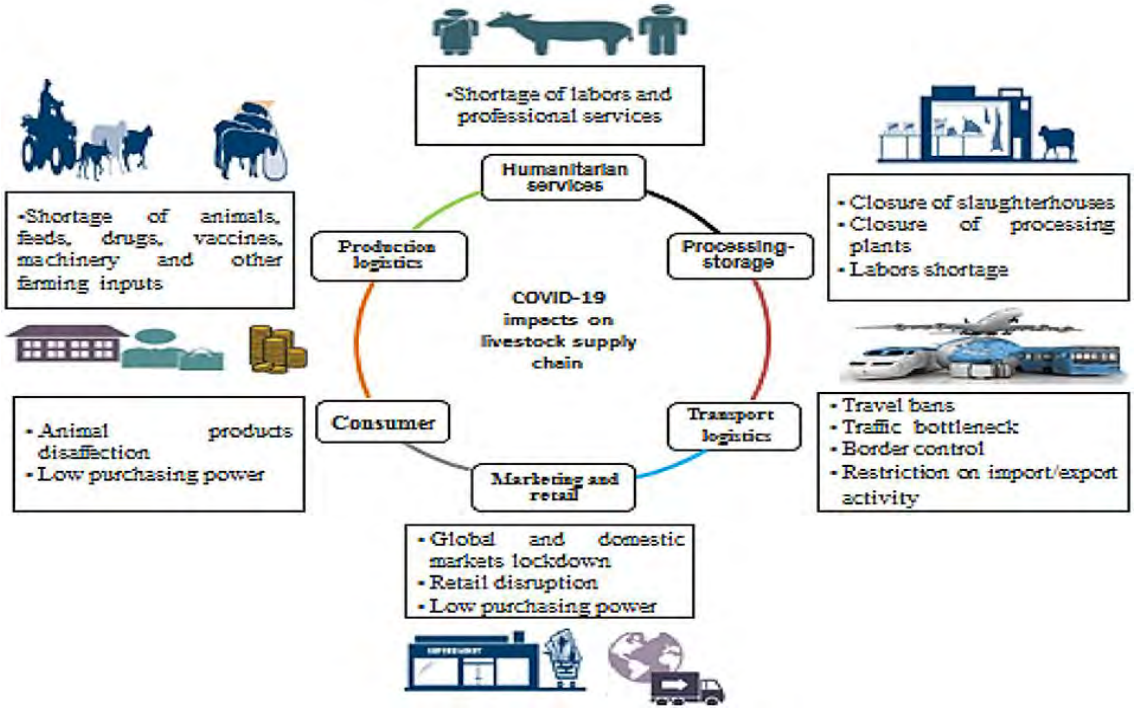
The closure of restaurants, hotels, and schools has also affected the sales of livestock products. Due to sales difficulties and the high cost of raising animals, this has led to the unfortunate problem of euthanasia of animals.

Due to the COVID-19 pandemic, the labour force of the livestock industry shrank, and many processing plants closed or reduced processing capacity; livestock companies faced difficulties in slaughtering and processing livestock. The increase in consumption of livestock

products has always been a driving force for the development of the livestock industry. However, the COVID-19 outbreak has caused significant losses to all economic sectors including the livestock industry, livestock companies and farmers have been losing their regular customers. The blockade of hotels, schools, and restaurants (the main consumers of animal products) and the tourism slump have led to a sharp decline in market demand for animal products, which further makes it difficult for livestock companies to sell their products

Impact On Livestock Industry

Due to Covid-19 pandemic food industries are facing significantly reduced consumption and supply chain disruption challenges. The livestock producers facing drastic drop in business due to this disruption along with limited mobility of people across the border. The worst part of the countrywide lockdown was that it coincided with the country's peak harvesting time of a variety of crops of the season. Summer vegetables and fruits were ripened, ready to pick; wheat, paddy and barley crops were ready for harvest but the entire farmer's hard work went in vain due to sudden halt of the country. There was a huge demand and supply gap as the food processing companies are running at low manpower when maximum quality work is labour-intensive. The closure of live animal markets in many countries has caused livestock producers to face difficulties in



selling animal products, which has greatly reduced the opportunities for livestock products to enter the market for consumers to purchase. In addition, due to traffic restrictions and the fear of being infected by the virus, people have drastically reduced the frequency of going to supermarkets and markets to purchase animal products from on-site stores, which has further led to a decline in sales of animal products.

The situation is similar in all affected countries with intensive livestock production industries. Following are some of the major impacts of pandemic on animal production:

- Access to Animal feed: Due to shortage of manpower, reduced supply of raw materials has been gravely hit the livestock feed processing industries. Globally for instance, certain countries have banned export of livestock produces creating a demand-supply gap in the animal feed industry. Many of the feed industry in India are dependent on the migratory labourers. But the first ever country wide lockdown put the entire feed production industry in crisis resulting in immediate shortage of animal feed supply.
- Diminution of market access: Due to lockdown, the disruption of transportation and logistical channels has reduced the sales of live animals as well as livestock products. The pandemic's initial estimated impact on the beef industry is around $13.6 billion, with additional influences that can occur in the future if the covid-19 situation does not come to control. Due to shortage of proper cold storage farmers are compelled to dump their non-perishable yields. For instance, milkmen of Palabavi village near Chikkodi in Belagavi district, Karnataka threw around 1,500 litres of milk into an irrigation canal as they had no way to sell it during the COVID-19 lockdown. Although lockdown facilitate direct contact between producers and consumers by selling of livestock produces door to door basis, but this also led to fetching lower.
- Lockdown halted services: Movement restriction, derange in national and international trade has a major impact upon accessing to breeding stocks, replacement stocks, importing superior germplasm etc. As per the higher officials, the outbreak of African swine fever (ASF) has claimed more than 13,000 pigs in the last year in different parts of Assam, affecting the livelihood of hundreds of people involved in the animal husbandry in the state.

Restrictions on import will have more preponderant impact on certain places which depend on imports to sustain engenderment or rely on meat and dairy imports for consumption.

- Shutdown of services: In order to prevent spread of covid-19, all related services to livestock (except medical aid) around the globe were asked to shut down their activity which gravely hit the workers/labourers as well as the consumers.
- Fake social media forwards can also reduce the demand and downgrade the livestock industry. For instance, In India during the first covid-19 wave, chicken sales were significantly reduced after a social media storm to create an impression by miscreants that human could contract Covid-19 by consuming chicken.

Case Study

After the outbreak of COVID-19, the sales of animal products on online sales platforms in China showed a significant increase, but the sales in the physical market have dropped significantly. In addition, there were rumours that livestock can spread COVID-19 and people should stop buying and eating animal products. These misunderstandings that led to the belief that livestock or animal products are the hosts or carriers of the virus have left people with the impression that humans may be infected with COVID-19 through the consumption of animal products, which has further exacerbated the decline in sales of meat and other animal products. The interruption of international trade routes also limits the development of livestock enterprises, which may eventually affect the sales of meat products and dairy products export suppliers, and further reduce the income of livestock companies and farmers.

Mitigation strategy

Government and policy makers can consider the below mentioned option to mitigate the gravely impact of Covid-19 on the livestock industry while ensuring the public health measures to suppress the transmission.

- Permit specified group of dealers to distribute animal feed in remote areas.
- Waiving the feed transportation cost, farmer's bank loans, tax exemptions, marketing of livestock products in cooperative pattern (bulk collection) will encourage the farmers to ensure proper supply of animal protein.

- Allowing a good number of shops that serves perishable livestock products to sell in the market with no time frame which will reduce mass gatherings through controlled human movement.
- Allowing agencies to take over trans-boundary animal movements.
- Development of e-commerce platforms will reduce physical contact and help to ease marketing of goods.

Conclusion

Covid-19 pandemic has a huge socio-economic impact. Although it's the primal responsibility of people associated with livestock sector, policy makers and different institutions to make necessary arrangements to identify and attempt to alleviate the downbeat impacts of the covid-19 as livestock sector being the key contributor to these areas need utmost care to ensure maintenance of supply chain. Actions should be taken to protect this sector and its activities, services and products upon which the world pin hopes on. Preparedness and response measures at right time to tackle this pandemic will ensure sustainable livelihood. To ensure uninterrupted supply of meat, milk, egg and other livestock products, it should be included in the emergency goods list. Establishment of bulk collection centres to ensure preservation of perishable items for future use in the high production zones around the country. For rapid sharing of information between the veterinarians/researchers, new emerging technologies should be introduced to the stakeholders/farmers for effectual farm management.

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THE SCIENCE WORLD
A Monthly e Magazine
ÍSSN: 2583-2212
August, 2022; 2(8), 1274-1277

Popular Article

Blue tongue disease in Sheep

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https://doi.org/10.5281/zenodo.6972784

Introduction

Bluetongue is an insect-borne, viral disease primarily of sheep, occasionally goats and deer and, very rarely, cattle. The disease is non-contagious and is only transmitted by insect vectors. The disease is characterized by fever, widespread hemorrhages of the oral and nasal tissue, excessive salivation, and nasal discharge. Bluetongue (BT) is an Office International Epizooties (OIE) list A arthropod-borne viral disease

Etiology

The disease is caused by a virus belonging to the family Reoviridae. Bluetongue virus is the type species of the genus Orbivirus in the family Reoviridae. The virion is a nonenveloped double-layered particle with an outer capsid that encloses a core containing a segmented double-stranded RNA genome.

Epidemiology

The virus is present in most countries of Africa, the Middle East, India, China, the United States, and Mexico. Bluetongue virus infection, without associated clinical disease, is present in Southeast Asia, Papua New Guinea, northern South America and northern Australia. A strain of bluetongue virus was first identified in Australia in 1975 from trapped insects but despite its long-term presence, it has not caused any clinical disease.The distribution and intensity of infection in region of the continents is determined by climate, geography and altitude, as they effect the occurrence and activity of Culicoides vectors, and by presence of susceptible mammalian hosts.

Host Range

Primarily a disease of sheep but other species such as goats, cattle, buffaloes, camels, antelopes and deer can be infected. Humans are not affected. Cattles are the major reservoir host for sheep.

Mode of transmission

Vector-borne transmission through *Culicoides* spp is the primary way that BTV is transmitted. Virus concentrations in secretions and excretions are minimal, making direct, indirect, or aerosol transmission unlikely. Bluetongue virus has been found in the semen of infected bulls during the initial viremic period, and infection has been transmitted through bull semen to susceptible cows, but it is unlikely that this is a significant mechanism of transmission. Transplanted embryos from infected services are free of the virus and this is regarded as a minimal risk technique for obtaining offspring from cattle and sheep in infected areas

Clinical signs

In sheep, BTV causes vascular endothelial damage, resulting in changes to capillary permeability and subsequent intravascular coagulation, leading to edema, congestion, hemorrhage, inflammation, and necrosis. The clinical signs in sheep are typical. After an incubation period of 4–6 days, a fever of 40.5°–42°C (105°–107.5°F) develops. Affected animals are listless and reluctant to move. Clinical signs in young lambs are more apparent, and the mortality rate can be high (up to 30%). Approximately 2 days after onset of fever, additional clinical signs may be evident, such as edema of the lips, nose, face, submandibular area, eyelids, and sometimes ears; congestion of mouth, nose, nasal cavities, conjunctiva, and coronary bands; and lameness and depression. A serous nasal discharge is common, later becoming mucopurulent.

Post mortem findings.

Post mortem lesions include generalized edema, hyperemia and hemorrhage and necrosis of skeletal and cardiac muscles. There is a most distinctive hemorrhage at the base of the pulmonary artery. Animals with damage to esophageal or pharyngeal musculature may have lung consolidation due to aspiration pneumonia. Hyperemia and edema of the abomasal mucosa are some times accompanied by ecchymoses and ulceration. Microscopically there is thrombosis and widespread microvascular damage leading to myodegeneration and necrosis.

Diagnosis.

Primary diagnosis can be made based on clinical signs, oral, nasal, ocular lesion along with persistent high temperature and enlarged lymph nodes. Confirmatory diagnosis is based on

pathognomy histopathological lesion at necropsy. Various techniques have been used to detect antibodies against BTV. These include agar gel immunodiffusion (AGID), hemagglutination-inhibition, complement fixation and ELISA, which are serogroup-specific and serum neutralization, which is serotype-specific. Although all these assays are available, only AGID and competitive-ELISA are recommended as prescribed tests for international trade in the OIE Manual of Standards for Diagnostic Tests and Vaccines.

Prevention and control

1. **Reduction of infection through vector abatement**
2. **Vaccination**

Reduction of infection through vector abatement

Attempts to control bluetongue through a reduction of infection consist of reducing the risk of exposure to infected Culicoides and reduction in Culicoides numbers. Neither are particularly effective. Reducing the risk of exposure is attempted by spraying cattle and sheep with repellents and insecticides and housing sheep at night. Biweekly application of permethrin was found not to be effective in preventing infection. During transmission periods avoidance of low, marshy areas or moving sheep to higher altitudes may reduce risk. Because of the preference of some Culicoides for cattle as a host, cattle have been run in close proximity to sheep to act as vector decoys. Local application of insecticides on animals and around animal holdings can be efficacious against *Culicoides* species There is a high mortality in Culicoides that fed on cattle that have been treated with a standard anthelmintic dose of ivermectin and also a larvicidal effect in manure passed for the next 28 d for Culicoides that breed in dung

Vaccination

Vaccination will not prevent or eliminate infection but it is successful in keeping losses to a very low level provided immunity to all local strains of the virus is attained. Current vaccines are usually polyvalent attenuated virus vaccines and are in use in South Africa and Israel and available in other countries. These vaccines have been used in South Africa for more than 50 years and they are known to induce effective and long lasting immunity. Currently they are produced in cell culture and freeze dried.

Treatment

Local irrigations with mild disinfectant solutions may afford some relief. Affected

sheep should be housed and protected from weather, particularly hot sun, and fluid and electrolyte therapy and treatment to control secondary infection may be desirable. (Radostits and Blood,1994)

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THE SCIENCE WORLD
A Monthly e Magazine
ÍSSN: 2583-2212
August, 2022; 2(8), 1278-1281

Popular Article

Salmonellosis in Poultry

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https://doi.org/10.5281/zenodo.6973177

Abstract

Salmonellosis in birds is thought to be the most common bacterial disease affecting the poultry industry globally. It has a substantial impact on public health and is expensive in many nations. This subject requires a lot of time because of the economic and public health burden chronic diseases entail. This review article suggests that a more efficient implementation of currently available control measures would significantly lower the risks to the public's health.

Introduction

One of the most significant bacterial infections in chicken, Salmonella infection is brought on by a range of Salmonella species and results in huge economic losses through mortality and decreased productivity. One or more Salmonella species belonging to the family Enterobacteriaceae can cause acute or chronic salmonella infections in chicken. Additionally, zoonotic relevance is associated with motile Salmonellae (paratyphoid group) infection, which causes salmonellosis in hens.

Epidemiology of Avian Salmonellosis

Avian Salmonella infections are significant as a source of food-borne disease transmission to people as well as a cause of clinical disease in poultry. The genus Salmonella belongs to the Enterobacteriaceae family and is a facultative intracellular pathogen that can cause systemic or localized infections as well as a long-term asymptomatic carrier status. Salmonella enterica subsp. enterica serovar Gallinarum, which is separated into two distinct biovars under the serogroup D1 and is known as S. gallinarum and S. pullorum, respectively, is the causative agent of pullorum disease and poultry typhoid.

The salmonella serogroup D1 also includes S. enteritidis, S. panama, and S. dublin in addition to S. gallinarum-pullorum. Paratyphoid salmonellae are the many motile, non-host-adapted, highly invasive serotypes like Salmonella enteritidis and Salmonella typhimurium. Compared to brooding (14.55 percent), developing (16.10 percent), and pullet (16.10 percent) chickens, adult layers (53.25 percent) had the greatest infection rate for avian salmonellosis.

Various routes of infection

- Oral route
- nasal and cloacal route
- vertical transmission either from an infected ovary, oviduct or from the infected eggs
- contaminated feeds, water and litter

Risk factors responsible for *Salmonella* contamination of broiler-chicken flocks

- Inadequate level of hygiene
- Salmonella contamination of the previous flock with a persistence inside the house
- Contaminated day-old chicks and feed
- The farm structure (>3 houses on the farm)
- Wet and cold season
- Litter-beetle infestation of the house

Pathogenesis and Disease Syndrome of Avian Salmonellosis

Salmonella is invasive and has the capacity to live and grow in cells, particularly macrophages, which contributes to its pathogenicity. The digestive tract is where these bacteria multiply most frequently, which could lead to widespread environmental pollution from bacterial excretion through faeces. After entering the body through the intestinal mucosa, cecal tonsils, and Peyer's patches, the organisms are consumed by macrophages before spreading to the liver and spleen, which are the primary sites of multiplication, through the bloodstream and lymphatic systems. They may cause a second invasion and be localized in different organs, such as the ovaries, oviduct, heart, pericardium, gizzard, yolk sac, and/or lungs, in the event that the body's defense mechanisms are insufficient. In the avian challenge, S. typhimurium quickly inflamed the intestinal mucosa, but S. pullorum first targeted the Fabricius bursa before inducing inflammation

of the intestinal mucosa. While fowl typhoid exhibits symptoms of septicemic sickness, pullorum disease primarily develops as an intestinal disease of hens. Both septicemic biovars can result in acute or chronic infections, but unlike S. pullorum, S. gallinarum can also result in acute infections and hemolytic anaemia in both children and adults. Young broiler chicks are very pathogenic to S. gallinarum.

Unless the etiological agent is isolated and identified, pullorum illness and fowl typhoid cannot be distinguished from one another. Anorexia, diarrhoea, dehydration, weakness, and a high mortality rate are some of the clinical symptoms that affect chicks and poults. The symptoms of pullorum illness and chicken typhoid in mature fowls include anorexia, decreased egg production, increased mortality, decreased fertility, and decreased hatchability. Adult birds with S. pullorum infection may or may not show any clinical symptoms, and their physical characteristics may not allow for physical detection. Furthermore, it is still unclear how exactly these chicken diseases are contracted.

Diagnosis of Avian Salmonellosis

Salmonella strain isolation, identification, and serotyping should be done in order to validate the diagnosis of avian salmonellosis. Serologic testing, necropsy analysis, accompanied by microbiologic culture and typing for confirmation, can be used to detect infections in mature birds. A serological ELISA test has been developed to diagnose avian salmonellosis caused by S. typhimurium or S. enteritidis. Molecular test like PCR, RTPCR, PSR, LAMP have also been developed for diagnosis.

Preventive Measures for Controlling Avian Salmonellosis

Achieving successful control programmes requires establishing excellent management practices, routine serological tests, and a slaughter policy. Chicks should be free of diseases, and they should be kept in an environment that is clean, sanitized, and free of S. gallinarum and S. pullorum with stringent biosecurity measures. Salmonella should not be present in the feed or water. The dead birds must be disposed of properly. The disease may be controlled with vaccinations, and poultry typhoid and pullorum disease may be treated with antibiotics.

Public Health Concerns of Avian Salmonellosis

The majority of Salmonella strains are potentially dangerous to both humans and animals, which raises concerns about salmonellosis' impact on public health. People who are exposed to avian salmonellosis may experience health problems. Food poisoning symptoms, like diarrhea and acute gastroenteritis, are present. However, it appears that birds primarily pick up the illness from their surroundings, and diseased birds only play a minor part in the spread of the illness to domestic animals and people. Salmonella is the focus of various global, national, and local monitoring programmes because to public health concerns and the potential for foodborne zoonotic transmission.

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THE SCIENCE WORLD
A Monthly e Magazine
ÍSSN: 2583-2212
August, 2022; 2(8), 1282-1285

Popular Article

Native Medicinal Plants: An Alternate Choice for Wound Healing

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https://doi.org/10.5281/zenodo.6973220

Introduction

A Wound is a split in the epithelial integrity of the skin including deeper punctures with disruption ending to the dermis, subcutaneous fat, fascia, muscle or even bone (Enoch and Price, 2004). Wound healing involves a series of cellular and biochemical events in a coordinated manner in order to restore the function of epidermis and dermis (Stadelmann et al., 1998) and occurs in 3 phases Viz: Inflammation, proliferation and remodeling (Iba et al., 2004). Synthetic drugs like antibiotics, antiseptics, de-sloughing agents are generally used to treat the wounds which have the limitation of side effects and residues in tissues which is of public health concern in case of animals raised for its meat.

Alternately, Plants and plant-based constituents have been extensively used for treatment and management of wounds since ages (Sharma et al., 2021). Many studies have shown that use of medicinal plants improve wound healing in diabetic, infected and opened wounds by inducing healing and regeneration of lost tissue by various mechanisms. The definite pharmacological action is due to the presence of bio active constituents like alkaloids, terpenoids, flavonoids, essential oils, saponins and phenolic compounds (Edeoga et al., 2005). This article summarizes the details of such locally available medicinal plants used in wound healing.

Medicinal plants with wound healing activity:

1) Aloe Vera

Scientific name: *Aloe barbadensis miller*
Useful part: Leaves

A

Mechanism of action:

- Increases the collagen synthesis and collagen content
- Modifies collagen composition and increases collagen cross linking thus accelerating the wound contraction and enhancing the breaking strength of resulting scar tissue.

1) Turmeric

Scientific name: *Curcuma longa*
Useful part: Root
Active principle: Curcumin
Mechanism of action:

- It promotes fibroblast migration, granulation tissue formation, re epithelization and collagen deposition,
- It promotes wound contraction and scar tissue formation

2) Ginseng

Scientific name: *Panax ginseng*
Useful part: Root and Leaves
Active principle: Ginsenoside
Mechanism of action:

- Strengthen keratinocyte migration and induce proliferation
- improves healing following laser burning and excisional wound injury.

3) Neem

Scientific name*: Azadirachta indica*
Useful part: leaves and seed kernels
Active principle: Nimbin, Nimbidine, Nimbolide
Mechanism of action:

- Increases migration of fibroblast cells, epithelial cells, and synthesis of extracellular matrix together with collagen during the healing process.
- Promotes angiogenesis and fastens wound healing.

4) Burdock

Scientific name: *Arctium lappa*
Useful part: Root and Leaves
Active principle: Arctigenin
Mechanism of action:

- Stimulates collagen synthesis and helps in faster wound contraction,
- Promotes angiogenesis, vascular dilation

5) Centella (Gotukola)

Scientific name: *Centella asciatica*
Useful part: Leaves
Active principle: Asiaticoside and madecassoside
Mechanism of action:

- Promotes collagen remodeling and synthesis of glycosaminoglycans
- Promotes epithelialization and stimulates scar maturation by producing type-I collagen deposition
- Effective in treatment of small wounds, hypertrophic wounds as well as burns

6) Periwinkle

Scientific name: Catharanthus roseus
Useful part: Flower
Active principle: catharanthine, vindoline, vinblastine and vincristine
Mechanism of action:

- Improves wound contraction and hydroxyl proline content of granulation tissue
- Decreases epithelization period and has antibacterial activities

7) Yarrow/Soldiers's wound wort

Scientific name: *Achillea millefolium*
Useful part: Leaves and flowers
Active principle: achilleine, trigonelline and betonicine
Mechanism of action:

- Accelerates the healing process and confers breaking strength to the healed wound
- Significantly increases rate of wound contraction

9) Pot marigold

Scientic name: *Calendula officinalis*
Useful part: Flowers
Active principle: saponins, triterpenes, alcohol triterpenes, fatty acid esters, carotenoids, flavonoids, coumarines, essential oils, hydrocarbons, and fatty acids
Mechanism of action:

- Shows faster resolution of the inflammation phase with increased production of granulation tissue
- Stimulates angiogenesis
- Increases production of type I,II and III Collagen

10) Chamomile

Scientific name: *Matricaria chamomilla*
Useful part: flowers
Active principle: α-bisabolol, chamazulene, azulenesse, farnesene
Mechanism of action:

- Promotes faster epithelialization,
- Increases rate of wound contraction, together with the increased wound-breaking strength and hydroxyproline content

Conclusion

Wounds are a significant socio-economic burden to animal owners of low income group due to their high prevalence and recurrence especially in grazing and farm animals which can be efficiently managed by using the locally available herbs. Many of the plants used for wound healing are shown to have good results; however, scientific validation of these plants is needed.

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THE SCIENCE WORLD
A Monthly e Magazine
ÍSSN: 2583-2212
August, 2022; 2(8), 1286-1289

Popular Article

Artificial Induction of Lactation in Bovine

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https://doi.org/10.5281/zenodo.6973322

Abstract

Artificial induction of lactation is a method to stimulate normal lactation by using hormones/drugs. It helps in diminishing economy losses which result due to culling and replacement on account of reproductive failure or infertility in bovine. Several drug/hormone combinations are used for induction of lactation viz. estrogen, progesterone, other hormones (prolactin and glucocorticoids) etc. The milk produced is identical in composition to that of normal calving and acceptably good for human consumption. Induced lactation can serve as valuable alternative for high producing cows with low fertility. But it should be considered as last option for initiating lactation as it involves usage of exogenous hormones/drugs.

Introduction

Milk production is an endocrine as well as exocrine function. Lactation is a combined phenomenon of milk secretion and its subsequent removal from the mammary gland. It has two components namely- lactogenesis (initiation of lactation) and galactopoiesis (maintenance of lactation).

Reports suggest that infertility and reproductive disorders affect 10-30% of lactation (Erb and Martin, 1980). Economic benefits through milk selling can be obtained from artificial induction (especially in high producing cows) besides establishing normal reproductive cycle in anestrus cows. The population of stray cattle and buffalo will also be reduced following their rehabilitation.

Hormones/Drugs used for Induced Lactation

Hormones play a central role in the development and functioning of mammary gland. There are various methods of inducing lactation in infertile cows by using a combination of estrogen and progesterone. Addition of other hormones/drugs (prolactin, glucocorticoids, reserpine, etc) along with estrogen-progesterone for the onset of galactogenesis, further enhances milk yield during induced lactation (Tucker, 2000)

Estrogen and Progesterone Estrogen initiates lactogenesis in cattle at parturition by a) causing release of prolactin from the anterior pituitary gland and b) increasing the number of prolactin receptors in cells of mammary gland. Progesterone (P4) regulates lobulo-alveolar growth and blocks lactogenesis during pregnancy in several ways. It blocks glucocorticoid receptors in mammary tissues suppressing the lactogenic activity of glucocorticoids. The removal of progesterone block, luteolysis or parturition allows the onset of lactogenesis indicating the use of **prostaglandin PGF2α.**

Prolactin along with estrogen and progesterone is required for lactogenesis. Prolactin levels surge several hours before parturition which is necessary for full lactogenesis in bovine.

Glucocorticoids: Cortisol, the major glucocorticoid in bovine helps in mammary gland development by alveolar cell differentiation of mammary gland. Glucocorticoids compete with P4 for binding sites on mammary epithelial cell. Increase in glucocorticoids displaces P4 from mammary cell receptors, thus reducing the P4 block to prolactin receptor synthesis. Addition of prolactin enhances milk yield in induced lactations.

Induced lactation protocols based on steroids are currently considered illegal because of consumer safety issues due to presence of hormones in milk.

Exogenous reserpine causes rise in blood prolactin concentration lasting for several hours in bovine.

Exogenous PGF2α can be used after the initial estrogen-progesterone therapy to induce luteolysis and depress circulating P4 levels during glucocorticoid and reserpine administration.

Somatotropin (bST): The effect of pituitary extracts (cattle) on milk yield in dairy cows was first reported by Asimov and Krouze in 1937. Young (1947) further demonstrated that somatotropin was the galactopoietic factor in pituitary extracts that stimulated milk yield. bST directly affects the receptors for endogenous bST located in hepatocytes and fat tissue and thus regulates the use and absorption of nutrients.

Thyroproteins: It is a hormone containing thyroxine or an iodinated amino acid which has thyroxine-like properties. Its feeding causes increase in milk production but results in marked reduction in body weight, longer calving intervals and increases in services per conception rate. Thus, it might best be utilized in overly fat cows after peak lactation.

Induction Protocols: Numerous protocols have been used successfully till date. A few have been listed

below:

1. **Day1-7**: Estradiol 17-β & Progesterone @ 0.1 & 0.25mg/kg BW/day respectively.
   Day9-12: Reserpine (2 mg) twice a day.
   Hand milking from 10th day onwards **(Smith and Schanbacher, 1973)**
2. **Day1-7:** Estradiol 17-β & Progesterone @ 0.1 & 0.25 mg/kg BW/day
   Day9-12: Reserpine (2 mg) twice a day
   Day 18, 19 & 20: Dexamethasone (20 mg/day).
   Lactation successfully induced between day 9 & 14. **(Dabas and Sud, 1989)**
3. **Day 1, 8 and 21:** Bovine somatotropin (500mg) along with Estradiol 17β & Progesterone.
   (Mellado *et al*., 2006)
4. **Day 1 to 7:** Estradiol-17 β (0.1 mg/kg) and progesterone (0.1 mg/kg) dissolved in absolute alcohol and administered subcutaneously in the neck during and over a period of 7-14 days.
   Day 8: Udder stimulation (massage) started on and continued till the udder was full
   Day 23 to 24: milking started **(Singh *et al*., 2002)**
5. **Day 1-** PGF2α Lutalyse (25 mg) I/M
   Day 10- PGF2α Lutalyse (25 mg) I/M
   Day 11-17- (0.1 mg of 17β—Estradiol and 0.25 mg of progesterone dispensed per kg body weight of the animal). S/C
   Day 18- PGF2α Lutalyse (25 mg) I/M
   Day 19-22- Reserpine (5 mg/day) and dexamethasone (20 mg/day) I/M **(Ramgattie *et al*., 2014)**

Points to consider: A frequent and thorough udder massage is a necessary requirement. Frequent milking should commence as soon as any udder secretion starts. Massage of udder and frequent milking stimulates the release of hormones from hypophysis for mammary gland development and milk synthesis. The milk of treated animal should not be consumed for about 30 days from the commencement of hormonal therapy owing to secretion of hormones in the milk. Treated animals require separate housing facility as they may exhibit signs of heat. A dry period of not less than 50 days should be given between two artificially induced lactations.

In conclusion, artificial induction of lactation can be used as an alternative to normal lactation as it helps in reducing culling losses in herd and increasing profits. Also, the milk from induced lactation is acceptable for human consumption and no side effects have been reported.

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THE SCIENCE WORLD
A Monthly e Magazine
ÍSSN: 2583-2212
August, 2022; 2(8), 1290-1294

Popular Article

ANTHRAX – All you need to know

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https://doi.org/10.5281/zenodo.6973445

Abstract
Anthrax also called Malignant pustule, Malignant oedema, Wool sorter's disease, Ragpicker's disease, Splenic fever or Milzbrand is an acute infectious disease of animals, primarily herbivorous animals that occasionally affects human. Anthrax is considered as rapidly fatal infectious disease often characterized by sudden death, exudation of tarry uncoagulated blood from the mouth, nares, and anus, splenomegaly, gelatinous infiltration of subcutaneous and subserous tissues, and malignant pustule. It was also the first infectious disease against which a bacterial vaccine was found to be effective by Louis Pasteur in 1880. Herbivores including domestic animals (cattle, sheep, goat and buffalo) as well as many wild species are highly susceptible to anthrax, while Pigs, Equines, Dogs and Camels are moderately susceptible.

Introduction

Anthrax also called Malignant pustule, Malignant oedema, Wool sorter's disease, Ragpicker's disease, Splenic fever or Milzbrand is an acute infectious disease of animals, primarily herbivorous animals that occasionally affects human.

Etiology

The causal agent of anthrax – Bacillus anthracis is one of the largest of all bacterial pathogen and is a gram-positive, spore-forming bacillus. Spores of B. anthracis can persist in the environment for many years in some types of soil and enter the body through skin abrasions, inhalation or ingestion and multiply to produce exotoxins. The first bacterial vaccine was prepared against anthrax by Louis Pasteur.

Distribution Of Disease

In animals Anthrax cases are distributed world over and, majority of these are reported in livestock from Africa, Asia and Middle East. It is endemic in certain parts of countries like Russia, France and India. In India, animal anthrax has been reported from most of the states. It is widespread in Tamil Nadu and Maharashtra, and has remained restricted to certain endemic areas in other states.

In man: The incidence of human anthrax in the world is estimated to be 20,000 to 1,00,000 cases per annum. Cutaneous anthrax accounts for 95-99% of human cases throughout the world. It is endemic in Middle-East Asia, Kenya, Gambia, Thailand, Iran, Iraq. In India, the disease has been reported from very limited geographic locations and majority of cases occurred in tri-junctional zone of south-west Andhra Pradesh, south-east Karnataka and north Tamil Nadu.

Current Indian Scenario

Anthrax is enzootic in southern India but is less frequently present in the northern Indian states. In the past years, the anthrax cases have been reported from Andhra Pradesh, Jammu and Kashmir, Tamil Nadu, Orissa and Karnataka. Outbreaks of Anthrax have been reported from Mysore 1999, Orissa 2004, 2005, West Bengal 2000, Jharkhand 2014. Recently kerala has reported the death of wild boars in Athirappilly forest region (June,2022).

Host Range and Reservoirs

Herbivores including domestic animals (cattle, sheep, goat and buffalo) as well as many wild species are highly susceptible to anthrax, while Pigs, Equines, Dogs and Camels are moderately susceptible. Carnivores and birds are generally highly resistant to anthrax, while Man is moderately resistant. In high-risk industries (wool, hair, meat and bone meal, leather) anthrax remains a major occupational zoonosis. Soil is considered as major reservoir for *Bacillus anthracis*. The pathogen present in the body fluid of infected host when comes in contact with atmosphere air, forms highly resistant spores under favourable conditions which remains viable for about 40-60years in contaminated soil and about 20-50years in bones of dead hosts.

Transmission

Animals usually become infected by ingestion of contaminated soil or feeds. Infected animals shed the bacilli during terminal hemorrhage, or if the blood of the dead animal is spilled accidentally. On exposure to the air, the vegetative forms sporulate. These spores are markedly resistant to many disinfectants and adverse environmental conditions and remain viable in the contaminated soil for many years. Dried or otherwise processed skins of infected animals may also harbor the spores for years. Thus, the spores are predominantly present in the environment and it is very largely through the uptake of spores that anthrax is contracted.

Cutaneous anthrax is the most common anthrax infection. Transmission occurs after exposure to infected animals and contaminated animal products such as hair, hides, wool, bones, or skin. Inhalation

anthrax results from inhalation of spores in particles less than 5 μm in diameter that may reach the terminal alveoli of the lungs. Aerosols of such particles may be created by the agitation of the hair or wool in the industry settings. Intestinal and oropharyngeal anthrax results from ingestion of contaminated meat. There is no evidence that milk from infected animal transmits anthrax. The disease spreads among omnivores and carnivores through contaminated meat, bonemeal and other feeds and among wild life from feeding on anthrax carcasses. Vultures have been reported to spread the organism from one area to another.

Accidental infection may occur among laboratory workers. Direct person to person spread of anthrax is extremely rare. However, precautions should be taken with drainage and secretions of patients to prevent cutaneous anthrax. Incubation period of this disease varies from a few hours to seven days but sometimes, a Incubation period up to 60 days is also possible. Most cases occur within 48 hours of exposure.

Clinical Manifestations

In animals

Important clinical manifestations in animals

- In ruminants, sudden death, bleeding from orifices, subcutaneous hemorrhage, without prior symptoms or following a brief period of fever and disorientation should lead to suspicion of anthrax
- In equines and some wild herbivores, some transient symptoms such as fever, restlessness, dyspnoea or agitation may be apparent
- In pigs, carnivores and primates, local oedema and swelling of face and neck or of lymph nodes, particularly mandibular and pharyngeal and/or mesenteric may be present

The incubation period in the susceptible herbivore ranges from about 36 to 72 hours. The first signs of an anthrax outbreak are one or more sudden deaths in the affected livestock. Other signs include going off feed, or producing less milk than usual. During the systemic phase, the animals become distressed, appear to have difficulty in breathing and cease eating and drinking. Swellings in the submandibular fossa may be apparent, and temperature may rise. If the animal fails to respond to the treatment, it lapses into coma followed by death from shock.

In humans

Anthrax infection occurs in three forms: cutaneous, inhalation, and gastrointestinal form depending on the mode of transmission. Symptoms of disease vary depending on how the disease was contracted, but symptoms usually occur within seven days.

Cutaneous anthrax: Most anthrax infections occur when the bacterium enters a cut or abrasion on the skin,

such as when handling contaminated wool, hides, leather or hair products of infected animals. The incubation period for cutaneous anthrax is 1-7 days. Skin infection begins as a painless, pruritic papule that resembles an insect bite but within 1-2 days develops into a vesicle (usually 1-3 cm in diameter) and then a painless ulcer with a characteristic black necrotic (dying) area in the center. Systemic symptoms are mild and may include malaise and low-grade fever. There may be regional lymphangitis and lymphadenopathy. The infection can also spread to the bloodstream with overwhelming septicemia. About 20% of untreated cases of cutaneous anthrax result in death. Deaths are infrequent with appropriate antimicrobial therapy.

Inhalation anthrax: Initial symptoms may resemble a common cold. After several days, the symptoms may progress to severe breathing problems, shock along with the mediastinal widening which can be seen in the chest X-Ray. Diagnosis of inhalation anthrax is difficult but should be suspected if there is a history of exposure to an aerosol that contains *B. anthracis*. Inhalation anthrax usually results in death in 1-2 days after onset of the acute symptoms.

Intestinal anthrax: The intestinal form of anthrax may occur following the consumption of contaminated meat and is characterized by an acute inflammation of the intestinal tract. There are two clinical forms of intestinal anthrax. Symptoms include nausea, vomiting, fever, abdominal pain, hematemesis, bloody diarrhea and massive ascites. Early toxemia and shock develop in this form which can result in death if treatment is not started timely or not given at all.

Case fatality rates

Inhalation anthrax is almost fatal, and results in death in 25% to 60% of cases. The fatality rate of untreated cutaneous anthrax may be up to 20% but can be considerably reduced with early treatment options.

Measures in the event of an outbreak of anthrax

Every effort is to be made to investigate the outbreak, to confirm through laboratory diagnosis and to search for the source. In the affected area, the following measures must be applied:

- The carcasses of infected cattle have to be either burnt at the site of death and the ashes of the carcass to be buried deeply; or the carcass should be wrapped in double thickness plastic bag to prevent spilling of body fluids and removed to a more suitable site where they are burnt and the ashes buried.
- The site where the animal died is to be disinfected with 5% formaldehyde after disposal of the carcass.
- All other animals in the affected herd are to be vaccinated.
- Affected premises has to be quarantined for at least 20 days after the last case or 6 weeks after

vaccination, whichever is later.

- Any milk collected from a cow, buffalo or goat showing signs of anthrax within 8 hours of milking have to be destroyed, along with any other milk that may have been mixed with the suspected milk.
- People entering infected premises are required to wear protective clothing and footwear, which has to be disinfected before leaving the premises.
- All cattle on neighboring premises should also be vaccinated.
- A buffer zone, 20-30 Km wide, is to be established around the infected area within which all cattle and exposed sheep are vaccinated and quarantined.
- Persons who have handled infected animals or their carcasses should be vaccinated against anthrax, if their exposure is frequent and if the human vaccine is available.
- Such persons should avoid any contact with other persons or animals and should change contaminated clothes, washing hands and taking appropriate disinfection measures.
- Where there is a risk of aerosolization of spores, further precautions should be considered such as damping down the material possibly with 5% formalin and, wearing facemasks etc.

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THE SCIENCE WORLD
A Monthly e Magazine
ÍSSN: 2583-2212
August, 2022; 2(8), 1295-1299

Popular Article

Monkeypox: A Re- Emerging Zoonosis

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https://doi.org/10.5281/zenodo.6973621

Abstract

Prior to April 2022, cases of monkeypox virus infecting humans outside Africa's endemic regions were infrequent. The ongoing 2022, outbreak is an extensive human-to-human transmission emerged outside Africa. By the end of July, the World Health Organization recorded almost 18,600 cases, and declared the outbreak as a Public Health Emergency of International Concern and reported its spread to at least 78 different countries, including India. While the reservoir host still remain unidentified, rodents from Africa are thought to be the intermediary hosts. In spite of decades of ongoing outbreaks, it is likely that the failure to stop the disease's spread in Africa's endemic regions is what led to the outbreak in non-endemic countries. To combat current and future outbreaks, a "One Health", globally driven approach must be taken to disease prevention and treatment.

Keywords: Monkeypox, One Health, Endemic, Public Health, Reservoir

Etiology

Monkeypox is a viral disease affecting mainly primates, including humans and monkeys that causes symptoms similar to smallpox, but milder in nature. Monkeypox virus belongs to family: Poxviridae, subfamily: Chordopoxvirinae, genus: Orthopoxvirus and species: Monkeypox virus. The genus Orthopoxvirus include vaccinia virus, cowpox virus, variola virus, and other animal - related poxviruses.

Orthopoxvirus are enveloped double stranded DNA virus, having relatively larger size (200-250 nanometers). They are brick-shaped and have a linear double-stranded DNA genome enclosed in a lipoprotein sheath. Poxviruses have all the assembly required for replication, transcription and proteins in their genome, in addition to relying on host ribosomes for mRNA translation. When compared to other enveloped viruses, poxviruses show exceptional resistance to drying as well as higher temperature and pH tolerance and long-lasting environmental stability. Materials from infected individuals (e.g., dermal crusts) or fomites (such as bed linen) may continue to be infectious for months to years. Despite these characterstics, they are sensitive to common disinfectants, although can be less sensitive to organic disinfectants, when compared to another enveloped virus.

Epidemiology

Monkeypox virus was first identified and isolated in 1958 in monkeys, while they were transported from Singapore to a Denmark research centre for polio vaccine related research. Although first identified in captive monkeys (hence the name), monkeys are the primary host but the available reports suggest native African rodents such as Gaambian giant rats and squirrels as the natural reservoir. The first human isolate of Monkeypox virus was discovered in a child in 1970, from the Democratic Republic of the Congo nine months after the eradication of smallpox.

Vaccination against the smallpox virus historically provided coincidental immunity against the monkeypox virus, but eradicating smallpox and subsequent lack of vaccination efforts allowed monkeypox to gain clinical importance.

Monkeypox was mainly considered an endemic in tropical rainforest regions of central and west Africa and is sporadically transported to other regions. The first monkeypox outbreak outside of Africa occurred in the United States of America in 2003, when infected captive prairie dogs have exposed humans to virus through imported African pets.

In May, 2021 three members of a family from UK who had visited Nigeria, become infected with the virus. The orderly onset of symptoms in each case within the family (day 0, day19, day 33) may indicate transfer from person to person. In July, 2021 a case occurred in a man who travelled from Nigeria to Texas following another case in November, 2021 in a man having travel history from Nigeria to Maryland.

In 2022, a more serious outbreak with widespread human-to-human transmission in nations outside of Africa emerged. The outbreak started in May, 2022 in the United Kingdom, when a man who returned from Canada to Massachusetts was confirmed for the virus. Following this, there were clusters of cases in the United Kingdom which quickly spread over the world within few months, thereby infecting nations in Africa, Asia, Australia, and the Americas.

With approximately 18,600 cases had been documented by the end of July, World Health Organization declared the outbreak a Public Health Emergency of International Concern. It has been reported by the World Health Organization that monkeypox virus has spread to at least 78 different nations.

The first case of monkeypox from India was reported on 15 July 2022, from a 35-year-old man who had travel history of Middle East. There have been nine confirmed cases in India so far and one mortality from Kerala has been reported. Following this, Indian government wrote to the WHO representatives in the

UAE to ensure that individuals exhibiting symptoms of monkeypox should not be permitted to board flights and strict guidelines should be issued.

Transmission

Humans can contract monkeypox virus by coming in contact with an infected animal or person or by handling contaminated objects. The respiratory tract, mucosal membranes, and damaged skin are also entry points for the virus into the body. Another potential risk factor is eating inadequately cooked meat. Sexual transmission of the virus has also been reported. There have been reports of other rare transmission routes such as mother-to-child transmission or nosocomial infection.

The incubation period follows two weeks and early symptoms include fever, headache, general malaise and fatigue and swollen lymph nodes. Few days later, rash develops on the face and body. The evolution of lesions progresses stages as - macule, papule, nodule, vesicle, to pustule –before scabbing over and resolving. The disease gradually takes its course in two to four weeks, and they eventually crust and peel off. Typically, monkeypox is a self-limiting illness but there may be severe cases. The case fatality ratio has recently been reported between 3 and 6 percent.

Diagnostics

Currently, Monkeypox virus real-time Polymerase chain reaction is used for diagnosis. Because viraemia only lasts a short time, swabs, scrapes, and aspirated lesion fluid are preferred to blood samples. The findings from these samples demonstrate the strongest association with both infectivity and the clinical course of illness.

IgM and IgG detection by Enzyme-linked immunosorbent assay (ELISA) or immunofluorescent antibody assay is also available in some laboratories for contact investigations and population surveys. Antigens in biopsy samples can be found via immunohistochemistry, which can also be used to find or rule out other suspect agents. A minimum of BSL-2 facilities should be available for diagnostic procedures and processing of specimens suspected to contain the virus. Monkeypox virus is categorized as a biological agent of group 3, therefore tasks involving the handling of Monkeypox virus should be carried out in working spaces that meet at least the requirements of level three confinement.

Treatment and management

There are currently no known, effective treatments for monkeypox infection. The treatment is supportive management symptom, as with most viral infections. However, there are precautions that can be taken to avoid an outbreak.

Until all lesion crusts have naturally fallen off and a new skin layer has grown, the infected person should stay in isolation, wear a surgical mask, and keep lesions covered as much as possible. For individuals exposed to the virus, temperature and symptoms should be monitored twice daily.

A modified vaccinia virus strain, Ankara vaccine (a live, non-replicating vaccine against smallpox and monkeypox) is sometimes advised as a post-exposure immunization. A "high risk" exposure that calls for prompt post-exposure vaccination is when broken skin or mucous membranes come into contact with an infected patient's bodily fluids, respiratory droplets, or scabs. Vaccination within four days of exposure may prevent disease start, and vaccination within 14 days may lessen disease severity, according to the Centers for Disease Control.

Public Health Control Measures

In order to prevent transmission to humans, public health initiatives include:

- Early recognition by expert evaluation and laboratory investigation
- Early detection of potential new cases by contact tracing in epidemic settings (standard, contact, and droplet precautions).
- Isolation of infected patients
- Implementation of suitable infection prevention and control measures in healthcare settings.

To reduce animal-human transmission, contact with potential animal reservoirs (such as rodents and non-human primates) as well as contaminated materials should be avoided. Additionally, meat should be cooked properly before eating. To stop the virus from spreading, potentially contaminated objects, such bed linens, should be properly disinfected in a safe manner to prevent the virus from establishing in local rodent populations.

Conclusion

The extent of this outbreak is a serious worry because the longer the virus spreads, the more it will extend its reach, and stronger the disease will take hold in nations where it is not endemic. Governments, health partners, and civil society are need to follow three key principles laid out by the World Health Organization in order to handle this pandemic includes

- Improved surveillance, contact tracing, and infection prevention and control should be done first.
- In-depth community involvement and improved communication in reducing transmission.
- The third step is genuine regional cooperation that is both immediate and long-term.

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THE SCIENCE WORLD
A Monthly e Magazine
ÍSSN: 2583-2212
August, 2022; 2(8), 1300-1303

Popular Article

Digital PCR: A Revolutionary Assay for Viral Disease Diagnosis

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https://doi.org/10.5281/zenodo.6973915

Abstract

Digital PCR is a new-age PCR technology with increased sensitivity and reduced inter-lab variations. Its partitioning principle helps to reduce PCR inhibitors and the detection of rare gene sequences. Absolute quantification without the requirement of a standard curve is a feature that makes it advantageous over other conventional PCR amplification methods. This assay has better reproducibility and efficacy making this technology suitable for application in viral disease diagnosis.

Introduction

Digital PCR (dPCR) is a revolutionary method introduced to ease the absolute quantification of DNA. Initially, the partitions of templates were done with the help of a microtitre plate. Further automation of this partitioning principle was done by an invention in 2011 by Quantalife Co, Ltd which was based on water-oil emulsion droplet technology. In this droplet digital PCR (ddPCR) assay a reaction mix is fractionated into droplets in which template DNA is randomly distributed. Each of these fractionated droplets undergoes PCR amplification (Chen et al., 2021). Conventionally real-time PCR (qPCR) is used for the quantification of nucleic acid. However, qPCR requires a standard curve for quantification purposes. The absence of standard references and inter-laboratory quantification biases can make this process complex. A standard curve is not needed in ddPCR. ddPCR can also tolerate PCR inhibitors like SDS, heparin, and other nucleic acid extraction-based inhibitors. Variation in reaction efficiencies can also alter the quantification process of qPCR while this doesn't happen in ddPCR.

In an early viral infection, the concentration of DNA/RNA copies is low which is difficult to detect with conventional PCR methods. ddPCR has a detection limit of 1 copy/µL which is 10 times higher than qPCR. Hence rare viral gene quantification which was difficult to do with qPCR is now possible with ddPCR. ddPCR can be used for virus identification, quantification of viral load, detection of single nucleotide polymorphisms in the viral genome, viral drug resistance, and malignancies caused by viruses (Kojabad et al., 2021).

Quantification Process of dPCR

In dPCR, the fundamental process is the distribution of nucleic acid containing samples into thousands of droplets. Ideally, single droplet should contain only a single amplification target. This partitioning of sample into droplets of the same volume reduces target competition and enables the detection of rare sequences. There are commercial equipment available that can aid in the partitioning of PCR reaction mix - Biomark® dPCR from Fluidgm is micro-fluid chamber based dPCR while QuantStudio12k flex dPCR and 3D dPCR from Life Technologies are micro-chip based dPCR. These can generate several hundreds of droplets. Droplet-based ddPCR QX100 and QX200 from Bio-Rad® and RainDrop from RainDance® can form up to 20,000 droplets and 10,000,000 respectively (Dong et al., 2015). This compartmentalization also reduces the concentration of probes and primers thereby further reducing the chances of mispairing of target sequences.

After the amplification process, end-point quantification is done, unlike qPCR where fluorescent signals are collected in the exponential phase. The absorbance from each compartment is recorded. These signals are counted as binary events either positive 1 or negative 0. Based on Poisson's distribution the proportion of droplets having a target sequence is predicted. Multiplex ddPCR assays can also be conducted by using probes with different fluorescent signals. Hence in a single reaction multiplexing can be done (Quan et al., 2018).

dPCR In Animal Viral Disease Detection and Quantification

ddPCR can detect 10 copies/reaction as recorded in most viral diseases which is way more sensitive than qPCR method. An early diagnosis of contagious and viral diseases of transboundary importance is crucial for control strategies. Swine viral diseases with a potential for outbreaks like African swine fever virus, Porcine circovirus type 2, and Porcine reproductive and respiratory syndrome can be detected with ddPCR (Vashi & Kumar, 2022). RT-ddPCR has also been developed for rapid detection of Japanese Encephalitis virus (Wu et al., 2017). It was found more sensitive when compared to qRT-PCR. Bovine leukemia virus causes milk production losses across farms and infected animals serve as a continuous source of infection as proviral genome integrates into the host genome. Quantification of this proviral load is important to determine the infectious status of animals. Using ddPCR even 3 copies per reaction can be detected and also the proviral load status of the animal can be determined (De Brun et al., 2022). Bovine Herpersvirus-1(BoHV-1) causing infectious bovine rhinotracheitis is intermittently excreted in semen. Virus

isolation is difficult due to cytotoxic activity of semen in cell culture. OIE recommends qPCR for screening of bulls. However, Low viral loads in mixed semen samples from herds is a constraint for qPCR due to its lower sensitivity. ddPCR has been used to detect low copy numbers with detection limit of 4.45 copies of BoHV-1. A novel technique RT-ddPCR has also been developed for foot-and-mouth viral detection in clinical samples (Yu et al., 2022).

dPCR In Human Viral Disease Detection and Quantification

ddPCR has been used in human patients to detect viruses affecting nervous system which include Varicella zoster virus, Herpes simplex virus, Human cytomegalovirus, and Epstein-Barr virus. These ddPCR results were found to correlate with clinical manifestations and treatment response. E gene-based Dengue virus detection for all serotypes can be done along with absolute quantification. For Zika virus limit of detection was found at 1 copy/μL from blood samples. The high sensitivity of ddpCR enables detection of only 11.1 copies/test for SARS-COV-2 from clinical samples (Chen et al., 2021). Multiplex ddPCR assay has also been developed for detection of enterovirus, parechovirus, herpes simplex virus-1, and 2 in CNS infections. The range of detection varied from 2000 to 2 copies per reaction (Zhu et al., 2022). Raindance droplet digital PCR has been used for ultrasensitive detection of simian immunodeficiency virus which serves as a model of Human immunodeficiency virus-1. The persistent latent infection in resting CD4+ Tcell even after anti-retroviral therapy requires ultrasensitive detection. SIV ddPCR can detect an average of 3 target copies per reaction and also give quantification for further anti-retroviral therapy (Long & Berkemeier, 2022).

Conclusion

In diagnostic procedures involving nucleic acid-based detection, the sensitivity of assay is a crucial factor. dPCR is a third-generation PCR technology that can provide ultrasensitive detection of viral antigen in early stages of the disease. Moreover, for diseases where cell culture-based and serological detection procedures are complex and time consuming this assay can be a solution. Absolute quantification to determine the level of infection and also a response to antiviral therapy without the need for standard curve generation could increase the efficaciousness of disease management.

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THE SCIENCE WORLD
A Monthly e Magazine
ÍSSN: 2583-2212
August, 2022; 2(8), 1304-1308

Popular Article

Monkeypox: An Emerging Zoonotic Disease

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https://doi.org/10.5281/zenodo.6976046

Abstract

Monkeypox is a member of the orthopoxvirus family, the double-stranded DNA virus was first noted in monkeys in the 1950s and has a wide host range, notably including rodents. Monkeypox spreads in different ways. The virus can spread from person-to-person through: direct contact with the infectious rash, scabs, or body fluids, respiratory secretions during prolonged, face-to-face contact, or during intimate physical contact. This represents the incubation period and typically lasts 7 to 14 days with an upper limit of 21 days. Symptom onset correlates with a secondary viremia leading to 1 to 2 days of prodromal symptoms such as fever and lymphadenopathy before lesions appear. Symptoms like Fever, Headache, Muscle aches and backache, Swollen lymph nodes, Chills, Exhaustion and A rash that can look like pimples or blisters that appears on the face, inside the mouth, and on other parts of the body, like the hands, feet, chest, genitals, or anus. A definitive diagnosis is accomplished via polymerase chain reaction testing of skin lesions or fluid. There are no treatments specifically for monkeypox virus infections.

Keywords: monkeypox virus, double-stranded DNA virus

Introduction

Monkeypox is a zoonotic disease, meaning that it can spread between animals and people, and is caused by *Monkeypox virus,* an *Orthopoxvirus*. While the animal reservoir is unknown, small mammals (rope and sun squirrels, giant-pouched rats, African dormice) are thought to maintain the virus in the environments of West and Central Africa (Moore MJ, et al. 2022). People can get infected with the virus through direct contact with infected animals, often while hunting, trapping, and processing infected animals or the infected body parts and fluids of animals. Small mammals can carry the virus, sometimes without apparent symptoms, while non-human primates can get sick with monkeypox and have signs of disease like humans.

In 2003, an outbreak of monkeypox in domesticated prairie dogs occurred after they shared bedding and caging with a shipment of infected small mammals from West Africa. This led to 47 human cases in 6 states in the United States. Instances of animal-to-animal and animal-to-person spread, such as the 2003 outbreak, demonstrate the need to reduce the risk of secondary infections to and from animals by isolating infected people as well as exposed and infected animals.

The first human case of monkeypox was recorded in 1970. Prior to the 2022 outbreak, monkeypox had been reported in people in several central and western African countries. Previously, almost all monkeypox cases in people outside of Africa were linked to international travel to countries where the disease commonly occurs or through imported animals. These cases occurred on multiple continents.

Etiology

Monkeypox is from the family: *Poxviridae, s*ubfamily: chordopoxvirinae, genus: orthopoxvirus, and species: Monkeypox virus. On electron microscopy, the monkeypox virus is relatively large (200-250 nanometers). Poxviruses are brick-shaped, surrounded by a lipoprotein envelope with a linear double-stranded DNA genome (Alakunle E, et al. 2020 and Kugelman JR, 2014) Aside from their reliance on host ribosomes for mRNA translation, poxviruses include all necessary replication, transcription, assembly, and egress proteins in their genome.

Transmission

Monkeypox spreads in different ways. The virus can spread from person-to-person through:

- direct contact with the infectious rash, scabs, or body fluids
- respiratory secretions during prolonged, face-to-face contact, or during intimate physical contact, such as kissing, cuddling, or sex
- touching items (such as clothing or linens) that previously touched the infectious rash or body fluids
- pregnant people can spread the virus to their fetus through the placenta

It's also possible for people to get monkeypox from infected animals, either by being scratched or bitten by the animal or by preparing or eating meat or using products from an infected animal.

Monkeypox can spread from the time symptoms start until the rash has fully healed and a fresh layer of skin has formed. The illness typically lasts 2-4 weeks.

Pathophysiology

Following viral entry from any route (oropharynx, nasopharynx, or intradermal), the monkeypox virus replicates at the inoculation site then spreads to local lymph nodes. Next, an initial viremia leads to viral spread and seeding of other organs. This represents the incubation period and typically lasts 7 to 14 days with an upper limit of 21 days.

Symptom onset correlates with a secondary viremia leading to 1 to 2 days of prodromal symptoms such as fever and lymphadenopathy before lesions appear. Infected patients may be contagious at this time. Lesions start in the oropharynx then appear on the skin. Serum antibodies are often detectable by the time lesions appear (Hutson CL, et al. 2015).

Symptoms

Monkeypox is a rare disease caused by infection with the monkeypox virus. Monkeypox virus is part of the same family of viruses as smallpox. Monkeypox symptoms are similar to smallpox symptoms, but milder; and monkeypox is rarely fatal. Monkeypox is not related to chickenpox.

Symptoms of monkeypox can include:

- Fever
- Headache
- Muscle aches and backache
- Swollen lymph nodes
- Chills
- Exhaustion
- A rash that can look like pimples or blisters that appears on the face, inside the mouth, and on other parts of the body, like the hands, feet, chest, genitals, or anus.

The rash goes through different stages before healing completely. The illness typically lasts 2-4 weeks. Sometimes, people get a rash first, followed by other symptoms. Others only experience a rash.

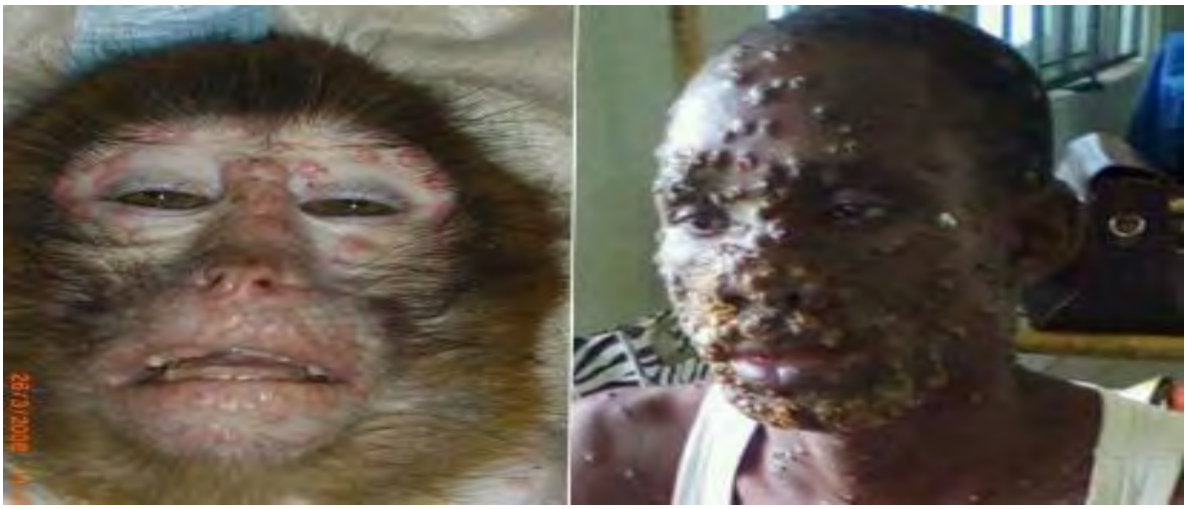

Fig.1: Gross photograph showing blisters like lesions on face.

Diagnosis

Given the current unfolding outbreak, clinicians seeing patients with new onset of febrile illness and rash should consider monkeypox, especially if lymphadenopathy is also present. The rash typically starts in the mouth, then moves to the face, followed by the extremities (including the palms and soles) in a centrifugal pattern. A definitive diagnosis is accomplished via polymerase chain reaction testing of skin lesions or fluid. These tests are available at state public health laboratories. There is no commercially available test (Sklenovská N, et al. 2018).

Treatment

There are no treatments specifically for monkeypox virus infections. However, monkeypox and smallpox viruses are genetically similar, which means that antiviral drugs and vaccines developed to protect against smallpox may be used to prevent and treat monkeypox virus infections. Antivirals, such as tecovirimat (TPOXX), may be recommended for people who are more likely to get severely ill, like patients with weakened immune systems.

Prevention

The smallpox vaccines are effective in the prevention of monkeypox and as post exposure prophylaxis. A newer-generation smallpox vaccine, JYNNEOS (Bavarian Nordic), has an FDA indication for the prevention of monkeypox, and the older-generation ACAM2000 can be used off-label for the same

purpose. In prior outbreaks, vaccination of close contacts has successfully limited transmission. Administration of prophylactic vaccine as early as immediately after possible exposure can abort infection or significantly attenuate it. In cases in which smallpox vaccine is contraindicated, vaccinia immune globulin may be given as an alternative postexposure prophylaxis agent (Sklenovská N, et al. 2018).

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THE SCIENCE WORLD
A Monthly e Magazine
ÍSSN: 2583-2212
August, 2022; 2(8), 1309-1313

Popular Article

Coccidiosis in poultry: A major threat to poultry industry

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https://doi.org/10.5281/zenodo.6976078

Abstract
Coccidiosis is one of the most important protozoan diseases affecting the poultry sector all over the world. Coccidiosis is caused by the many species of Eimeria. They are typically intracellular parasites of the epithelial cells of the intestine of vertebrates. Cocidiosis can occur in all age groups of birds. Eimeria tenella is the most pathogenic than other species of Eimeria. Coccidiosis causes high mortality in chickens and this led to great economic loss to poultry sector. So, it is important to control the coccidiosis by better management in poultry houses, use of prophylactic coccidiostatic drugs and by vaccination of chickens.

Keywords: Poultry, coccidiosis, Treatment and control

Introduction

India presently holding the third rank in the world in egg production and poultry meat production has reached about 4.2 million tons per year. It is clear that the poultry sector is not only playing a great role for the nutritional safety of the country, but also providing working chance to the population of the world (Shirley et al., 2007). About three million people in India are directly linked to the poultry sector and contributing to the economy of the nation. Coccidiosis is caused by the different species of Eimeria. They are typically intracellular parasites of the epithelial cells of the intestine of vertebrates. Among all the Eimeria sp., Eimeria tenella is the most pathogenic strain that causes high mortality in chicken flocks. This high mortality due to coccidiosis causes great loss to the poultry industry. Intensive system of rearing gives more chances for transmission of the coccidian oocysts.

Different *Eimeria* species of poultry

Eimeria acervulina, Eimeria brunetti, Eimeria hagani, Eimeria maxima, Eimeria mitis, Eimeria mivati, Eimeria necatrix, Eimeria tenella and *Eimeria praecox.*

Eimerian reproduction

The lifecycle of the *Eimeria* sp. includes development in both inside and outside of the host. Within the host, parasite undergoes both asexual and sexual stages of development. In general, oocysts passes via faeces and get sporulated in the external environment. The excystation of the oocysts within the intestinal lumen is favoured by trypsin, bile and CO2 and the released sporozoites penetrate the villous epithelial cells. Sporozoites of some species (*E. brunetti* and *E. praecox*) develop within cells at the site of penetration. Sporozoites of other species (*E. acervulina, E. maxima, E. necatrix*, and *E. tenella*) are transported to crypt epithelium (Trout and Lillehoj, 1993), where they develop as trophozoites. Within the host cells, trophozoites undergo asexual reproduction (schizogony or merogony) to produce merozoites which penetrate the healthy intestinal cells. A few cycles of merogony take place which is followed by sexual reproduction or gametogony. Merozoites enter the host cells and differentiated into either microgamonts (male) or macrogamonts (female). The microgamonts divided to form microgametes, which fertilize the macrogamonts and leading to the development of oocysts which are passed through the droppings.

Transmission of coccidiosis

It is man-made disease due to overcrowding and unhygienic conditions in the poultry houses responsible for spreading and reinfection.

Pathogenesis of coccidiosis

Coccidiosis can occur in all age groups of birds. The presence of oocysts normally discharged by the carriers in their droppings. *E. tenella* is the most pathogenic than other species. *E. tenella* is most commonly found in 4 weeks old chicks, while 2 weeks old chicks are comparatively resistant. Chicks less than one week old are most susceptible to *E.brunetti*. *E. necatrix* infection commonly occurs in birds of six weeks age and above. *E.acervulina* is common in both young and old birds. Three types of coccidiosis are identified in poultry:

(1) Intestinal coccidiosis caused by *E. necatrix, E. maxima, E. acervulina* and *E. mivati* affecting the small intestine. **(2)** Caecal coccidiosis caused by *E. tenella* affecting the caecum.
(3) Rectal coccidiosis caused by *E. brunetti* affecting the lower small intestine, rectum and cloaca.

Clinical symptoms

Intestinal coccidiosis

- There is chronic watery diarrhoea without blood, Malabsorption of feed leads to stunted growth and decline in egg production
- In chronic form, the birds show watery mucoid dropping which soil the vent and feathers of the tail

Caecal coccidiosis

- Initially the bird droop, stop feeding but may continue to take water
- Pass large quantities of blood in dropping (red diarrhoea), become anaemic and die, Some of the recovered birds may show paralysis

Rectal coccidiosis

- Affected birds pass white fluidy droppings mixed with blood and mucus casts
- Loss of body weight due to severe dehydration or reduced food intake.

Lesions found in intestine of different coccidian infection

- In *E. acervulina* infection, upper part of small intestine especially duodenum shows white pin point foci or streaks running transversely in the intestinal mucosa.
- In *E. maxima* infection, middle portion of small intestine becomes flaccid and dilated. Inflammed mucosa covered with pinkish mucoid exudates with blood.
- In *E. mivati* infection, intestinal mucosa reveals oedematous petechiae. Greyish white mucosal lesions, representing colonies of gamonts and oocysts, are circular and petechial haemorrhages may also be seen.
- In *E. necatrix* infection the main lesions occur in the middle small intestine. Serosal surface of the small intestine show pin point to pin head sized greyish white foci.
- In *E. tenella* infection, petechial haemorrhage seen in caecum. The caecal pouch becomes greatly enlarged and there is dark brown to blackish caseous mass in caecum.
- In *E. brunetti* infection, lesions are confined to posterior part of small intestine between the yolk stalk and caecum. The gut wall is covered with haemorrhagic catarrhal exudate.

Diagnosis of coccidiosis

(1) History of the flocks **(2)** Clinical signs of various coccidiosis **(3)** Examination of faeces to detect the oocysts **(4)** Postmortem findings: dead as well as affected birds may be sacrificed to get the pathogenic lesions. The location and type of lesion will provide the clue.

Treatment of coccidiosis

A lot of drugs are available against poultry coccidiosis. Some of them are coccidiostatics while others are coccidiocides.

(1) Sulphonamides- It includes: **(a)** Sulfaquinoxaline @ 120-250 ppm along with feed or water **(b)** Sulfadimidine @ 120-250 ppm along with feed or water

(2) Thiamine analogues: Amprolium @ 62.5-125 ppm

(3) Nitrofurans: They are coccidiostatic drugs **(a)** Nitrofurazone @ 120 ppm for curative purpose and 50 ppm for prophylactic use **(b)** Furazolidone @ 120 ppm for curative purpose and 50 ppm for prophylactic use

(4) Carbanilide derivatives: Nicarbazin @ 100-125 ppm

(5) Nitrobenzamide: Zoalene @ 62.5-125 ppm

(6) Pyridinoles: Clopidol @ 125 ppm

(7) Polyether ionophorus antibiotics: (a) Monensin @ 100-125 ppm **(b)** Lasalocid @ 100-125 ppm **(c)** Salinomycin @ 50-70 ppm

(8) Triazine derivatives: (a) Toltazuril @ 25 ppm in water **(b)** Diclazuril @ 1-5 ppm in water

Control of coccidiosis: Control of coccidiosis is based on combination of good managemental practices in poultry houses and chemotherapy.

(1) Chemotherapy

Anti-coccidial drugs are available for curative and prophylactic purpose. But the emergence of drug resistance has created a great problem mainly due to the frequent use of same drug and it can be avoided by following 'Shuttle programme'.

(2) Hygienic measures

(a) The litter should always be kept dry (b) Feeding and water troughs should be kept to such a height that they cannot be contaminated by droppings (c) Good ventilation should be provided to reduce humidity and sporulation of coccidian oocysts (d) Overcrowding of flocks should be avoided (e) The faeces should be cleared regularly (f) High protein feed along with vitamins (especially fat soluble vitamins, i.e. A, D, E and K)

(3) Vaccination

Live vaccines (Coccivac®, Immunocox®) are available to induce immunity against coccidiosis. It is a suspension of live oocysts of 8 species of *Eimeria* of chicken except *E. hagani.* It is given in the drinking water at 3-5 days of age. Live attenuated vaccine (Paracox®) is also available in which precocious lines of different species have been used and is given orally. Recently a subunit vaccine (Cox A bic®) has been launched in market where purified proteins of gametocytes have been used.

Conclusion

Poultry industry plays important role in the economy of the nation. Coccidiosis causes great loss to the poultry sector due to high mortality of poultry take place in the coccidiosis. So control of

coccidiosis is important, the current methods of control of coccidiosis are by anticoccidial drugs, vaccines and managemental practices. But due to use of same drugs it causes resistance against coccidiosis. To plan an effective vaccine, it is important to understand the dynamism in the evolution of diversity among genes that encodes effective vaccine antigens at the genome level along with the related factors that drive this diversity.

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THE SCIENCE WORLD
A Monthly e Magazine
August, 2022; 2(8), 1314-1317

Popular Article

Sexed semen technology a boon to the Dairy Industry

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https://doi.org/10.5281/zenodo.6982710

Abstract

Livestock farmers always incline producing young ones of the desired sex, to meet the increasing demand for meat and milk which leads to economic benefits to the farmer. Earlier, various techniques have been employed to separate the X and Y sperm, some of the techniques showed encouraging results but lack scientific validation and some remained yet to be established. Presently only one, flow cytometry, is effective. However, the accuracy of the process is great but the speed and yield are slow and low. Additionally, equipment is extremely expensive, and specially trained technicians are required to assure sorting accuracy. Despite these limitations, sexed semen is being produced and cryopreserved for artificial insemination.

Introduction

The expanding demand for dairy products entails a greater focus on improving the dairy industry. Dairy farming is the major supportive business of the farmers in a rural area. There is about 192.49 million cattle population in India. Though artificial insemination increases the overall pregnancy rate, it does not give a choice to produce either male or female offspring. The advent of the sexed semen technology has brought a revolution in cattle breeding. This technology of sex determination prior to conception has always fascinated the reproductive biotechnologist. In the early 20th century, it became conspicuous that the male gamete determines the sex of offspring. However, success couldn't be achieved in sorting the X and Y chromosomes as all the sperms are phenotypically identical and no method was available for determining the composition of chromosomes in sperms before the last two decades. The evolution of the sex sorting technique of spermatozoa based on their DNA content with high accuracy proved an asset to the AI industry. Thus, integrating sexed semen into the breeding program can minimize the number of undesirable male dairy calves and also reduces the chances of dystocia. This technology is expected to come as a blessing for the farmers who prefer cows over bulls to enhance their dairy business in terms of productivity as well as profitability.

An attempt has been made to sort the X and Y-bearing spermatozoa but success was achieved only after the chemical composition of X and a Y-bearing spermatozoon was studied. The use of sex-sorted technique allows the predetermination of calf sex with 90% reliability.

In cattle, an X-chromosome bearing sperm contains 3.8% more DNA than a Y chromosome bearing sperm (Johnson, 1995), providing an attribute that can be utilized to differentiate between the sperm bearing X or Y chromosome. Different methods are available for sperm sorting which includes albumen gradient method, percoll density gradient method, swim-up procedure, free flow electrophoresis, identification of H-Y antigen, sorting based on volumetric differences, centrifugal counter current distribution, immunological approaches, and flow cytometry. Among this flow cytometry is commonly used for sorting of sperm.

Applications of sexed semen

The prime reason for consolidating sex-sorted semen in the dairy or beef system is to impose a desired sex bias in the resulting progeny. Herd replacements and additional heifers for herd expansion at a faster rate from within a herd; can be generated with the help of sexed semen, thereby reducing the biosecurity risk associated with bringing in animals from different herds. Sexed semen helps to increase the selection intensity by choosing superior females as replacements. For maintaining the constant herd strength for herd replacement 80% of females must be bred. By the application of sexed semen, a producer is required to breed only 40% of the cows for an equal number of herd replacements and therefore increase the selection intensity. In addition to this, the use of sexed semen can increase herd genetic gain compared with the use of conventional semen. Utilizing the sexed semen would minimize the production of unwanted male dairy breed calves, thus allaying potential welfare issues associated with it. Sexed semen reduces the incidence of dystocia and the risk factors associated with it like retained fetal membranes, uterine diseases, delayed resumption of estrous cyclicity and conception failures. The use of the sexed semen will reduce the number of destitute animals since the male calves; unproductive females are left for roaming on roads to reduce the financial burden, incurred by the farmers for management purposes.

Commercialization of sexed semen will help to increase the heifer calves either to expand or to sell replacements. However, if most heifer producers use this technology the cost of replacements is likely to come down substantially and thereby, making the heifer rearing system less profitable. In most of breeding programs incentives are often rewarded to the farmers for producing male calves. Through the use of sexed semen young bulls can be produced from the elite cows which can be successfully used for further breeding programs. For the conservation of endangered species sexed semen can prove beneficial, where any change in male and female sex ratios could lead to species extinction. It would also help in the optimization of breeding programs of zoo animals for avoiding inbreeding and to make long-term breeding plans. This

technology can also prove to be a powerful tool for studying the sex-limited and sex-influenced traits. It can be employed to study the sex-limited diseases as well as problems of infertility.

Limitations

There are some technological and implementation limitations associated with the sexed semen technology like the high cost of the sex-sorting machine, low sorting efficiency and speed, require a highly skilled person to operate the machine, damage to the sperm due to shear force, electrostatic charge, and droplet formation. There is wastage of approximately 50% of sperm during the sorting procedure. The sperm concentration in sexed semen is less as compared to the conventional semen straw. The sexing procedure poses injury to the sexed sperm; the conception rate is around 10 percent less with sexed semen as compared to conventional semen. However, with the advancement of technology and sexing equipment, the gap between sexed and conventional semen in terms of conception rate is lowering.

Current scenario

Currently in India 5 semen stations are producing sexed semen. And they are available at the rate of ₹ 900-2000 per dose however some states are making them available at a subsidized rate of ₹ 100-300. This sexed semen is not available in all the AITs. The breeds of cattle for which sexed semen is available in India include Gir, Sahiwal, Tharparkar, Kankrej, Red Sindhi, Hariana, Gangatiri, CBHF/CBJ, and pure HF and Jersey and buffalo Mehsana, Murrah, and Jaffarabadi. Taking into consideration the high fertility rate of the heifers, the recommendation is to use this semen only in the heifers (especially virgin heifers) for better a conception rate. However, the sex-sorted semen can be used in cows up to the third lactation with an excellent reproduction record.

Conclusion

The use of sexed semen can be of huge benevolence to society as it can address the problem of destitute animals and also greater genetic gain can be achieved through it. Also, the success of the sexed semen industry depends largely upon sorting speed, accuracy, and fertility of the sorted semen and existing technologies. Till date sex sorting through a flow cytometer is the only fully validated method for sperm sexing. Though this technique has some constraints on sexed semen quality, therefore several improvements have been recently made in sperm sorting procedures. In the future, it is possible to improve the existing methods or to develop an entirely new technology package for sorting spermatozoa and thus it needs to be researched further to achieve a greater good for society.

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THE SCIENCE WORLD
A Monthly e Magazine
August, 2022; 2(8), 1317-1323

Popular Article

Coccidiosis in Rabbits

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https://doi.org/10.5281/zenodo.6982782

Abstract

Rabbits are considered as an important and healthy source of animal protein all over the world. They are susceptible to important diseases that can reduce their productivity, causing severe economic losses. Coccidiosis is a ubiquitous protozoan infection of animals seriously impairing their growth and food utilization and also causes significant mortality in domestic rabbits which is caused by Eimeria species. The protozoa parasite that are microscopic, one-celled organisms and cause two forms of coccidiosis in rabbits which are intestinal and hepatic coccidiosis. Coccidiosis occurs in both clinical and subclinical form. Severity of the disease depends on the age of rabbit, amount of sporulated oocyst ingested by the susceptible host, immune status of an animal. The main predilection site for this organism is intestine and liver. Affected animals indicated the symptoms of diarrhea, reduced appetite, dehydration, and weight loss as well as liver and intestinal lesions. Diagnosis is based on the detection of the infective stages of the protozoon in feces or affected tissues. Prevention and control are achieved by adopting strict hygienic measures and using different anticoccidial drugs for treatment.

Introduction

Rabbits (Oryctolagus cuniculus) are regarded as a potential source of animal protein for human consumption. The meat of rabbits is recommended for human consumption more than other sources of proteins due to its high nutritious protein, calcium, phosphorus, and linoleic acid, with low fat and cholesterol contents. In addition to the commercial use of rabbits, they can be used for wool production and in medical research as laboratory animals, and they are raised as pets for hobby purposes. Rabbits are susceptible to dangerous viral, bacterial and parasitic diseases that drastically affect their production. Coccidiosis is a ubiquitous protozoan infection of animals seriously impairing their growth and food utilization, it causes significant mortality in domestic rabbit. It is caused by Eimeria species, protozoa parasites that are microscopic, one-celled organisms. There are two forms of rabbit coccidiosis – intestinal and hepatic.

Intestinal coccidiosis

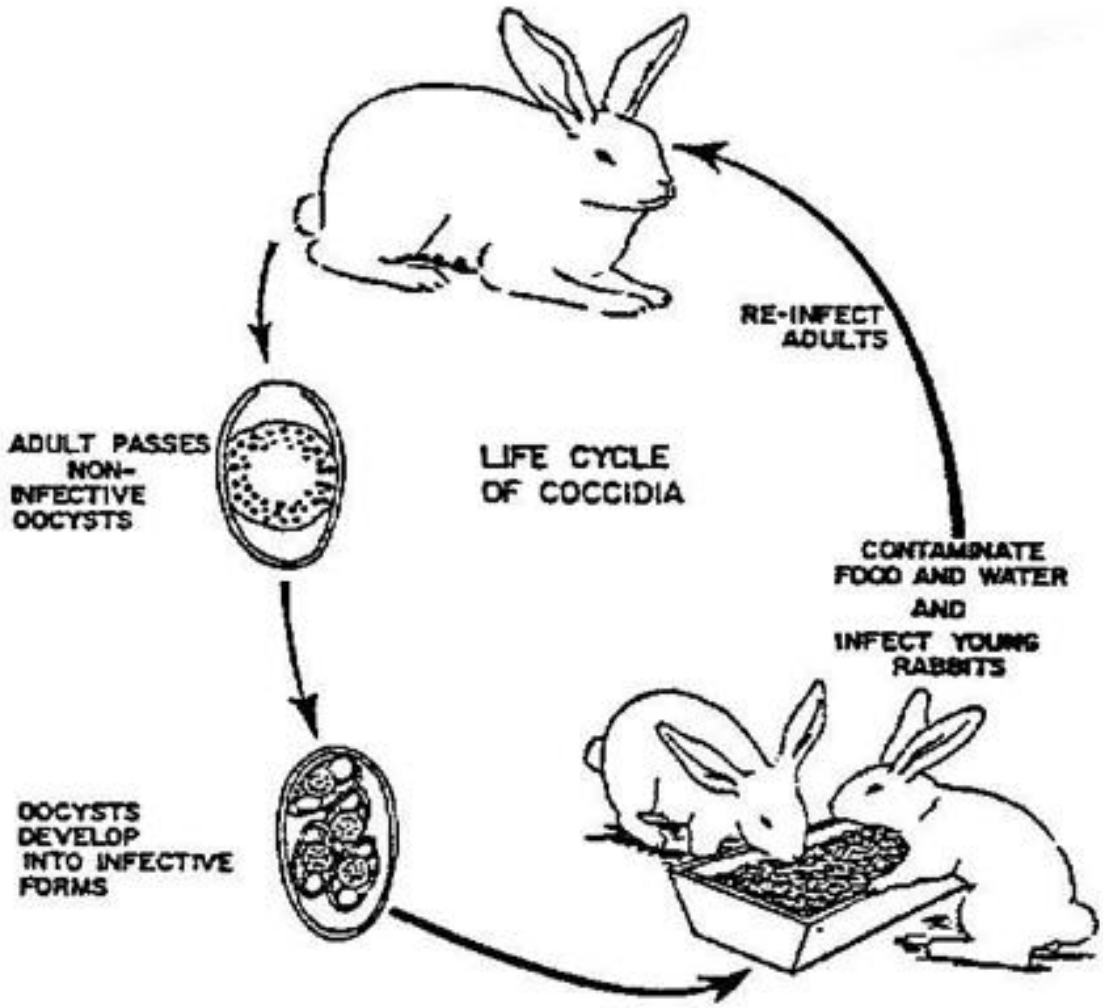
E. intestinalis and *E. flavescens* - more pathogenic; *E.magna, E. irresidua,* and *E. Piriformis* - moderate pathogenic; *E. perforans, E. neoleporis*, and *E. media* - least pathogenic

Hepatic coccidiosis

E. steidae is one of the most pathogenic coccidian protozoans in domestic rabbits causing severe disease manifestations and increased mortality. Coccidiosis is mainly seen in intensively managed animals, especially young rabbits, although it can occur in small rabbitries and pet rabbits.

Life Cycle

Intestinal coccidiosis:



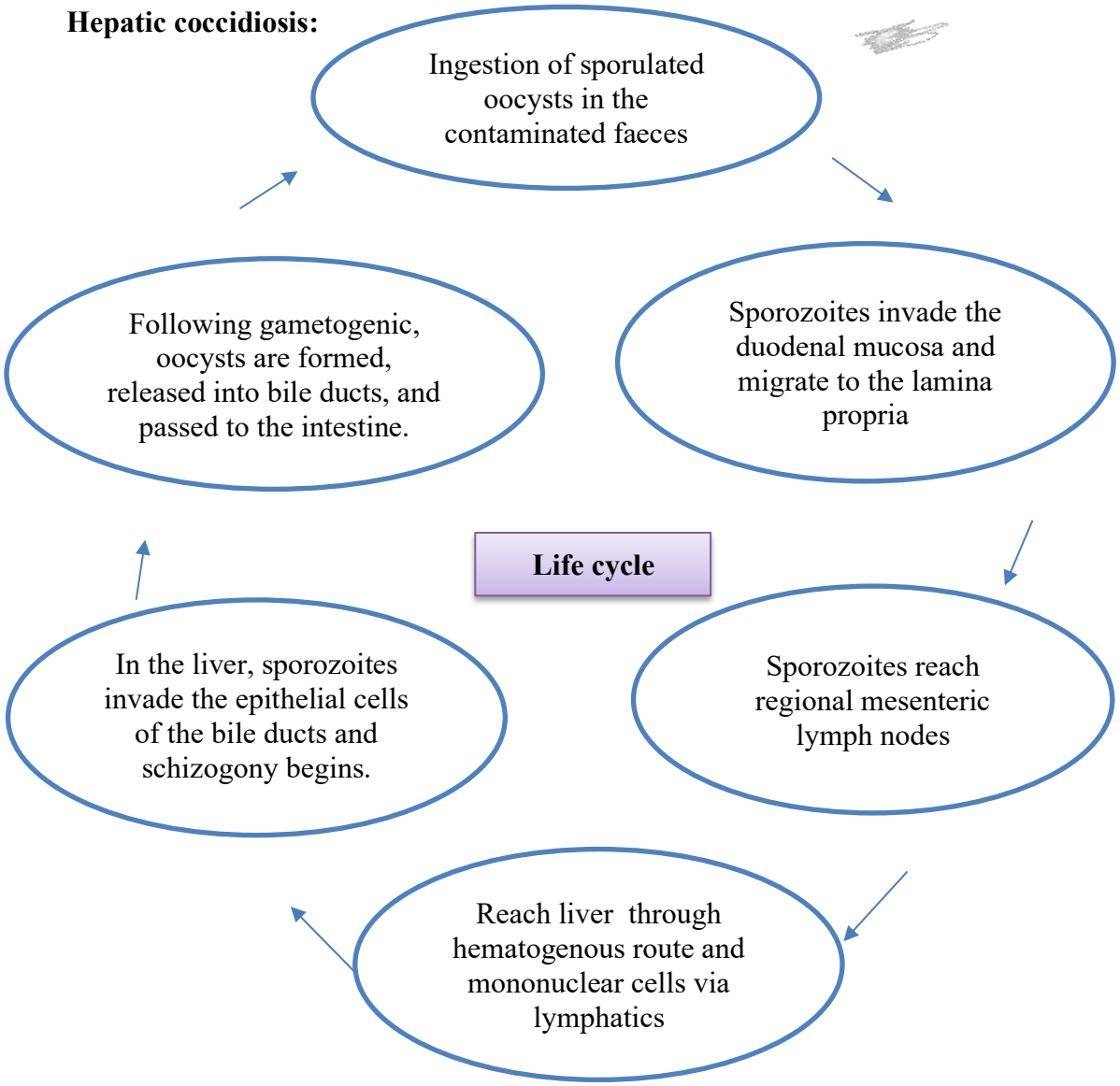


Fig 1. Life cycle of Eimeria species.

Clinical Signs

Reduced appetite, depression, abdominal pain, diarrhoea, retarded growth, pale mucous membranes, blood or mucous mixed feces. Intussusceptions may be associated with chronic infections. Subclinical coccidiosis results in reduced feed conversion.

Gross Lesions

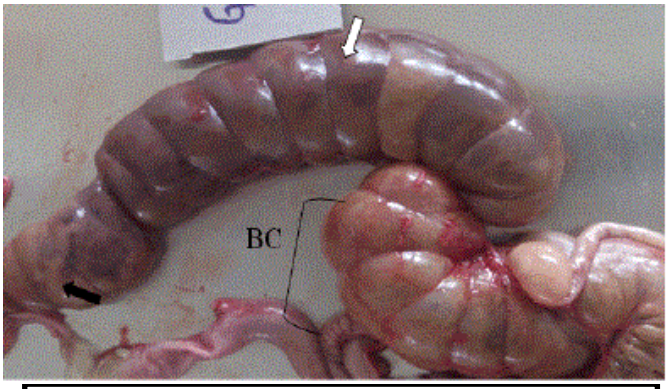


Fig 1. Intestine showing marked congestion (white arrow), necrotic area (black arrow) and ballooned section of the caecum (BC)

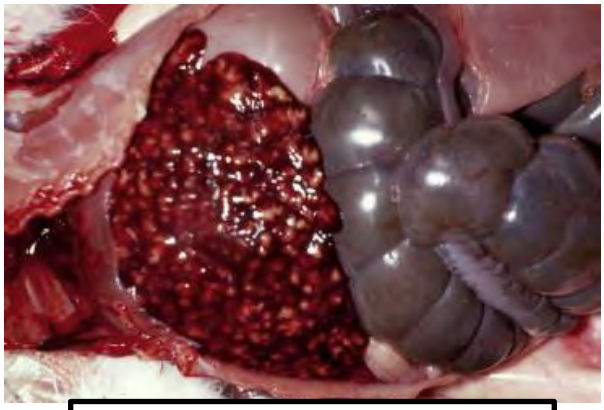


Fig 2. Multifocal irregular yellowish nodules in the liver

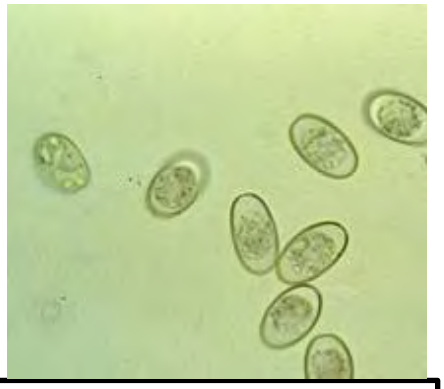


Fig 3. Intestinal scrappings revealed unsporulated oocyst

Diagnosis

Laboratory diagnosis of hepatic and intestinal coccidiosis depends on the analysis of feces of suspected rabbits. Microscopic identification of *Eimeria spp*. oocysts through the fecal analysis of suspected animals is very important. Developmental stages of *E. stiedae* have been detected in stained impression smears from the liver. Histopathological examination of the liver tissues, bile duct, or intestine is also used for the detection of different developmental stages of the parasite. Serological diagnosis of E. stiedae using ELISA has also been reported. Identification of *Eimeria spp*. using molecular assays such as multiplex PCR assay was also been reported.

Histopathology

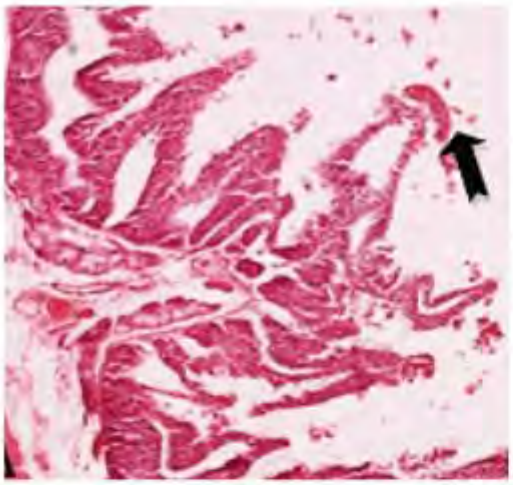


Fig 4. Intestine showing destruction of enterocyte and desquamated epithelium (arrow). H&Ex100.

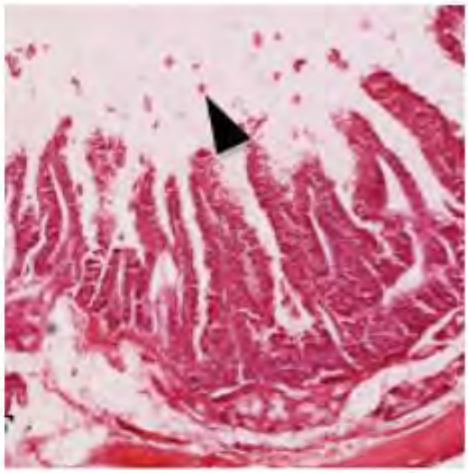


Fig 5. Intestine showing several oocysts within the lumen (arrow head). H&Ex100.

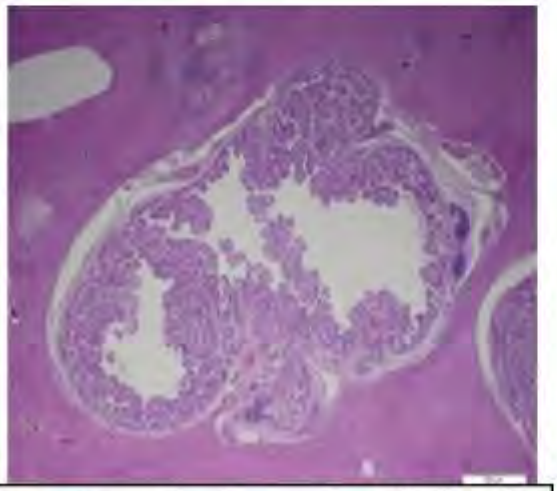


Fig 6. Liver showing marked dilation of bile ducts & hyperplasia of biliary duct epithelium. H&E x100.

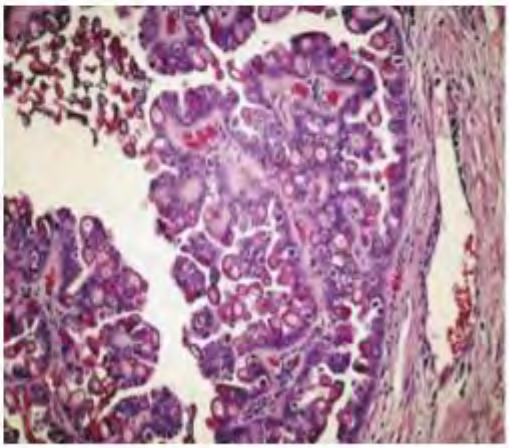


Fig 7. Hyperplasia of intestinal epithelium, with papillary projections with different stages of oocysts. H& E x400.

Treatment

Anti-coccidial drugs should be used for successful treatment of coccidiosis in rabbits which should be broad-spectrum, highly effective with a good therapeutic index, and easily administered for short time. Drugs includes sulphadimidine, amprolium, furazolidone, monensin etc can be used. nticoccidial drugs and are relatively inexpensive and showed successful results. However, increase in consumer demand for the production of organic products, the potential development of resistant strains of parasites toward drugs and the presence of antibiotic residues in meat created a potential need for searching for natural and safe alternatives to anticoccidial chemicals. Hence, several studies investigated the effects of natural alternatives such as sulfur and sulfates, tannic acid, bismuth compounds, thymol, camphor, alum, volatile oils, and garlic on rabbit coccidiosis.

Prevention

Coccidiosis in rabbits is aggravated by poor hygienic conditions and high stocking densities that encourage the spread of protozoa. Rabbits raised in groups are more affected than those kept alone. Accordingly, the first steps for preventing the occurrence and spread of coccidiosis in a rabbitry are proper hygiene and husbandry practices as well as strict biosecurity measures. Control of coccidial infection using common disinfectants is difficult as oocysts have a remarkable ability to survive under exogenous environmental conditions.

Conclusion

Strict hygienic measures and effective treatment plays a major role in control of coccidiosis. As coccidiosis is considered a very important parasitic disease in rabbits, future studies should focus on finding novel approaches for the prevention and control of such a significant threat. Economic value of rabbits can be improved by preventing coccidiosis following good sanitary measures.

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THE SCIENCE WORLD
A Monthly e Magazine
August, 2022; 2(8), 1324-1328

Popular Article

A Review on Lumpy skin disease Prevention and its Control

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https://doi.org/10.5281/zenodo.6984159

Abstract

Lumpy skin disease is an emerging bovine viral disease, which the currently rapid spread of disease in different countries and even different states of countries. The causative agent capripoxvirus, can also induce sheeppox and goatpox. LSD can be transmitted by both the vector and non-vector routes. Though the disease has less mortality rate but causes great economic loss. The disease has not any specific treatment only given to supportive and symptomatic treatment but it is reported that control and prevention are possible by immunization, controlling the vector, maintaining biosecurity in the herd, and isolating the infected animal. The present review is to understand various aspect of disease like transmission clinical symptoms, diagnosis prevention and control.

Introduction

Lumpy skin disease (LSD) is an infectious viral disease of cattle and buffaloes caused by the Capri pox virus of family Poxviridae. All ages and breeds of cattle are affected, but especially the young and cattle in the peak of lactation. It is transmitted by arthropod vectors such as mosquitoes, biting flies and ticks. In India the disease is first reported during the year 2019. The disease characterized by mild fever for 2-3 days followed by development of stiff, round cutaneous nodules (2-5 cm in diameter) on the skin all over the body. These nodules are circumscribed, firm, round, raised and involves the skin, subcutaneous tissue and sometimes muscles. Symptoms may include lesions in mouth, pharynx and respiratory tract, emaciation, enlarged lymph nodes, oedema of limbs, reduction in milk production, abortion, infertility and sometimes, death. Although infected animals often recover within a period of 2-3 weeks, there is reduction in milk yield in lactating cattle for several weeks. The morbidity rate is around 10-20% and mortality rate is around 1-5%.

Causative Organisms

The disease is caused by lumpy skin disease virus (LSDV). The causative agent is a member of genus Capri pox virus (CaPV) in the family Poxviridae. LSDV is a double stranded DNA containing virus enclosed in lipid envelope, which is genetically related to the sheep pox virus (SPPV). Transmission of virus occurs through infected lesions in the skin, and mucus membrane of mouth and nasal cavities, secretions like saliva, nasal and ocular discharges. Blood feeding vectors can transmit the virus. Virus may transmit through infected bull semen and through infected milk and teat lesions.

Clinical Symptoms

Lumpy skin disease can occur in acute, sub-acute and chronic forms. Affected animals showed the symptoms of anorexia, ocular and nasal discharge, hyper salivation and mild fever for 2-3 days followed by development of stiff, round cutaneous nodules (2 - 5 cm in diameter) on the skin all over the body. These nodules are circumscribed, firm, round, raised and involves the skin, sub cutaneous tissue and sometimes muscles. Some marks of crust are seen after bursting the nodules on whole body. Symptoms may include lesions in mouth, pharynx and respiratory tract, emaciation, enlarged lymph nodes, oedema in legs, dewlap and brisket region, reduction in milk production, abortion, infertility and sometimes death.

Diagnosis

Diagnosis of disease mainly depends upon typical clinical signs, differential diagnosis from other related diseases. In the laboratory confirmatory diagnosis can be done by using various advance techniques like isolation of virus, serological test, indirect Enzyme-Linked Immunosorbent Assay (ELISA) test and Polymerase chain Reaction (PCR) test.

Samples like (EDTA blood and skin biopsies/scabs) from animals in LSD suspected outbreaks should be referred to ICAR-NIHSAD, Bhopal for confirmatory laboratory testing.

Treatment

There are no specific antiviral drugs available but supportive treatment can be given to diseased animals which control the skin lesions and secondary bacterial infections.

a. Sick animals are to be kept in isolation.

b. Symptomatic treatment of affected animals may be carried out in consultation with veterinarian.

c. Administration of antibiotics for 5-7 days to check secondary infection may be considered on case-to-case basis to check secondary bacterial infection.

d. Administration of anti-inflammatory and anti-histamine preparation may also be considered.

e. In case of pyrexia, paracetamol can be given.

f. Application of antiseptic ointment with fly-repellent property over the eroded skin is recommended.

g. Supportive therapy likes vitamin B-complex, parenteral/ oral multivitamins are advised.

h. Feeding of liquid food, soft feed and fodder and succulent pasture is recommended for the infected animals.

Prevention and Control

The following measures should be imposed for prevention of LSD (Lumpy Skin Disease)

- Immediate isolation of sick/ infected animals from the healthy animals.
- Movement control of animals- Ensure strict control of animal movement from affected areas to free areas and to local animal markets to check the transmission/spread of LSD.
- Movement of people to and from the affected area should be restricted. The animal handlers and those attending to the affected animals should be advised to keep away from healthy animals. It is therefore, of utmost importance to ensure these safety measures.
- Ecto-parasiticide should also be applied to healthy animals on the infected and on surrounding farms.
- The persons dealing with the infected animal should wear gloves and face mask. All biosecurity measures and strict sanitary measures for disposal of personal protective equipment (PPE) used during sampling from affected animals should be followed.
- Care should be taken to report any unusual sickness of other animals to nearest veterinary Hospital/Dispensary.
- Disinfection of premises at regular intervals: Thorough cleaning and disinfection of affected personnel, premises and contaminated environment including vehicles plying through the affected. Animal holdings should be carried out with appropriate chemicals/disinfectants like sodium

hypochlorite (2-3%), iodine compounds (1:33 dilution), and quaternary ammonium compounds (0.5%).

- Farms with affected animals should be visited regularly by the field veterinarians until all the cases are recovered. The veterinary staff should take all precautionary hygiene measures to avoid further spread of disease to other farms households.
- In case of mortality, carcass should be disposed of by deep burial method observing all hygienic measures.
- Cattle markets located within 10 km radius of the epicenter of infection should be closed. Trade of live cattle, participation in fairs, shows should be banned immediately upon confirmation of the disease in the affected areas.
- Vector control: Control of vector population in the premises and the animal body should be carried out using the insecticide, repellents and other chemical agents. Unaffected animal should be applied with insect (ticks, flies, mosquitoes, fleas, midges) repellent to minimize mechanical transmission of LSD.
- Affected bull should not be used for natural breeding and semen production for artificial insemination.
- Mass awareness campaign to be taken up to make the public aware of the disease and report to the veterinary authority immediately when suspected cases are detected. This will help in prevention and control of LSD.

Vaccine and Vaccination

Vaccination is the only effective method of control the disease in the endemic area along with movement restrictions and removal of affected animals. Most commercially available vaccines against LSD are live attenuated vaccines based on a LSDV strain, sheep pox virus (SPPV), or goat pox virus (GTPV). LSD vaccines are safe to use in all age groups, both sexes, and all breeds and bovine species. Cattle and buffaloes should be vaccinated with Goat pox vaccine (cattle and buffalo at the age of 4 months and above through S/C route) with $10^{3.5}$ $TCID_{50}$ of GTPV vaccine (Uttarkashi Strain). The same dose of $10^{3.0}$ $TCID_{50}$ used for prophylactic vaccination/ring vaccination in cattle and buffalo

The infected villages to be identified so that precautionary plans will be carried out in a specific area and ring vaccination will be carried out in villages upto 5 km around the affected village. However, affected animals should not be vaccinated.

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THE SCIENCE WORLD
A Monthly e Magazine
ISSN: 2583-2212
August, 2022; 2(8), 1324-1328

Popular Article

Clinical Management of Canine Pyometra: A Mini Review

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Abstract

Canine pyometra is an endometrial pathology that causes the uterus to become clogged with a purulent, semisolid substance. A sequence of cystic endometrial hyperplasia (CEH), which is brought on by hormonal imbalance. Because the afflicted animal may become very dehydrated, septicemic, fall into shock, die from toxaemia alone, or be coupled with peritonitis from uterine rupture, prompt diagnosis and treatment of canine pyometra are crucial.

Keywords: Canine Pyometra, Progesterone, Diagnosis, Pathogenesis, Treatment.

Introduction

Canine pyometra is a frequent reproductive syndrome that affects sexually mature, intact female dogs throughout the met/diestrous stage and manifests as a variety of systemic and reproductive-specific clinical and pathological symptoms (Fransson, 2003). Pyometra or chronic purulent endometritis as an accumulation of pus in the uterus. It is a prevalent metestrual disease with a median age of 10 years and primarily affects bitches between the ages of 9 months and 18 years (Jitpean et al., 2012). The illness typically strikes after oestrus and typically during the luteal phase (Blendinger, 1997). Several terms, such as chronic endometritis, chronic purulent metritis or cystic endometrial hyperplasia pyometra complex (CEHPC), have been used in the literature to describe the condition (Fakuda, 2001).

Based on the condition of the cervix, canine Pyometra can be classified as either open-cervix or closed-cervix; however, the closed form is a more serious condition that requires surgical intervention to prevent concurrent infection and mortality (Smith, 2006).

It is a consequence of cystic endometrial hyperplasia and accumulation of exudate in the uterus as the most severe end stage (Dow, 1957). Dow described four stages of canine pyometra: Stage I, uncomplicated cystic endometrial hyperplasia; Stage II, cystic endometrial hyperplasia with plasma cell infiltrate; Stage III, cystic endometrial hyperplasia with acute endometritis; Stage IV, cystic endometrial hyperplasia with chronic endometritis.

Nulliparous bitches have a moderately higher risk of developing pyometra than primiparous and multiparous animals (Niskanen and Thrusfield, 1998).

Hagman (2004) reported 25% that of the female dog population developed pyometra by 10 years of age which is a very high incidence compared to other uterine problems.

Etiology

- Several studies suggested that progesterone and estrogen, the two reproductive hormones, play a major role in predisposing to pyometra, with the former being the most important one. The well-established effects of progesterone on endometrial gland secretions and myometrial contraction, which encourage bacterial growth and colonization well known (Cox, 1970).
- Estrogen plays a secondary role by improving progesterone's endometrial responsiveness. The most prevalent occurrence of E. coli and endotoxins can be used to determine the etiology of bacterial origin (Hageman, 2004; Bondade et al., 2010) Numerous other pathogenic bacteria, such as Klebsiella Spp., Streptococci, Staphylococci, anaerobic bacteria, and Pseudomonads, are also identified as the causative agent (Dhaliwal et al., 1998). The virulence factors of E. coli, such as K antigen and cytotoxin necrotizing factor, are associated with pathological conditions.
- Parity and age are significant risk factors in the development of pyometra (Niskanen and Thrusfield 1998).
- Several researchers have said that progesterone and the host's sensitivity to pathogenic germs appear to be key factors in the development of disease (Krekeler et al., 2012a; 2012b).

Prevalence, background, and clinical observations

Kumar and Saxena (2018) reported that canine pyometra is commonly presented in mature bitches ranging from 4 to 16 years, but most common at the age of 7.5 years with regular and repeated estrous cycle. The occurrence was reported as 19% in bitches below 10 years of age and 20% in older female dogs. Breed susceptibility is also observed in this condition with high risk include Rottweiler, Saint Bernard, Chow chow, Golden Retriever, Miniature Schnauzer, Irish Terrier, Airedale Terrier, Cavalier King Charles Spaniel, Rough Collie, and Bernese Mountain dog. Moreover, a few breeds possess low risk like German shepherd, Daschunds and Swedish hounds. Breed susceptibility strongly indicates the contribution of genotype towards increase or decrease risk of disease.

Pathogenesis

Blood progesterone levels rise during the luteal phase of the estrous cycle, which in turn causes an increase in endometrial gland secretions, endometrial growth, decreased myometrial contraction, and cervix

closure (Hardie, 1995) all of which favour the development of illness. Bacterial factors and the expression of their receptors may promote bacterial adhesion to endometrium (Gabriel et al., 2016).

According to Wijewardana et al. (2015), progesterone has a deleterious effect on the development of antigen-presenting dendritic cells, which may lower cell-mediated immunity (CMI).

Gultiken et al. (2016) showed elevated expression of 3-hydroxy steroid dehydrogenase on endometrial tissue in pigs with pyometra, further indicating the role of local progesterone production in the development of the disease, even when it is within normal limits. Due to lowered local immunity and decreased CMI brought on by progesterone dominance in the luteal phase (Sugiura et al., 2004), infections can develop and colonize the uterus more quickly.

Clinical Signs and Diagnosis

Haematological and biochemical parameters

Shah *et al.,* (2017) studied the hematological parameters in 6 clinical cases of pyometra-affected bitches with different breeds and reported that.

Parameter	Units	Patient data		Reference range*
		Mean ± SE	Observation range	
Hb	g/dl	5.62 ± 0.32	2.0 – 8.2	12 - 18
RBC	$\times 10^6/\mu l$	3.24 ± 0.59	1.8 – 4.9	5.5 – 8.8
PCV	%	18.55 ± 1.18	8 - 25	37 - 55
MCV	Fl	60.88 ± 6.71	44.4 - 80	60 - 77
MCH	Pg	20.55 ± 1.85	11.1 – 21.6	19.5 - 24.5
MCHC	%	33.3 ± 3.37	21 – 38.4	32 - 36
WBC	$\times 10^3/\mu l$	104.8 ± 4.0	81.2 – 131.2	6 - 17
Neutrophils	%	94.25 ± 0.73	92 - 96	60-70
Lymphocytes	%	5.25 ± 0.41	4 - 6	30-40
Platelets	$\times 10^3/\mu l$	182.5 ± 17.01	100 - 250	200 - 500
Reticulocytes	%	1.29 ± 0.64	1.5 – 4.5	0.0 – 1.5
BUN	mg/dl	63.6 ± 7.07	30.4 – 110.4	7 – 32
Creatinine	mg/dl	2.96 ± 0.6	1.9 – 4.0	0.5 – 1.4
Albumin	g/dl	2.93 ± 0.03	2.9 – 3.0	3.2 – 4.2
Total protein	g/dl	9.53 ± 0.78	8 – 10.6	5.3 – 7.6
ALP	IU/L	154.66 ± 7.72	129 - 180	0 – 90
ALT	IU/L	43.66 ± 4.68	33 - 63	10 – 94
AST	IU/L	55.66 ± 1.71	51 - 63	10 - 62

Pathology

Gross Lesion

Gupta *et al.,* (2015) studied the gross changes in the uterus of bitches with pyometra. Grossly, blood mixed reddish-brown to greyish-white contents with watery to thick creamy consistency was observed in the lumen of uterus. The endometrium was smooth in most cases and thickened in few cases. Uterus in pyometra was dialated with purulent to sanguino-purulent materials.

Histopathology

Schlafer and Gifford (2008) reported that the most common histopathological finding in pyometra is the progression of events starting with the development of endometrial hyperplasia, with or without cyst formation Endometrial hyperplasia is associated with uterine bacterial infection in bitches. This stimulates a local inflammatory reaction and in turn the hyperplastic endometrium causes secretions to accumulate, followed by the establishment of a bacterial infection. This results in the accumulation of exudate in the uterine lumen leading to pyometra. Small aggregates of cystic endometrial glands sometimes stimulate deposition of interstitial fibrous connective tissue that can expand and protrude to form endometrial polyps. Bitches and queens may have only one or several endometrial polyps, which are frequently small and of little consequence. Occasionally larger polyps develop that can compromise the uterine lumen.

Radiographical examination and Ultrasonography

Baithalu *et al,* (2010) stated that the diagnosis of pyometra is best made with the help of radiology used as an aid in diagnosis of pyometra in the bitch. In pyometra radiographically, a fluid dome, tubular structure should be seen in the ventral and caudal abdomen, displacing loops of intestine dorsally and cranically. The pyometra may be difficult to palpate uterine enlargement, especially in case of open cervix pyometra and in case of large and obese bitch. In case of closed cervix pyometra the degree of uterine distension is greater and may be associated with visible enlargement**.**

Rautela and Katiyar (2019) reported that ultrasonography reveals an enlarged uterus with convoluted, tubular horns containing anechoic or hypoechoic fluid with thickened endometrium .The luminal contents are usually homogenous and echo-dense due to pus particles. The presence of cystic structures with thickened endometrium is diagnostic for CEH with or without pyometra. Ultrasonography is the best diagnostic method that has been used for diagnosis of pyometra.

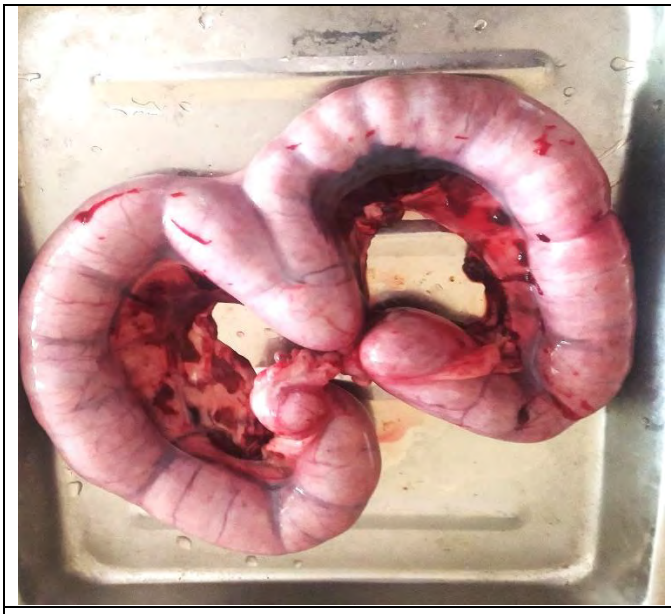


Figure 1: Pus Filled Uterine Horn on Caesarean Section

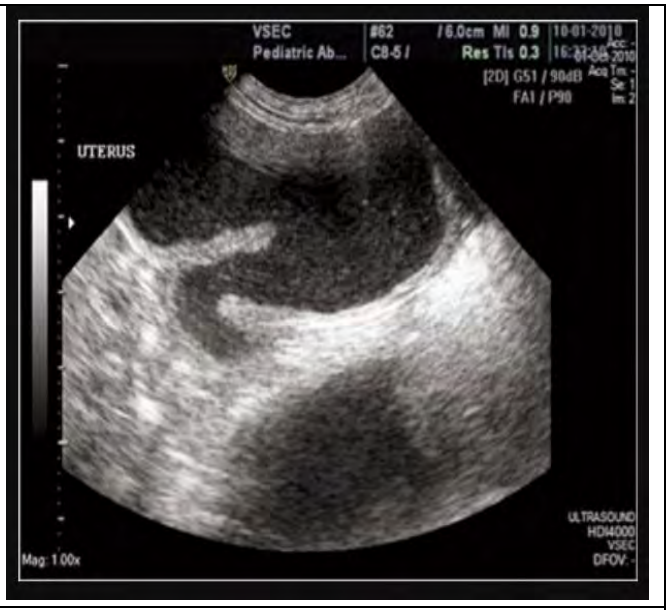
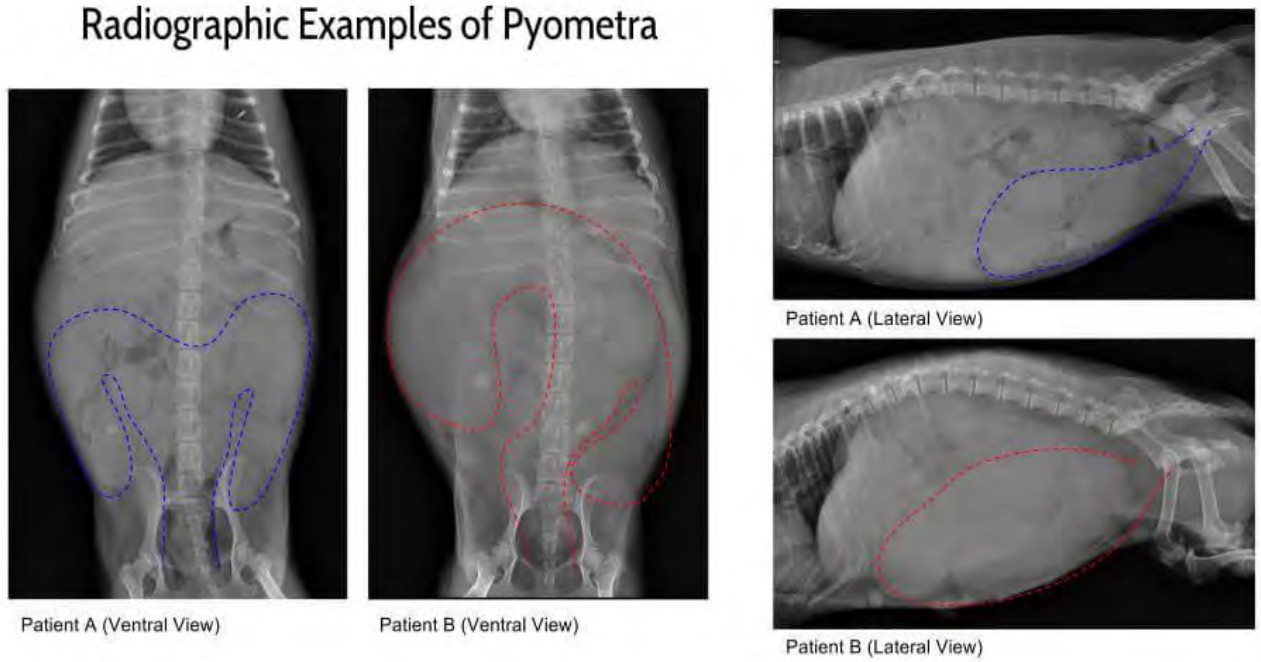


Figure 2: Distention of the uterus with an anechoic to hyperechoic fluid



Treatment

Surgical Approach

Kumar and Saxena (2018) stated that spaying remains the choice of treatment for majority of obstetrician, however recently Laparoscopic Assisted Ovariohysterectomy (LAOVH) is advocated for

treatment of select cases of canine pyometra, which is proved to be efficacious over conventional open method with careful case selection in order to improve success rate.

Medical Approach

The primary goals of medical treatment are the systemic and intrauterine administration of drugs. Prostaglandin (PGF2α) given subcutaneously at a dose rate of 150–200 g/kg/day for more than 10 days produced 100% of the desired effects (Myhre, 2016), which may be because PGF 2α promotes luteolysis, which results in progesterone block (Renton et al., 1993). Another treatment using cloprostenol (@ 1 Pg/kg once daily) and cabergoline (@ 5 Pg/kg PO once daily) for seven days was well received.

However, progesterone blockers like mifepristone (Hoffman and Schuler, 2000) or aglepristone (Wehrend and Traschbostedt, 2003; Arnold et al., 2006) have recently proven to be a more effective treatment option.

Additionally, Contri et al. (2015) had success with a regimen that paired aglepristone with a brief (6 days) antibiotic cover. A third-generation GnRH antagonist, acyline, at 330 µg/kg orally (single dosage), combined with amoxicillin-clavulanate at 12.5 mg/kg twice a day, orally for seven days, has shown encouraging results in the treatment of pyometra (Batista et al., 2016).

Conclusion

Since canine pyometra is one of the bacterial infections that could lead to systemic inflammatory response syndrome (SIRS), it is advised that any bitch that won't be used for breeding in the future be spayed before the age of six to prevent the development of pyometra. Due to the extremely complicated nature of the disease, one of the many causes of this problem can be attributed to the absence of comprehensive and accurate information regarding the etio-pathology of canine pyometra. Finding a proven medical procedure with a high rate of recovery that may be utilised as an alternative to a demanding, expensive, and time-consuming surgical procedure is urgently needed today.

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THE SCIENCE WORLD
A Monthly e Magazine
August, 2022; 2(8), 1335-1338

Popular Article

Dragon Fruit- An Emerging Fruit Crop in India

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https://doi.org/10.5281/zenodo.6984190

Abstract

Dragon fruit, pitaya or strawberry pear (Hylocereus spp. and Selenicereus spp.) or Kamalam is emerging as a super crop worldwide. It has many advantages, because of which it has drawn much attention among Indian growers like low water and nutrient requirements, relatively less requirement of resources for establishing the orchard and maintenance, multiple harvest of fruit in a year, potential to sustain high yield up to 20 years, high benefit to cost ratio. It has now become the favorite fruit among consumers due to high nutraceuticals and functional properties (e.g., rich in antioxidants and fibres). Being a crassulacean acid metabolism (CAM) plant with xerophytes' characters, it has got potential to grow in diversified agroclimatic conditions, marginal areas and owing to its low maintenance, high profitability. In recent years the area under dragon fruit cultivation is increasing in Maharashtra, Karnataka, Andhra Pradesh, West Bengal, Telangana, Tamil Nadu, Odisha, Gujarat and the Andaman and Nicobar Islands, as well as in many north eastern states. The major challenge in dragon fruit cultivation is to standardize region specific protocols of cultivation, harvesting and post–harvest management practices for enhancing yield and quality. At present, little information is available on cultivation aspects of Dragon fruit. Research on different aspects of cultivation, global and national cultivation status and health benefits of this fruit can help to maximize the benefits to worldwide growers and consumers and to expand the market of dragon fruit.

Keywords: Dragon fruit, health benefits, cultivation

Introduction

Dragon fruit (*Hylocereus spp.*), an herbaceous perennial climbing cactus, also referred to as red pitaya, is one of the emerging fruit crops due to its attractive red or pink colour and fruit's high economic value as well as its high antioxidant potential, vitamin and mineral content. It has been originated from Central and South America and was introduced in India during the late 90's. Production of dragon fruit has many advantages including low water and nutrient requirements, relatively less resources requirement for establishment. It has a potential to produce multiple fruit harvest per year, higher yield up to 20 years and high benefit to cost ratio. The production of dragon fruit in India is about 4.2MT with an area of 400ha with a productivity of 8.0 to 10.5 t/ha (Ahmad *et al*., 2019). on the condition of the cervix, canine Pyometra can be classified as either open-cervix or closed-cervix; however, the closed form is a more serious condition that requires surgical intervention to prevent concurrent infection and mortality (Smith, 2006).

Dragon fruit belongs to cactus family and requires long day for flowering and can be well cultivated in the agro-climatic regions of Southern, Western and North Eastern India. Dry and Frost-free climate is most suitable for its cultivation. Indian states like Gujarat, Karnataka and Maharashtra are the leading producers contributing about 70% of India's dragon fruit production.

Health benefits of Dragon fruit

Dragon fruit is rich in vitamins, minerals, phenolics, flavonoids, antioxidants and dietary fibres and hence has great health benefits It is believed that dragon fruit helps in prevention of cough and asthma, speedy healing of cuts and wounds due to its high vitamin C content, helps to alleviate uterine hemorrhage issues, act against cardio related problems and lowering blood sugar levels for people with type 2 diabetes. It plays a crucial function in tissue creation, strengthens bones, and creates strong teeth as it is rich in Ca and P content.

Types of dragon fruit based on color

(i) Red skin, white flesh (*Hylocereus undatus*), mainly from Vietnam and Thailand;
(ii) Red skin, red flesh (*Hylocereus polyrhizus*) come mainly from Israel and Malaysia;
(iii) Red skin, purple flesh (*Hylocereus costaricencis*) from Guatemala, Nicaragua, Ecuador, and Israel; and
(iv) Yellow skin, white flesh (*Hylocereus (Selenicerus) megalanthus*) from Colombia and Ecuador


Training of dragon fruit

Soil and climate

Dragon Fruit can be grown in wide range of soil types. However, soils which are rich in organic matter, slightly acidic and well drained are most suitable for its cultivation. Climatic conditions in states of Karnataka, Kerala, Tamil Nadu, Maharashtra, Gujarat, Orissa, West Bengal, Andhra Pradesh and Andaman Nicobar Islands are ideal for dragon fruit production. It is tolerant to adverse weather conditions. It requires an annual rainfall of 1145- 2540 mm/year. It prefers a dry tropical climate with an average temperature of 20-29ºC, but can withstand temperatures of 38-40ºC and as low as 0ºC for short periods (Karunakaran, *et.al*.,

2014). Above 40ºC, plants will be damaged. Flower and fruit drop is a common problem during heavy rainfalls (Karunakaran and Arivalagan, 2019).

Propagation and Planting

Dragon fruit can be propagated by two methods mainly stem cuttings and seeds. The most common and commercial method of dragon fruit propagation is stem cuttings as seeds (showed variability) take long time (3-4 years) for fruiting. Cuttings should be prepared from quality mother after fruiting season. Planting is done using 20-25 cm stem cuttings. Cuttings are taken 1-2 days before being planted in the field, as the latex oozing out of cut is allowed to dry. The cuttings should be treated with fungicides and planted in poly bags, filled with 1:1:1 ratio of soil, farmyard manure and sand. The bags should be placed in shady area and cuttings become ready for planting within 5-6 months (Tripathi *et al*., 2014). Dragon fruit should be planted in open sunny area and shade should be avoided. The planting distance of dragon fruit plants depends on the kind of support system used for training. In vertical support, the distance between the plants should be 1.5-2.0 meter while in horizontal support the distance is reduced to almost 50 cm and allows for intensive farming. With this method we can accommodate more than 1700 plants in 1 acre of land.

Training system

The Dragon fruit plants are fast growing vines and they grow up to 8 cm per week, so proper training is very essential. The lateral buds and branches should be pruned to grow towards stands. Lateral branches are then allowed to grow once vine reaches the top of pole. The removal of tip of main stem allows growth of new lateral shoots at the ring to form an umbrella like structure of vines where flowers are formed and develop into fruits. The dragon fruit is trained on different trellis systems namely concrete pole and rings, 'T'stand and iron wires and wooden ladder for dragon fruit establishment. Concrete poles are mostly preferred because of its durability. With a vertical support a 2–3 m distance between planting lines is required which could accommodate 2000 and 3750 cuttings/ ha, at the rate of three cuttings per support is planted.

Water and nutrient management

The requirements of fertigation schedules/ irrigation practices were optimized based on soil and climatic conditions. About 2–4 litres of water weekly twice per plant is sufficient and installation of drip system could be main practice in orchards of dryland areas.The pitahaya's root system is superficial and can rapidly assimilate even the smallest quantity of nutrients. For proper nutrient requirement to the plant the

combination of mineral and organic nutrition is advantageous. The dose of N-450, P-2O5 and 350- K_2O 300 g/plant perform best result for yield and quality.

Harvesting

The fruit skin colors very late in the maturation stage, after anthesis the skin color changes from green to red or rosy-pink within 25 or 27days (Nerd *et al*., 1999). It will take 30 days for harvest to *H. costaricensis.* The absence of a peduncle makes picking difficult. The present harvesting technique of simply move the fruit in clock wise direction and twisting the fruit cause less or no injury to the fruits. Careful handling during processing and storage, especially for *H. costaricensis* whose foliated scales is brittle is necessary.

Pest and diseases

Prevalence pests like ants, nematodes, scale insects, mealy bugs are common in dragon fruit in India. The ants are very notorious and cause major damage to the flowers and fruits. Different fungal (*Gloeosporium agaves*, *Macssonina agaves*, *Dothiorella* sp. and *Botryosphaeriadothidea*), viral (Cactus virus X), and bacterial (*Xanthomonas* sp. and *Erwinia* sp.) diseases are also reported (Guyen, 1996).

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THE SCIENCE WORLD
A Monthly e Magazine
August, 2022; 2(8), 1339-1342

Popular Article

Large roundworm of poultry: Ascaridia galli

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https://doi.org/10.5281/zenodo.6985434

Abstract

Large roundworm of poultry *Ascaridia galli* is the most common and pathogenic nematode, causes serious infections in young poultry and are very common in free ranging young birds. Diarrhoea, anaemia, unthriftiness, marked emaciation, retarded growth and decreased egg production are the important clinical signs. In heavy infection the worms lead to intestinal obstruction and rarely perforation of intestine leading to peritonitis and death. Regular deworming, treatment of the infected birds and adoptation of good managemental practices are the important control measures.

Keywords: Poultry, *Ascaridia galli,* treatment and control

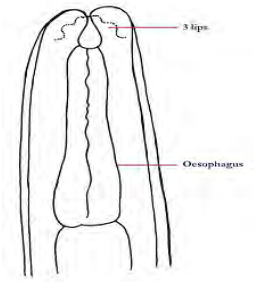
Introduction

Amongst all gastrointestinal nematodes, large roundworm of poultry *Ascaridia galli* is very common and prevalent throughout the world. *Ascaridia galli* causes serious infections in chickens of one to three months of age. It is commonly known as large roundworm of poultry, located in the small intestine of fowls, guinea fowls, turkey, goose and wild birds. Parasite comes under the Family Heterakidae of Order Ascaridida. Worms are thick and densely white in colour, eggs are oval, smooth shelled and comparatively smaller in size. *Ascaridia galii* has significant effect due to the direct life cycle of the parasite and ability to survive extreme environmental conditions (Sharma *et al*., 2019).

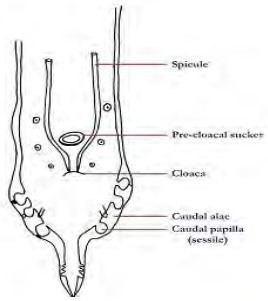
Infection is most common in free ranging young birds while adults act as symptomless carriers. Infected birds will show diarrhoea, anaemia, unthriftiness, marked emaciation and retarded growth. Loss of apetite and body weight, ruffled feathers, drooped wings, retarded muscular and bone development, altered hormonal levels, anorexia, depression and increased mortality have reported in *Ascaridia galii* infection (Dahl *et al*., 2002). *Ascaridia galii* infection has various effects on the performance, health, immune response, egg quality, decreased egg production of free-range layer bird (Sharma *et al*., 2019). In heavy infection the worms cause intestinal obstruction and rarely perforation of intestine leading to peritonitis and death. Regular deworming, treatment of the infected birds and accommodation of good managemental practices are the important control measures.

Morphological characters of *Ascaridia galli*

- Worms are thick and densely white in colour. Measure upto 12cm.
- Both ends are pointed and cuticle is thick. Anterior end has three small lips.
- Oesophagus: posterior bulb is absent
- Tail of male has a large alae and a prominent precloacal sucker and 12 pairs of papillae.
- Spicules are unequal, the right one is long and cylinder and the left one is short and broad.
- Vulva lies behind the middle of the body.
- Eggs are oval, smooth shelled, comparatively smaller in size



Anterior end of *Ascaridia galli*



Posterior end of *Ascaridia galli*

Life cycle

- Life-cycle is direct. Earthworm may ingest egg and act as Transport host.
- Eggs embryonate in open and become infective with L2 stage in 10 or more days at optimum temperature.
- Infection of birds takes place on ingestion of infective eggs with feed or drinking water or earthworm.
- On ingestion of infective eggs, larvae hatched in the small intestine. The larvae live in the intestinal lumen for first 8 days post infection.
- Afterwards, majority of the larvae invade the intestinal mucosa and remain there upto 17 DPI (**histotrophic phase**).
- The larvae in their location reach third stage on 8 days post infection, and to L4 stage on 14-15 days post infection.
- The larvae then return to the intestinal lumen and become adults in 6-8 weeks.

Pathogenesis

- 1-3 months old chickens are most susceptible to *Ascaridia galli* infection.
- Previous exposer of infection makes the bird to more resistance.

- Some dietary deficiencies, like vitamin A, B and B12, minerals and proteins, predisposed to heavy infections.
- Massive larval invasion results in haemorrhagic enteritis and chicken become anaemic.

Clinical signs

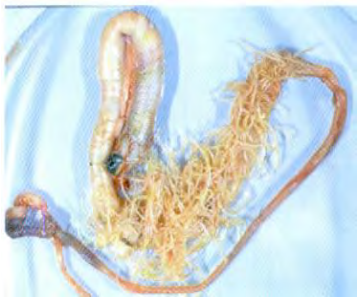
- Diarrhoea, anaemia, unthriftiness, marked emaciation and retarded growth.
- Layer bird show decreased egg production.
- In heavy infection the worms lead to intestinal obstruction and rarely perforation of intestine leading to peritonitis and death.
- On postmortem examination, intestine seen haemorrhagic and large no. of adult worm.

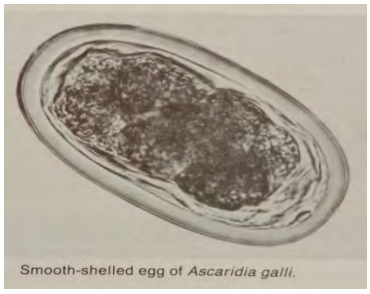
Epidemiology

- Ascaridiosis is most common in free ranging young birds while adults act as symptomless carriers.
- Larvated eggs remain viable for three months under shade.
- Earthworm play important role in the prevalence of infection, act as a transport host.

Diagnosis

- Microscopical examination of faeces to identify oval, smooth shelled, small sized eggs.
- Necropsy finding- The adult large roundworms are seen in the small intestine.





Treatment

- Piperazine adipate or citrate is highly effective drug given @ 0.5 mg/kg b.wt. will eliminate 99-100% worm burden
- Phenothiazine @ 0.5-1 gm/bird is also very effective.
- Levamisole is also an effective drug given @ 30mg/kg or 300 ppm via feed
- Mebendazole should be given 60 ppm over 7 days

Control

- Treatment of all infected birds with suitable drugs
- Accomodation of good managemental practices such as
- Young and adult birds should be reared separately
- Regular cleaning of floor, Feeding and drinking water troughs
- Proper ventilalation should be provided
- Regular deworming should be done with good anthelminthics at regular intervals
- Sterilization of the litters before the placing of each new batch of birds properly

Conclusion

The parasite Ascaridia *galli* has great significance in poultry industries in terms of production and economic losses. It has been associated with reduced health, immunity and egg production in layer birds and mortality in young birds due to heavy worms loads lead to intestinal obstruction**.** Hence young birds are most susceptible to parasite and have high mortality, they should be segregated from adults because they are symptomless carrier. Therefore, effective control of this parasite is necessarily required to minimise the production and economic losses to poultry industries.

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THE SCIENCE WORLD
A Monthly e Magazine
August, 2022; 2(8), 1343-1348

Popular Article

Lumpy Skin Disease (LSD): Global Threat to Livestock and Farmers

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Introduction

The manifestation of skin nodules is a defining feature of the vector-borne pox illness lumpy skin disease, which affects domestic cattle and Asian water buffalo. The disease is endemic to Africa and the Middle East, and it has now spread to the Balkans, the Caucasus, and southern Russian Federation. In 1929 in Zambia and in August 2019 in India, the first descriptions of LSD's clinical symptoms were made. LSD outbreaks result in significant economic losses for the afflicted nations, but poor, small-scale, and backyard farmers are the hardest hurt. This is true even if all industry participants in the cattle business experience financial losses. Production of cattle, milk outputs, and the physical health of animals are all severely impacted by the disease. Abortion, infertility, and damage to hides are all consequences. In LSD, morbidity rate is 10-15% and mortality rate is 1-5% (OIE, 2021). Incidence rate of LSD in Cattle is 30.8%, in Buffalo 1.6%, in Arabian Oryx 1.0%, in Giraffe 1.0%, in Impala 1.0%, in Yak 1.0% (El-Nahas *et al*., 2011).

Transmission can also happen by direct contact, contaminated feed or water consumption, spontaneous mating, or artificial insemination in addition to vectors. The best method for controlling the disease's spread is widespread vaccination.

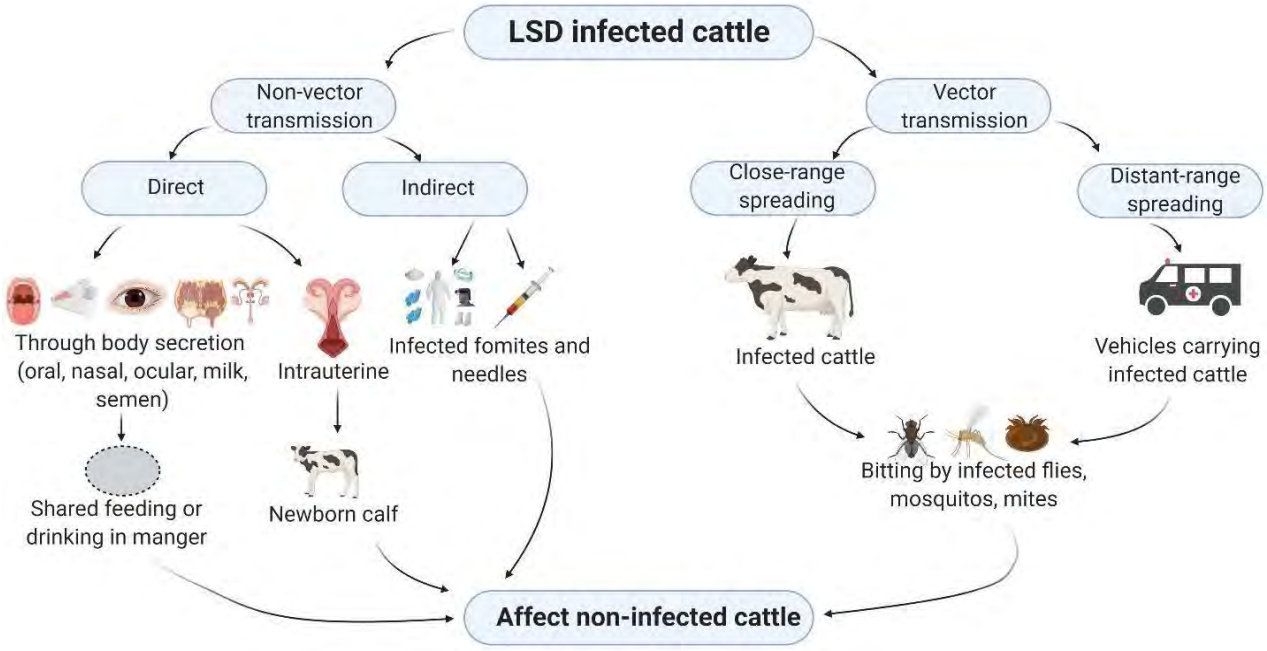
Animals from 1 to 5 years were the most afflicted (58.54%), followed by those older than 5 years (34.85%), and livestock younger than 1 year were the least impacted (6.61%) (Hatzade *et al*., 2022).

Causative Agent

Lumpy skin disease is caused by the lumpy skin disease virus (LSDV), a member of the genus *Capripoxvirus* (CaPV) in the family *Poxviridae*. Lumpy skin disease virus is in the same genus as sheep pox virus (SPPV) and goat pox virus (GTPV), both of which are closely related but phylogenetically distinct.

Transmission Of Lumpy Skin Disease

1. Vector transmission: Biting by infected flies, mosquitoes, mites.
2. Non-vector transmission: Infected fomites and needles, shared feeding or drinking in manger.



Clinical Signs of Lumpy Skin Disease and Postmortem Findings

The incubation time varies between four and seven days in experimentally infected animals, although it can last up to five weeks in naturally infected animals.

Clinical signs include:

- Lachrymation and nasal discharge are typically the first symptoms seen.
- The prefemoral and subscapular lymph nodes expand and become easily palpable.
- A high fever (greater than 40.5 °C) may last for around a week.
- Rapid decline in milk production.

- Emaciation, anorexia, and depression.
- Skin lesions with nodules 10 to 50 mm in diameter (Fig.1).
- Mastitis and pneumonia brought on by the virus itself or subsequent bacterial infections are frequent side effects.
- Skin sores on the tops of the joints and in the legs may cause lameness and deep subcutaneous infections that are worsened by secondary bacterial infections (Fig.2).

Fig.1

Fig.2

Postmortem findings include:

- Pox lesions can be seen all over the digestive and respiratory systems, as well as on nearly any internal organ's surface.
- After the animal is skinned, subcutaneous lesions are easily discernible.
- Hemorrhages in the lungs, spleen, and rumen.
- Distinctive skin nodules.

Differential Diagnosis

Severe LSD symptoms are quite distinctive and simple to identify. Early infection stages and moderate instances, however, could be hard to tell apart. To distinguish between real instances, samples should be taken from all suspected animals and examined utilising quick and extremely sensitive PCR techniques. The following diseases may be considered as a differential diagnosis for LSD:

- Insect bites, urticaria, and photosensitisation: Dermal lesions that are caused by LSDV may resemble those from other diseases, however they are less severe and more superficial. The disease can be ruled out by detecting LSDV by PCR.
- Pseudocowpox (Parapoxvirus): Lesions occur only on the teats and udder. The disease can be ruled out by detecting LSDV by PCR.

- Dermatophilosis: Early ringworm lesions have a non-ulcerative, more superficial, and obviously distinct surface structure.
- Demodicosis: Alopecia is frequently seen, with the majority of the skin lesions being on the withers, neck, back, and flanks. Mites can be found using skin scrapings to rule out the condition.
- Bovine papular stomatitis (Parapoxvirus): Lesions occur only in the mucous membranes of the mouth. The disease can be ruled out by PCR testing.
- Besnoitiosis: Scleral conjunctival lesions are common, and dermal lesions can show alopecia with thick, wrinkly skin. LSDV detection by PCR can rule out the disease.
- Onchocerciasis: Dermal lesions are most prone to occur around the ventral midline. PCR can be used to rule out the disease.

Treatment

There are no specific antiviral medications available, however supportive therapy for the afflicted animal can include treatment of skin lesions and antibiotics against subsequent skin infection and pneumonia.

Treatment with Enrofloxacin along with antihistaminic, NSAIDs and B-Complex for 3-10 days depending upon the severity of cases. Combination therapy of Dexamethasone for three days and broad-Spectrum antibiotics were effective in LSD virus infection (Feyisa, 2018). Ivermectin reduced the number of infectious virions in treatment of Lumpy skin disease (Yesilag *et al.,* 2021).

Ethno-Veterinary Treatment of Lumpy Skin Disease

First preparation

- Ingredients for one dose: Betel leaves (10 numbers), black pepper (10 grams), salt (10 grams), and any necessary amounts of jaggery.
- Preparation: Blend to a paste, then combines with jaggery.
- Administration: Orally, take one dose every three hours on the first day; starting on the second day, take three doses each day for three weeks.
- Caution: Each dose should be freshly prepared.

Second preparation

- Ingredient for two doses: Two pearls of garlic, 10 grams each of cumin and coriander, and 1 handful of Tulsi, 10 grams Black pepper, two bulbs of shallots, five numbers of betel leaves, ten grams of bay leaves, 10 grams of turmeric powder, 30 grams of Chirata leaf powder, One handful of sweet basil, one handful each of Neem leaves, Aegle marmolos (BEL) leaves, and 100 grams of jaggery.

- Preparation - Blend to a paste, then combines with jaggery.
- Administration: Orally, start with one dose every three hours and increase to two doses per day (morning and evening) from day two until the problem is resolved.
- Caution: Each dose should be freshly prepared.

For external wound

- Ingredients: One handful of Acalypha Indica leaves, 10 pearls of garlic, one handful of Neem leaves, 500 ml of coconut or sesame oil, 20 grams of turmeric powder, one handful of Mehendi leaves, and one handful of Tulsi leaves.
- Preparation: Blend each ingredient with 500 ml of coconut or sesame oil, then boil the mixture and let it cool.
- Administration: Clean the wound and apply directly.
- If maggots are seen: Apply Anona leaf paste or camphorated Coconut oil for the first day

Control And Prevention of Lumpy Skin Disease

- Prophylactic vaccination of the entire cow population, performed well in advance in at-risk locations, provides the best protection.
- The movement of cattle within the nation and across international boundaries should be severely regulated or outright prohibited.
- If possible, without compromising animal welfare, cow herds in affected villages should be maintained apart from other herds by refraining from communal grazing.
- Movements of vaccinated animals may be permitted inside a limited zone within a country if it has been demonstrated that full immunity has been delivered by a vaccine with proven efficacy (28 days after vaccination).
- Cattle should be treated with insect repellents on a regular basis to reduce the risk of disease vector transmission. Although it cannot completely stop transmission, this step may lower the danger.
- Cleaning and sanitising of workers, facilities, and the surrounding area.
- Control of insects on animals and in the environment.

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THE SCIENCE WORLD
A Monthly e Magazine
August, 2022; 2(8), 1348-1354

Review Article

Environmental Conflicts and Cooperation

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https://doi.org/10.5281/zenodo.6989186

Introduction

Industrialization, urbanization and rapidly increasing population is posing a burden on the earth's resources while simultaneously causing climate change around the globe. Various local, national and international conflicts arise with the exploitation of the natural resources of the earth and their injudicious uses. Unwise discharging of the waste in the transboundary zones brings such conflicts in two or more parties. Some countries began imposing limits on themselves in order to conserve the environment and alleviate the effects of anthropogenic climate change. This proved to be a futile attempt, and it reinforced the view that achieving the goals on one's own is impossible. Thereby, the idea of environmental cooperation surfaced, with the goal of halting the ongoing environmental degradation. This collaboration brought together a number of industrialized and less developed countries in an attempt to regularize and make declarations on biodiversity preservation and environmental protection.

Environment

The environment is defined as a set of numerous biotic and abiotic variables that surrounds human as well as living organisms. It encompasses land, air, water as well as the interrelationship of humans with these variables as well as other biotic variables including plants and animals [1]. This natural environment system consists of four interlinking systems which are inextricably linked and dynamic in nature, being influenced by anthropogenic activities and vice versa [2]. Hydrosphere, consist of all the water that exists below, on the surface, and in the atmosphere. Lithosphere is the rigid and rocky outermost layer of the earth consisting of the crust and uppermost mantle of the earth's layers. The atmosphere is a thin layer of gases, such as oxygen, carbon dioxide, nitrogen and other trace gases, that envelops the planet to protect it and its inhabitants from harmful radiations of the sun. It consists of five concentration layers differentiated based on their temperature and other characteristics [1]. Biosphere is the combination of the atmosphere, lithosphere and hydrosphere, where life exists. It is also known as life layer as it refers to all the living organisms on the earth and their interaction with air, water and earth's crust. It consists of all flora and fauna present on the earth's surface.

Environmental conflicts:

Environmental conflicts include the key issues challenging the local, regional, national and global security. These conflicts are widespread and are increasing rapidly. The causes for these conflicts vary across the globe and manifestation differs substantially including control over vital environmental resources by one party or dispute overuse of natural resources of the planet. The term conflict is defined as "a social situation in which a minimum of two actors (parties) strive to acquire at the same moment in time an available set of scarce resources" [3]. Environmental conflicts occur when one party is perceived to take action at the expense of another party's interests. Factors like competition for finite environmental resources, conflicting attitudes and beliefs as well as institutional factors trigger and intensify these environmental conflicts. For example, conflicts on water resources, their flow, salinity, diversion, floods and pollution, are the major and most common reason for international conflicts. Other international and intra-national conflicts arise because of the depletion of the natural resources, deforestation, flooding and pollution etc.

The impacts posed by these environmental conflicts include:

1. Conflicts over environmental resources pose physical harm to both human and natural reserve bases.
2. It brings impact on productivity levels and economic development of the nations and affects globally.
3. It affects the livelihood and health of either one or both the parties in conflict.
4. It also exacerbates poverty and inequality among developing nations.

Types of Environmental conflicts earth is witnessing are:

Biodiversity conflict- This type of conflict arises between human, wildlife or other aspects of biodiversity [4]. These conflicts majorly include the issues related to the conservation of protected areas, their limited resources, green technologies and also in demand for the fair trade of indigenous natural resources. These conflicts can occur internationally and have serious implications, and require conservation and environmental management policies formulated and implemented in a holistic way to balance the needs and interests of conservation and people. Natural resource management conflicts, a major part of biodiversity conflicts, are complex because of the involvement of multiple stakeholders and parties.

Coastal zone conflicts- *These conflicts between two or more nations may arise* in offshore waters due to oil exploitation, ocean dumping, mineral mining and excessive fish harvesting. Conflicts may also

arise due to high development demands, high population density, environmental degradation and poor and fragmented management to balance conservation and development of coastal zones.

Conflicts about air quality- These conflicts relate to issues with social justice and the right to live in a clean and healthy environment. Most of these conflicts in any nation or at global level occur in the favor of handing over the more sustainable world to the next generations. These conflicts may arise as local demonstrations and legal disputes between residents and other parties. Environmental activists take part by mobilizing communities to assert their rights; there are also incidences of violent protests and conflicts.

Climate change and environmental conflicts- It is widely recognized that climate change has significant impacts on social, economic and ecological systems. Due to these impacts, rise in socio-economic inequalities occur locally as well as globally [5]. Investigation of climate change needs to include the relationships between global processes (including emission effects and international conventions), national responses and local outcomes, and particularly the effects of national decisions and policies on local opportunities and abilities to adapt. Thus, aspects relating to environmental conflicts are significant to consider [6]. There are a range of direct and underlying drivers, fundamental needs and desires of individuals and groups, affecting the natural environment and intensifying climate change. The direct drivers associated with climate change are land clearing, land cover conversion, the introduction of alien species, agricultural practices, fossil fuel and biomass burning, poor water use and management practices. The underlying human-induced drivers include an upsurge in demand for a varied range of goods and services including basic needs, transport, recreation and leisure activities, safety and security, and entertainment and luxury items [7].

Environmental Cooperation

Many developing countries have been facing environmental conflicts including urban air pollution, water pollution, deterioration of health environment, forest and soil degradation, loss of biodiversity, and marine pollution. A combination of various factors including population growth, urbanization, industrialization, and poverty plays a major role in enhancing the problems. The world as a whole is facing wide-ranging issues such as climate change and acid precipitation due to trans-boundary pollutants discharged from many countries. Many of such countries had taken the first steps to halt environmental degradation locally in their countries, but they came up with the understanding that the global environment and common resources of the world might not be protected if every country looked after only its national environmental interests. These crisis conditions required immediate

global attention and action. Advantages of international environmental cooperation to curb environmental degradation became understandable. Starting from the Stockholm conference, many other agreements like the Kyoto Protocol and Paris agreement came into existence.

Goals which were addressed in the environmental cooperation are:

- Reduction of global pollution to achieve zero pollution
- Maximum utilization of renewable energy resources and reducing the consumption of non-renewable energy resources, also initiatives for the development of alternatives for energy production
- Judicious use of scarce resources such as water, land, and air also initiatives for sustainable long term use and conservation.
- Protection of the unique ecosystems and preservation of threatened and endangered species from extinction
- Protection of biodiversity and ecosystems by establishing nature and biosphere reserves.

Some Important Environmental cooperation conventions:

Stockholm Conference- It was the first United Nation's conference that focused on international environmental issues. This conference was held in Sweden from June 5-16, 1972, and laid the foundation of global environmental governance. The final declaration of the conference was the statement declaring finite nature of the earth's resources and the need to safeguard them. It led to the formation of the United Nations' Environment Program (UNEP) in Dec 1972, the role of which was to coordinate the global efforts in promoting sustainability and safeguarding the natural environment [8].

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)- This international agreement was adopted in March 1973, to regulate the worldwide commercial trade in wild animals and plant species. The goal of this convention was to ensure that international trade does not threaten the survival of any species. CITES was adopted in Washington DC on March 1973 and came into force on July 1, 1975. It classifies plants and animals in categories based on how threatened the species are. The List I consist of endangered species at the risk of extinction, List II includes species not threatened with extinction but at a serious decline and List, III includes species have protected status at least in one country [9].

United Nation Conference on Environment and Development (UNCED)- also known as Earth Summit and Rio de Janeiro Summit. It was held in Brazil on June 3-4, 1992 to reconcile worldwide economic development with protection of the environment. Most of the world's nations committed themselves to the pursuit of economic development in ways to protect non-renewable resources and earth environment. Treaties of the Convention of Biological Diversity and UN Framework Convention on Climate Change were signed in the conference. Declaration on Environment and Development was laid out for environmentally sound development. Statements were released regarding the protection of forests. Nearly a decade later Earth summit II was held in Johannesburg, South Africa from 26th August to 4th September to discuss sustainable development organizations. It particularly established type II partnership facilitating the inclusion of civil and private actors [10].

Kyoto Protocol- It was an International treaty linked to the United Nations Framework Convention on Climate Change, adopted in December 1997 that aimed to reduce the emission of "greenhouse gases" that contribute in global warming. It came into force in 2005 and protocol was set to reduce 6 [carbon dioxide, methane, nitrous oxide, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF6)] greenhouse gases in 41 countries. Article 3 of the Kyoto protocol contains the joint commitment of industrialized countries to reduce and regulate the greenhouse gases emission by at least 5% below the 1990 level in the commitment period of 2008-12. It was based on the principle of common but differentiated responsibilities to be shared, by acknowledging the limited role of developing countries in climate change and putting obligations on developed nations to reduce the current greenhouse gases emission as those developed nations were more responsible for the current status of greenhouse gases [11].

Paris Agreement- This agreement was signed in December 2015 to reduce "greenhouse gas emissions" in order to combat global warming. It was intended to improve on and eventually replace the previously established Kyoto Protocol. The Paris Agreement, ratified by 197 nations, entered into force on November 4, 2016. The main striking point of negotiation was the issue of transferring funds from developed countries to less developed countries. The accord aimed to hold the increase of global temperature to below 2 degrees Celsius. This agreement emphasized the cooperation, transparency, flexibility and regular reporting of progress in achieving intended nationally determined contributors. Each country is indicated to determine, plan, and regularly report on the contribution that it undertakes to mitigate global warming [12].

2021 United Nations Climate Change Conference (COP26)- The COP stands for "Conference of the Parties," and this was the 26th annual summit held on November 13, 2021, in Glasgow, Scotland,

UK. Ahead of the conference, 200 nations were requested to submit plans to reduce emissions by 2030. During COP26, countries examined climate commitments made under the 2015 Paris Agreement and the Glasgow Climate Pact was signed by 197 nations as a new non-binding agreement. This pact aimed at staving off dangerous climate change. More than 140 countries have committed to achieving net-zero emissions, which accounts for 90% of world GDP. This pact has been formed with the goal of making the 2020s a decade of climate action. The decision package includes a variety of agreed-upon topics, such as increased efforts to improve resilience to climate change, reduce greenhouse gas emissions, provide the required financing for both. Nations reiterated their commitment to meet the offer of 100 billion dollars per year from industrialized to underdeveloped countries. They also committed to work together to close the gap between existing emission reduction plans and what is needed to cut emissions so that the global average temperature rise is restricted to 1.5 degrees Celsius. For the first time, nations are being encouraged to phase out unrestricted coal power and expensive fossil fuel subsidies. The world's two largest CO2 emitters, the United States and China, have agreed to work together more closely over the next decade on issues such as methane emissions and the transition to clean energy. China has previously been hesitant to address domestic coal emissions, so this was interpreted as acknowledging the need for immediate action. Leaders from almost 100 nations, which account for around 85 percent of the world's forests, pledged to halt deforestation by 2030. More than 100 nations have agreed on a plan to reduce methane emissions by 30% by 2030. Financial institutions with a combined market capitalization of $130 trillion decided to support "green" technology such as renewable energy and divert funds away from fossil fuel-burning sectors [13] .

Conclusion

Environmental conflicts may arise in different forms and have varying impacts in different circumstances. In particular, key points of global conflict are concerning exploitation of resources, increasing climate change, conservation of resources and biodiversity, better water quality and availability, safe air quality and also its management aspects. International environment cooperation brings together various actors (parties) under one roof with the goal of halting the ongoing environmental degradation. For a sustainable and healthy future, industrialized nations must limit their pollution discharge into the transboundary environment of less developed nations. Conflicts arising due to injudicious division of natural resources can occur internationally and have serious implications,

and require conservation and environmental management policies be formulated and implemented in a holistic way to decide the sustainable use of resources.

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THE SCIENCE WORLD
A Monthly e Magazine
August, 2022; 2(8), 1355-1359

Popular Article

Effects of various plant extracts on ruminant health for sustainable livestock development

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https://doi.org/10.5281/zenodo.6989250

Abstract

Despite the fact that many animal products are comparatively rich in nutrients when matched to other diets, but the overuse and abuse of many drugs, particularly antibiotics in animals, is a factor in the growing issue of antibiotic resistance. Furthermore, the widespread use of synthetic chemicals in a variety of agricultural and livestock sectors creates risk to the environment, human health as well animal health. To combat this, bioactive compounds or plant secondary metabolites (PSM) through the several plant extractions are looked on as natural substances that can take the place of antibiotics and such synthetic chemicals as secure and enduring substitutes. According to latest scientific research, there is a tremendous opportunity for using plants to improve animal productivity especially in ruminants. This article discusses the use of various plant extracts as feed additives in ruminants and their impact on livestock production performance.

Keywords: Animal health, Plant extractions, Plant Secondary Metabolites (PSM), Ruminants

Introduction

People have employed plants for their therapeutic qualities throughout history. Although in ancient times the emphasis of this application has frequently been on human health only, but now a day, medicinal value of plants continues to be applied in ethnoveterinary therapies and the management of animal health. As we all are aware about the hazards related to environment, human and animal health due to the extensive use of artificial chemicals in different agriculture and livestock sectors. It is now unlawful to use of excess antibiotics in livestock field as it significantly increases the chance of humans contracting bacteria with antibiotic resistance through animal products. Therefore, such actions have heightened the need to identify natural alternatives to synthetic chemicals and antibiotics, and research has once more focused on using plant extractions as natural bioactive components to enhance animal health.

The reduction of antimicrobials use has raised interest in herbal plant products such as tannins, essential oils, saponins, and similar substances as an alternate methods of controlling rumen fermentation. Plant extracts positive benefits are linked to how they affect microbial fermentation. According to one theory, they create dietary protein complexes that bypass the rumen and shield them from microbial fermentation. When the complexes break down in the acidic environment of the abomasum, proteins become available to the animal (Salem *et al*., 2012). Essential oils primary effects in the rumen causes a slowdown in protein, starch degradation as well as suppression of amino acid breakdown, which helps the animals for higher degree of digestion and absorption of microbial proteins in small intestine. This may be due to their selective action on specific rumen microbes. Protozoa and end products of rumen fermentation are also being positively impacted by saponins, although these effects are partly uneven because other microbial populations have emerged that can degrade saponins in the rumen. Consequently, these different plant extracts have the ability to be used as rumen modifying agents for sustainable livestock development by replacing antibiotic growth promoters and other pharmaceuticals. In this article we explained about the impact of plant extracts on rumen fermentation constraints, gut health and immunity status of dairy calves.

1. Impact of plant extracts on health and immunity status of dairy calves

We already know that so many plant extracts promote rumen fermentation more effectively in adult dairy animals. Nevertheless, the impact of plant extracts on the welfare and performance of dairy calves has given mixed findings. These variations are probably due to different plant types, numerous extraction techniques, dietary compositions, supplemental dosages and animal circumstances. Now few recent studies found that some significant effects in calves regarding this plant extraction uses. Jahani-Azizabadi *et al*. (2022) observed that inclusion of a blend of phytobiotic-rich herbal extracts (monoterpene hydrocarbon and sesquiterpene hydrocarbon-main plant secondary metabolites) to dairy calf milk may improve various health and immunological issues by reducing the frequency of diarrhea and boosting the prevalence of specific cellulolytic bacteria in the rumen. This is one of the alternatives of administering antibiotics at sub therapeutic dosages in order to boost the health and immunity level of the calf.

2.Effects of plant extracts on rumen fermentation in adult ruminants

Plant extracts enhanced ruminal development and nutrient digestion because plant secondary metabolites (PSM) had a favorable impact on rumen microbe's activity and PSM accelerate protein metabolism and mitigating methane generation (Patra *et al*., 2006). It has been proved that certain active ingredients of herbal plant extracts, including *Fructus Ligustri Lucidi*, *Crina Ruminants* and *Radix*

Codonopsis increase the effectiveness of fermentation process in ruminants (Qiao *et al*., 2013). Abd'Quadri-Abojukoro *et al*. (2022) reported that ethanolic extracts of various plant materials can manipulate rumen microorganisms to promote effective rumen fermentation by inhibiting the growth of gram-positive bacteria. The saponin-rich seed pulp of *Sapindus mukorossi*, the tannin-rich leaves of *Populus deltoides* and *Mangifera indica*, the tannin- and essential oil-rich bud of *Syzygium aromaticum* and the essential oil-rich bulb of *Allium sativum* are just a few examples of plants that have the potential to control methanogenesis in ruminants. Tannins have a stronger impact on rumen metabolism when added to hay-based diets, as its lower acetate to propionate ratio and ruminal protein degradation (Menci *et al*., 2021). The end products of rumen fermentation and nutritional digestibility were improved by fresh amla fruit, which also boosted milk production and milk nitrogen utilisation (Tilahun *et al*., 2022).

3. Effects of plant extracts on worm load of ruminant GI tract

A significant barrier to the performance of animals is mainly helminthes infestation. The fundamental issue cause due to the infection of ruminant gastrointestinal tracts with parasitic worms, significantly negative impacts on farm output and the farmer's economy. Hoste *et al*. (2022) reported that utilization of such plants, forages and legumes containing tannins as active bio component which manage and control the gastrointestinal nematodes in ruminants. But the beneficial level of tannins in the diet is varies greatly, so its threshold level should be decided to have a significant impact on productivity of animals. Kimani *et al*. (2014) conducted a study on ruminants with herbal extract comprising *Prosopis juliflora* and *Entada leptostachya* concluded that this herbal mixture consequently had the potential to be a new anthelmintic medicine for gastrointestinal infection in ruminants due to its secure and adequately active components. Some recent studies on various extractions from plants containing plant secondary metabolites as active components and their significant impacts on ruminants are compiled in **Table 1.**

Conclusion

The use of synthetic chemicals such as antibiotics in agricultural and livestock sectors now poses a threat to environment and animal health. Plant secondary metabolites extract are natural alternatives to synthetic chemicals and antibiotics which improves the performance and health of ruminants and helps in sustainable development of livestock. However, further study with different concentration of plant extract will be needed which might help for well understanding of animal health performance under different conditions.

Table 1. Effects of different plant extracts on ruminants

Plant Species	PSM* (Active Component)	Animal Species	Effects	References
Mixture of phytobiotic-rich herbal extracts	monoterpene hydrocarbon and sesquiterpene hydrocarbon	Calf	Improve health and immunity level by reducing the frequency of diarrhea and boosting specific cellulolytic bacteria in the rumen	(Jahani-Azizabadi *et al*., 2022)
Amla (*Phyllanthus emblica*) fresh fruit	Vitamin C, Flavonoids and Hydrolysable tannins	Lactating dairy cows	enhanced milk production and milk nitrogen utilisation	(Tilahun *et al*., 2022)
Legume family (Fabaceae)	Condensed tannins	Cattle	manage and control the gastrointestinal nematodes in ruminants	(Hoste *et al*., 2022)
Whole-seed fenugreek powder combined with natural essential oil	Saponin and essential oil	Cattle	an improvement in energy efficiency and rumen ammonia nitrogen proportion	(e Silva *et al*., 2021)
Quebracho and a mixture of quebracho and chestnut	Tannins	Sheep	reduces acetate to propionate ratio and ruminal protein degradation	(Menci *et al*., 2021)
Entada leptostachya and *Prosopis juliflora*	terpenoids, flavonoids, saponins and phenols	Sheep	new anthelmintic medicine for the treatment of gastro-intestinal parasites	(Kimani *et al*., 2014)

PSM*- Plant Secondary Metabolite

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THE SCIENCE WORLD
A Monthly e Magazine
August, 2022; 2(8), 1355-1357

Popular Article

Microchipping For Pet Dogs

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https://doi.org/10.5281/zenodo.6990883

Few months ago, I came across the story of a dog named 'Alaska' reuniting with his owner after being lost for six years at Tucson, Arizona. I was so surprised to know that microchips helped several such pet parents to be reunited with their lost pets. When I started reading more about microchips, I strongly felt that there is a need to make more pet owners aware of this existing technology.

The dog is man's best friend - one that may have an urge to wander, explore and runs the risk of getting lost. Unfortunately, it is not too uncommon for dogs to lose their way back home and end up in shelters. A staggering number of dogs are lost in shelters each year because there is a lack of reliable means for identification once they are found. If your pet is lost, you are far more likely to be reunited if they are microchipped.

What is a microchip?

A microchip is a small, electronic chip enclosed in a glass cylinder that is about the same size as a grain of rice. Once the microchip is implanted under the skin, it will remain for the entirety of your dog's lifetime. The chip contains a unique 15-digit number for identification, similar to Aadhaar number for individuals. When scanned, the chip transmits its identification number using passive RFID (Radio Frequency Identification) technology on to the scanner, which displays the number on a screen.

The International Standards Organization (ISO) has approved and recommended a global standard for microchips that ensures a consistent identification system worldwide. The ISO standard frequency is 134.2 kHz. Also, contrary to popular belief, the microchip is not a GPS device and cannot track your animal if it gets lost. The chip is RFID which enables it to be read by a microchip scanner, but only once your pet has been found.

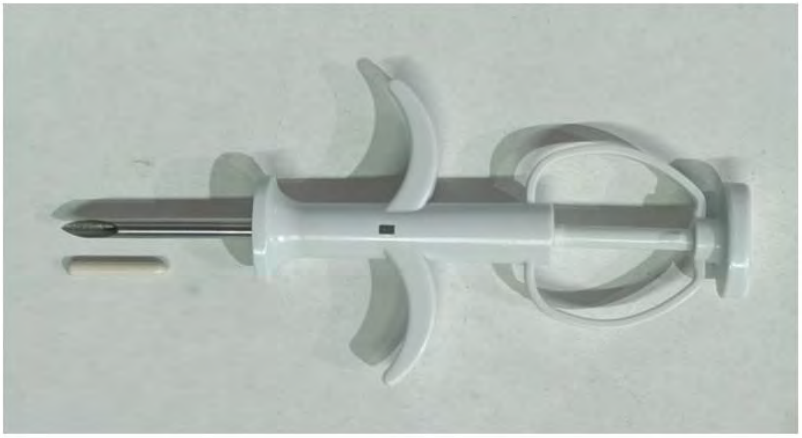

Fig 1. Microchip with the inject applicator

Procedure

It is a 2-step process wherein which chip is implanted and then the unique identification number is registered along with all the relevant details about the owner and the pet. Microchip comes pre-loaded in a sterile inject applicator. The chip is injected subcutaneously (just under the skin) between the shoulder blades using a hypodermic needle at the back of your pet's neck by a registered veterinarian. It is no more painful than a typical injection, although the needle is slightly larger than those used for injection. No surgery or anaesthesia is required and the microchip can be implanted during any regular vet check-ups. Make sure to read the chip right after injection using a microchip scanner. Also, ask your veterinarian to scan your pet's microchip at least once every year to make sure it is still detected. Having a microchip placed is only the first step, and the microchip must be registered in a central database and keep your registration information in the database up-to-date.

Fig 2. Implanting the microchip

Fig 3. Scanning the microchip

Why Microchip your pets?

1. **Unique Identity.** The microchip acts as the unique identification of your pet. The chip stores only a 15-digit unique number. This number is mentioned on all the records for the pet. Most pets wear collar tags imprinted with their name and the phone number of their owner, but only a microchip provides permanent ID that cannot fall off or be removed.
2. **Find lost pets.** If your pet is lost, you are far more likely to be reunited if they are microchipped as they can be scanned at nearest vets and the owner details can be obtained

from the database. A study of more than 7,700 stray animals at animal shelters showed that dogs without microchips were returned to their owners 21.9% of the time, whereas microchipped dogs were returned to their owners 52.2% of the time.

3. **Travel.** Microchipping is mandatory for international travel and recommended for travel within India. All pet documents must have microchip number.
4. **Pet insurance.** Microchipping is mandatory for buying pet insurance.
5. **Pet registration.** Every dog registered with KCI (Kennel Club of India) must compulsorily be microchipped.

As per The Prevention of Cruelty to Animals (Dog Breeding and Marketing Rules), 2017 and The Prevention of Cruelty to Animals (Pet Shop) Rules, 2018, no puppy can be sold by a breeder without a microchip. Also, microchipping can be one of the most effective ways to solve the cases of theft, abandonment and illegal pet trafficking.

Conclusion

A microchip is non-bio reactive and hence, biologically safe for the pet. It is a one-time investment with several benefits. The concept of microchipping for pet safety is not new, but pet owners in India are slowly becoming aware of it and the microchipping of pet dogs will be made compulsory in the days to come. Microchipping is also recommended for pet cats.

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THE SCIENCE WORLD
A Monthly e Magazine
August, 2022; 2(8), 1363-1366

Popular Article

Quail Production and Management

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https://doi.org/10.5281/zenodo.6991797

Abstract

Quail is a small to moderate-sized game bird that is a member of the family of pheasants. India has two types of quail: the brown-colored Japanese quail (CoturnixCoturnix Japonica), which is grown for meat, and the black-breasted quail, which is found in the forest (CoturnixCoromandelica). There is no licensing system for farm-bred Japanese quail (Coturnix japonica), which was previously classified in Schedule IV of the Wildlife Act Protection Act (1972). The flesh is used to make pickled meat, tandoori quail, and ready-to-cook meat. Numerous recipes can be made with quail eggs. At 5 weeks, a quail can be marketed as a broiler (for meat). The 250 g adult Japanese quail can produce up to 250 eggs each year.

Introduction

The ongoing population expansion in developing countries is the primary factor driving the demand for greater sources of animal protein. The need for chicken products has been growing in this circumstance. The expansion of the poultry sector is crucial to supply the rising demand for poultry products without importing them. Quail provides animal protein in the form of meat and eggs and it is a source of income too. The use of quail dates back to 1974, when it was introduced from California to India for non-commercial purposes. Changes or adaptations are made to the Japanese quail. Some farms have received assistance for the country's production of Japanese quail stock under the "Assistance to State Poultry Farms" (ASPF) program of the Indian government. Improved germplasm and technical know-how were subsequently provided to a franchise for commercial exploitation across the nation since being firstly reared by CARI, Izzatnagar, as experimental poultry birds. Unfortunately, quail farming is still relatively unknown in rural areas. Understanding the potential for and limitations of commercial quail farming in India's socioeconomic setting is crucial.

Advantages Of Quail Farming

Require less capital and space in one square foot, 5–6 mature quails can be raised. The quail is a strong bird. Birds can be sold as young as five weeks old. At the age of six to seven weeks, it achieves adulthood and starts to lay eggs at around six to seven weeks old (280 eggs per bird each year). A short generation interval of 3–4 generations every year. Low feed consumption (550–600 gram/bird through the fifth week). Quail flesh is delicious and lower in fat than chicken. Low levels of cholesterol are present. It promotes the physical and mental development of kids. Compared to chicken eggs, quail eggs have a much higher nutritional value. Three to four times more nutrients are included in quail eggs than in chicken eggs.

They have 13 % more protein than chicken eggs, and they also have 140 % more vitamin B1 than chicken eggs. Quail eggs contain five times as much potassium and iron. Quail eggs contain ovomucoid protein, which aids in reducing allergy symptoms. Quail meat and eggs are healthy for pregnant women and breastfeeding women too. Quail varieties available are Grey spotted, Brown spotted, Grey Brown cross, White-breasted brown, White-breasted grey, Brown and Grey cross. Other Institutions' quail kinds include Nandanam quail, Cari - Uttam (broiler quail line), Cari - Ujjwal (white-breasted quail), and Cari - Pearl (white eggshell line).

Incubation And Hatching

Quail eggs require 17–18 days to hatch.Hatching eggs should be taken from breeder flocks that are older than 7 weeks. Eggs should be taken 10 days following the introduction of males to the mating pen for maximum fertility. In artificial incubation during the first 14 days of incubation, eggs are set in a setter. Eggs are moved from the setter to the hatcher on the 14th day, where they are held for the remaining three days of incubation. Before transferring the eggs to the hatcher, candling should be done on the 14th day to remove dead embryos, sterile eggs, and damaged eggs.

A quail egg weighs about 10gm and is around one-fifth the diameter of a chicken egg.The spots on the eggshells range in hue and show variation from white to brown. These eggs are much higher quality than chicken eggs nutritionally speaking, and they also have less cholesterol.In contrast to chicken eggs, there is a larger ratio of albumen to yolk, which is 39:61.Each week, the 500 quails may produce up to 1500 offspring.

Sexual Differentiation

The rich brown color of the breast feathers in the 5th week allows identifying male birds. The breast region of the females has speckled feathers but lacks this coloration. Female quails typically weigh more than male quails. When light pressure is given to the vent region of male quails, a white foam-like

discharge is released. The white-breasted and totally white male quails are sexually distinct from the females by having this characteristic.

Rearing

Deep litter system: Adult quail require 0.2 square feet of rearing space per floor type. Paddy husk and fine wood shavings are also suitable materials to use as litter.

Enclosure system: Each cage unit is split into six smaller cage units, each measuring 6 feet long by 1 foot broad. A 2 cm deep faeces tray is included with each cage. At least 50 cm should separate the base of the lowest tier from the ground. Quail males are inserted into the enclosures in a 1:3 ratio for breeding purposes.Long, slender feed troughs are placed in front of the enclosures; water troughs are placed behind them.

Battery system rearing: Every section is split into six smaller components, each measuring nearly 6 feet long by 1 foot broad. The enclosures can be stacked up to six levels high to maximise space. Four to five cages should be arranged in a row. The cage's bottom is secured with removable hardwood plates to make cleaning up bird droppings easier. Long, narrow feed troughs are in front of the enclosures. Water troughs are located behind the cages. Typically, commercial egg-laying colonies include 10 to 12 cages per colony of birds. For the breeding program, male quails are paired with three females in each cage.

Feeding

The feeding material should be composed of small particles. Quail that are 5 weeks old can consume 500 grams. At six months old, quail eat at least 30 to 35 grams of feed per day. The amount of feed needed to produce a dozen eggs is about 400 grams. The particle needs to be thoroughly ground.

Table 1. Nutrient requirements of Japanese quail

Nutrient*	Starter (0-3 weeks)	Grower (4-6weeks)	Layer/Breeder (7 weeks onwards)
ME(Kcal/Kg)	2750	2750	2650
Protein (%)	25-27	22-24	20-22
Calcium (%)	1.0	0.8	3.0
Phosphorous available (%)	0.45	0.45	0.45

*Vitamins and minerals as per BIS recommendation

Disease Control

Quails often exhibit higher levels of infectious disease resistance than chickens. Vaccinations and deworming are not necessary for quail during the raising phase. Both Ranikhet disease (RD) and ascariasis (a roundworm infection) are said to be resistant to them. In locations where RD is endemic, it is advised to deliver the Lasota/B1 vaccine through the water during the second week as a precaution. Coccidiosis, ulcerative enteritis, and aspergillosis are the most often observed illnesses in quails. In humid environments, a preventive dose of moderate coccidiostat is administered.

Conclusion

The distinctive sound that male quails usually produce is generally distressing to people. The male quails attack other quails and blind them when they are raised with the female quails. Mortality occurs in quail occasionally. These can come over by proper management as there is more demand for quail meat in the market. The potential for hotels, hypermarkets, etc. is enormous. The Indian government is encouraging people to create quail farms and is working to help them with infrastructure. Quails are eager to be produced for commercial use, and the Central Avian Research Institute (CARI) in Izatnagar, Bareilly, Uttar Pradesh, has shown a desire to provide hatching eggs to potential Entrepreneurs.

THE SCIENCE WORLD
A Monthly e Magazine
August, 2022; 2(8), 1367-1371

Popular Article

Impact of Probiotics in Ruminants

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https://doi.org/10.5281/zenodo.6992320

Abstract

Among various agricultural sectors, the livestock industry has a pivotal role in ensuring livelihood and food safety for the growing population and economies of countries. A changing climate, food scarcity for animals, increasing demand due to population burden, and low productive animals exert a negative impact on the livestock sector. These challenging factors and rising resistance to antibiotic-based growth promoters demand new and better approaches to improve the health, productivity of animals, and the sustainable growth of the livestock farming. Probiotics are living, non-pathogenic microbes, and their use is increasing nowadays as a substitute for antibiotic-based growth promoters. Probiotics exert a beneficial effect on the production, growth, nutrient intake, digestibility, and health of ruminants by regulating microbial homeostasis and by modifying ruminal fermentation.

Keywords: probiotics, rumen fermentation, microbes

Introduction

Animal husbandry is a dynamic industry that plays a critical role in ensuring food safety by meeting the animal-origin food demand for a growing population. This sector has also grown to be a main source of revenue for farmers and aids in the socio-economic advancement of developing nations (Tona, 2021). Globally, approximately 40% of agricultural goods are animal-based, and ruminants play a vital role in this production. Ruminant animals are pre-gastric fermenters that possess a large compartment for fermentation known as the rumen. To produce valuable nourishment sources, viz., milk and meat for humans, ruminants consume the structural elements of the plant (Öztürk and Gursel, 2021). Mostly in developing countries, ruminants are fed agricultural residues, poor quality roughage, and by-products of industries that are rich in lingo-cellulose, low in fermentable carbohydrates, and higher quality proteins. In addition, the changing climate conditions, viz., high temperatures, prolonged dry season, infertile soil, and food scarcity, also affect rumen fermentation (Galmessa *et al*., 2019).

In ruminants, symbiotic microorganisms, viz., bacteria, protozoa, fungus, etc., execute enzymatic and mechanical fermentation activities during digestion that alter the composition of the feed. Therefore, ruminal fermentation modulation may become a superior option to optimize fermentation for enhancing the production and utilization of nutrients in ruminants (Öztürk and Gursel, 2021).

Probiotics are non-pathogenic live microbes that have the potential to produce favourable effects on the host once consumed by regulating the gut microbes. Nowadays, probiotics are increasingly employed as a substitute for the antibiotics feed-additive to enhance the productivity and health of animals (Kassa, 2016). The most frequently used probiotics in ruminants are Saccharomyces cerevisiae yeast and bacteria such as *Lactobacillus, Bifidobacterium, Streptococcus, Prevotella bryantii, Propionibacterium, Enterococcus*, and *Megasphaera elsdenii* (Seo *et al.,* 2010; Arowolo and He, 2018). Supplementation of probiotics in ruminants reduces the acetic acid/propionic acid ratio and enhances the fermentation process by increasing the generation of propionic acid, decreasing the protozoal biomass in the rumen, stabilization of ruminal pH, and improving the production in animals (Öztürk and Gursel, 2021).

Mechanism of action of probiotics

Probiotics improve the host's gastrointestinal tract health by enhancing the healthy microbial flora, increasing digestive capacity, absorption, and bio-availability of nutrients. In addition, they also prevent the colonization of pathogenic microbes in the intestine, restore gut microbes, stabilize the pH and enhance mucosal immunity (Kassa, 2016).

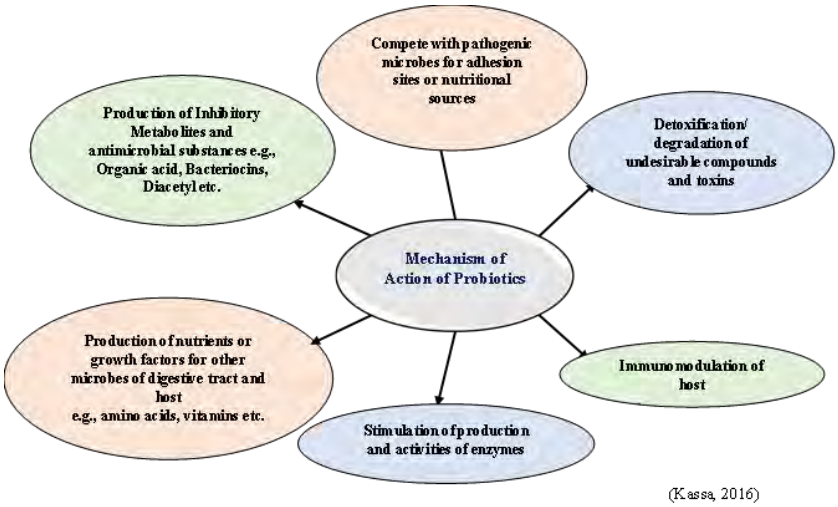

Fig. 1: Mechanism of action of probiotics

Effect of probiotics on intake and digestibility of feed

The quality and quantity of feed taken by the animals influence their daily output. Probiotics regulate the pH of the rumen by stimulating starch-consuming ciliate protozoa that compete with amylolytic bacteria, which mainly produce lactate. Some strains of yeast also provide the nutrients (peptides and vitamins) and cofactors that are necessary for the microbes utilizing lactate. The stabilized pH, nutrients, and growth factors produced by yeasts exert a beneficial effect on the proliferation and activities of fibre-digesting cellulolytic microbes. Therefore, probiotics also help in the prevention of ruminal acidosis by balancing the ratio of VFA (volatile fatty acids) generated in the rumen (Kassa, 2016; Arowolo and He, 2018). *Aspergillus oryzae* and *Lactobacillus plantarum* probiotics improve the performance of animals by producing fibre-digesting enzymes and breakdown of carbohydrates into simpler glucose forms, respectively (Khalid *et al.,* 2011). Probiotics increase feed intake by enhancing the flavour and palatability of feed. They also enhance the digestibility of dry matter, fibres, organic matter, and crude protein along with enhancing energy and nitrogen retention in animals. Therefore, probiotics improve the cellulolytic bacteria, stabilize ruminal pH, reduce the interval between feed intake, and increase the degradation of fibres and digestibility of the lower quality forage by altering the pattern as well as the rate of ruminal fermentation (Kassa, 2016; Arowolo and He, 2018).

Effect of probiotics on the growth of animals

Due to the tendency of resistance development against antibiotic-based growth promoters, probiotics are emerging as a better alternative growth promoter in animals. Probiotics promote the growth of ruminal and intestinal epithelial cells by improving ruminal fermentation and VFA production. Thus, these feed supplements enhance the ability of nutrient absorption by epithelial cells (Nalla *et al.,* 2022). Furthermore, probiotics also enhance the growth in animals by improving microbial protein synthesis, fibre degradation by cellulolytic microbes (Kassa, 2016), and the ratio of growth hormone to insulin-like growth factor-I (Nalla *et al.,* 2022). Therefore, probiotics may enhance weight gain by increasing feed intake, nutrient utilization ability, feed conversion rate, nitrogen retention, and reducing the excretion of vital nutrients in animals (Arowolo and He, 2018; Schofield *et al.,* 2018).

Effect of probiotics on productivity of animals

Manipulation of ruminal fermentation by probiotics modifies nutrient digestibility, the efficacy of fibres-degradation, absorption, and bioavailability of nutrients in the intestine. Moreover, they also alter the numbers of cellulolytic bacteria and volatile fatty acids in the rumen (Kassa, 2016; Nalla *et al.,* 2022). As probiotics increase the population of beneficial microbes in the rumen and enhance the synthesis of crude proteins of microbial origin. These feed additives improve the quality, quantity, and intestinal absorption of metabolizable proteins, which are turned into milk proteins. Therefore, probiotics enhance milk output and protein content (Ma *et al.,* 2020; Suntara *et al.,* 2021b). After absorption, volatile fatty acids play an important role in the synthesis of milk. Probiotics improve the ruminal pH, total VFAs production, and ratio of acetic and propionic acid, resulting in enhanced fat content of milk (Sun *et al.,* 2021). Therefore, probiotic supplementation in ruminants improves productivity by modifying ruminal fermentation.

Effect of probiotics on animal health

In an appropriate quantity, probiotics exert a beneficial impact on animal health by maintaining microbial homeostasis in the gastrointestinal tract and enhancing the immune response. The microbiome of the rumen and gut is a diverse mixture of various bacteria, fungi, and ciliated protozoa. The healthy microflora exerts a positive impact on animal health by enhancing the relative biomass of beneficial microflora, preventing the mucosal invasion and colonization of pathogens, and regulating immunological homeostasis. Furthermore, general health benefits are also provided by probiotics by increasing the feed conversion ratio, stabilizing the pH, controlling acidosis, enhancing the uptake of nutrients and promoting the epithelial growth of the rumen and intestine (Abd El-Tawab *et al.,* 2016; Nalla *et al.,* 2022). Probiotics inhibit the pathogen's growth and maintain health by producing bacteriocins, creating an acidic environment and facilitating the degradation of toxins. Probiotics that increase the immunoglobulin level have a beneficial effect on immune response and improve disease resistance, growth performance, and defence mechanisms of animals (Kassa, 2016).

Conclusion

Probiotics help in maintaining the microflora homeostasis, stabilizing the pH of the rumen, improving digestibility, protecting from pathogens colonization, and enhancing the feed intake and conversion ratio in animals. Therefore, these feed additives exert a beneficial impact on the growth, production, and health of ruminants by modifying ruminal fermentation.

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THE SCIENCE WORLD
A Monthly e Magazine
August, 2022; 2(8), 1371-1376

Popular Article

Microgreens - An Emerging Trend in Urban Agriculture

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https://doi.org/10.5281/zenodo.6993571

Abstract

According to the United Nations, by 2050 the world's population will grow to almost 10 billion people, which will put enormous pressure on the possibilities of modern agriculture. With projections and scenarios for a population growth of more than 9 billion by 2050, it becomes necessary to focus our attention and efforts on finding innovative tools that can help solve the problem of malnutrition and ensure food security for the population. To meet the need for fresh, nutrient-rich and high quality - phytochemicals in the diet for healthy body development, the vegetable industry is exploring the prospects of the time-tested concept of the 'microgreens. Microgreens can be seen as a concept innovation in vegetable growing in general, with the potential to change the whole idea of vegetables. Since the introduction of microgreens to the Californian restaurants in the 1980s, it has gained popularity. The microgreens are also known as micro-herbs or vegetable confetti. Interest has been in the rise on nutraceutical, fresh and functional foods in healthy eating. Presently consumers are looking for foods which improves their health. Due to the presence of the various phyto-constituents and minerals in abundance, it opens up a huge prospect for the researchers in the field of health and nutrition.

Keywords: Microgreens, nutritious value, health benefits, urban agriculture, production.

Microgreens In Urban Agriculture

Urban agriculture means the production, distribution, and marketing of food and other products within the geographical limits of a metropolitan area. Urban agriculture increases the access to healthy, affordable, fresh produce and provides communities with opportunities to learn about nutrition and growing healthy food. There are various techniques employed for food production in urban agriculture like vertical farming, hydroponics, aquaponics, aeroponics, rooftop farming, microgreens, etc., Among these, growing microgreens is a technique requiring very low inputs and little technical expertise. The microgreens would be one of the best options to grow anywhere in the home, workplace, garage, shed, in living rooms with shade or even in window sills. With lots of nutritious benefits microgreens fill the diet plates of the fast-working world as a hand-full of seeds can produce a bag-full of nutritious greens.

Introduction

Microgreens are the emerging sector in vegetable products which are gaining popularity and increased attention in the modern agriculture (urban agriculture). Microgreens are young vegetable greens which are generally 1-2 inch tall. These are immature shoots germinated from seeds of herbs, vegetables or grains and harvested two weeks after germination. They are considered plants, falling somewhere between a sprout and baby green. Interest in microgreens has gained importance due to their unique colour, texture and taste which can be either sweet or spicy. Microgreens consists of three parts which are stem, cotyledons and the true type leaves. The basic concept of growing microgreens is collecting plants while they are still young. The scientists hypothesized that producing microgreens from local varieties of traditional vegetables and wild types of vegetables would be more profitable due to their higher nutrient content compared to commercial improved varieties.

Types of Microgreens

The microgreens of the crops belonging to the following families are popularly produced.

- **Brassicaceae family:** Cauliflower, broccoli, cabbage, watercress, radish and arugula
- **Asteraceae family:** Lettuce, endive and radicchio
- **Apiaceae family:** Dill, carrot, fennel and celery
- **Amaryllidaceae family:** Amaranthus, quinoa swiss chard, beet and spinach
- **Cucurbitaceace family:** Melon, cucumber and squash

Cereals such as rice, oats, wheat, corn and barley as well as legumes like chickpeas, beans and lentils, are also grown as microgreens.

Microgreens vary in taste, which can range from neutral to spicy, slightly sour or even bitter, depending on the variety. In general, the flavor of microgreens is considered as strong and concentrated.

Crops With Nutritional Value and Health Benefits

Microgreens are packed with nutrients. They vary according to the variety but most of them are rich in potassium. They also contain vitamins, minerals and have some antioxidant properties. Research also shows that they contain a wide variety of polyphenols. Although microgreens generally appear to contain higher nutrient levels than more mature plants, this may vary based on the species at hand.

Nutritional benefits of microgreens

Different types of microgreens contain different amounts of functional compounds such as antioxidants, minerals, vitamins, and phenols. Growing, harvesting and storage conditions can have a significant impact on nutrient content. Researchers estimated the concentration of vitamins and carotenoids were found in 25 microgreens. The highest concentrations of vitamin C, carotenoids, phylloquinone and tocopherols were found in red cabbage, cilantro, pomegranate amaranth and daikon green radish. The microgreen cotyledon leaves have higher nutritional value than mature leaves. The vitamin levels in microgreens are about five times higher than in their mature plants.

Researchers at the Laboratory for Food Quality and the Laboratory for Crop Production Systems and Global Change, USDA-ARS, conducted a study that analyzed the concentrations of macronutrients (calcium, magnesium, phosphorus, sodium, potassium) and micronutrients (copper, iron, manganese and zinc) in 30 microgreen species from 10 genera of the Brassicaceae family. The Brassicaceae microgreens are a good source of macronutrients (such as potassium and calcium) and micronutrients (such as iron and zinc).

The protective effect against oxidative stress exhibited by Brassicaceae (broccoli, Brussels sprouts, cabbage, cabbage, cauliflower) is provided by glucosinolates, which are sulfur-containing glucosides. For example, broccoli contains: sinigrin, glucoraphanin, and progoitrin; Chinese cabbage has indolyl glucosinolate glucobrassicin, and glucoraphanin is one of the most common glucosinolates found in broccoli. Vegetables of the Brassicaceae family are also known to contain high concentrations

of polyphenols associated with human health: anthocyanins, flavonol glycosides, hydroxycinnamic acids, etc.

CROPS	HEALTH BENEFITS
Broccoli	Stimulate immune system
Cress	Good source of fiber
Fenugreek	Stimulate appetite
	Effective against anemia and fatigue
Kale	Rich in anti-oxidants
	Prevent macular degeneration
Linseed	Rich in omega-3 fatty acids
Fennel	Decrease risk of heart attack
Mustard	Effective against fever and cold

How To Grow Microgreens?

- Microgreens are easy and convenient to grow, as they don't require much equipment and time. They can be grown year-round, both indoors and outdoors.
- Materials required are good quality seeds, a growing medium, such as a container filled with potting soil or vermiculite, peat and more.
- Alternatively, we can use a single-use growing mat specifically designed for growing microgreens.
- The microgreens are grown in 25 × 50 cm flats or blocks of nearly inert materials like growing on flat jute, cannabis fibers, coco hair, and polystyrene sheets or it can be grown on blocks that are filled with peat and vermiculite or perlite alone, together or mixed with other fine commercial ready substrates mixtures.
- Proper lightning is required at least 12-16 hours per day.
- Now fill the container with soil gently, do not over compress it.
- The growing blocks is filled only to a depth of about 2–3 cm.
- Currently, the sowing process is still done manually, hand seeding may be the most efficient method for small operations.
- Sprinkle the seeds on the top of the soil evenly with light sprinkle of water on top of it.

- Cover the container with a plastic lid.
- Check the tray daily and water it as needed to keep it moist once in a day is sufficient.
- After 7-10 days, the microgreens are ready to harvest.

Conclusion

Despite their small size, microgreens pack a nutritional punch, often containing higher nutrient levels than their mature counterparts, making them an excellent addition to any diet. They have the combination of flavor, nutrient content and come with a variety of colours and textures. They can be grown from various seeds. Their taste can vary greatly depending on the variety. Microgreens are rich in nutrients. Microgreens deliver a concentrated dose of nutrients and beneficial plant compounds. As a result, they may reduce the risk of certain diseases. Microgreens are generally safe to eat. It can be eaten raw, juiced or blended and incorporated into a variety of cold and warm dishes. In addition to the nutritional and environmental benefits, microgreens have major impacts in urban areas by making fresh produce more easily available to areas considered food deserts. As more farmers look to avoid unpredictable weather and leave less of a carbon footprint, experts predict microgreen consumption will continue growing worldwide.

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THE SCIENCE WORLD
A Monthly e Magazine
August, 2022; 2(8), 1377-1379

Popular Article

A Review on African swine fever and its Prevention

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https://doi.org/10.5281/zenodo.6993644

Abstract

African swine fever is a highly contagious and deadly viral disease affecting both domestic and feral swine of all ages. ASF is not a threat to human health and cannot be transmitted from pigs to humans. It is not a food safety issue. ASF is found in countries around the world. More recently, it has spread to the Dominican Republic and Haiti. ASF has also spread through China, Mongolia and Vietnam, as well as within parts of the European Union. It has never been found in the United States – and we want to keep it that way.Vietnam successfully produced the first vaccine against African swine fever on June 1, 2022.There is no treatment or vaccine available for this disease. The only way to stop this disease is to depopulate all affected or exposed swine herds.An experimental vaccine is in development against the 2007 Georgia isolate currently circulating, which is attenuated by deletion of the viral I177L gene.

Introduction

African swine fever (ASF) was first reported in Kenya in 1921 and is one of the most complex infectious swine diseases causing the greatest concern in the pig industry because of its high mortality. The disease is caused by a large double-stranded DNA virus, a sole member of the *Asfarviridae* family, which affects domestic pigs and wild boars The risk of an ASF incursion continues to exist as the virus is still spreading across Europe with a recent wild boar occurrence detected in Italy. This is the first reported case of ASF in mainland Italy. The disease has also been detected for the first time in North Macedonia in a backyard holding close to the Bulgarian border.Four cases of ASF have now been detected in domestic Pigs in Germany since the first domestic case was reported in July 2021. Elsewhere frequent outbreaks in domestic pigs are still being reported in Moldova, Romania, Russia and Ukraine. ASF has also continued to be reported in wild boar across Europe.

Clinical signs

The clinical signs of ASF may occur in chronic, sub-acute or acute form. The incubation period for ASF is usually between five and fifteen days. In the acute form pigs develop a high temperature (40.5 degrees C or 105 degrees F), then become dull and go off their food. Other symptoms can vary but will include the following:

- Vomiting
- Diarrhoea (sometimes bloody)
- Reddening or darkening of the skin, particularly ears and snout
- Gummed up eyes
- Laboured breathing and coughing
- Abortion, still births and weak litters
- Weakness and unwillingness to stand

Diagnosis

The clinical symptoms of ASFV infection are very similar to classical swine fever. The diagnosis is usually performed by an ELISA, real time PCR or isolation of the virus from either the blood, lymph nodes, spleen, or serum of an infected pig.

Prevention and control

The spread of ASF can be prevented only by early detection and the strict application of classical disease control methods, including surveillance, epidemiological investigation, tracing of pigs, stamping out in infected holdings, biosecurity measures, quarantine, and animal movement control. PCR is acceptedas the gold standard test for ASF detection because of its high sensitivity, specificity, and high-throughput application to detect the target viral genome in various samples from domestic pigs, wild boars, biological vectors, and evenpork products transported illegally.

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THE SCIENCE WORLD
A Monthly e Magazine
August, 2022; 2(8), 1380-1381

Success Story

Management of splay leg in emu chicks

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Introduction

Emu is adaptable to a wide range of environmental conditions. Leg deformities are one of the major causes of mortality in emu chicks. Spraddle leg or splay leg is leg deformities that begin when birds are quite immature. It occurs when abnormal lateral forces on leg & feet cause the long bones & sockets of upper leg to distort & bend outward or sideways. Both legs are usually affected. Main cause of this condition is slicky nesting area, abnormal bedding, mycotoxins, deficiencies of Ca and Vit. A, D_3 and high phosphorus.

Total 20 emu chicks with splay leg were recorded in emu farm. Among these 20 emu chicks, fourteen had bilateral leg deformities and six had unilateral leg deformities. Both legs of all emu chicks were ties with an adhesive tape at proximal to ankle i.e., tibiotarsus, so that leg can no longer splay outwards. To protect baby legs a wrap is made on leg by bandage and adhesive tape with the help of ice-cream stick on both medial and lateral side. Bandage applied was not much tight to maintain circulation of the foot. All chicks were also supplemented with Vit. AD3 and Ca 2 ML/Lt. water for one month. All emu chicks provided soft bed that prevent slipping and maintain normal balance over leg. Out of 20 emu chicks, twelve emu chicks were nearly walking normally without leg deformities after 15 to 28 days. Five emu chicks died during period of management and three recover with slight leg spay even after 60 days. Training programme organized by extension department of Bihar Veterinary College Patna. Farmer trained regarding emu farming and management of chick to prevent mortality in chicks. Farmer adapts leg tie and supplementation of mineral and vitamin to prevent leg deformities in emu chicks and thus prevent chick mortality in their farm.

THE SCIENCE WORLD
A Monthly e Magazine
August, 2022; 2(8), 1383-1386

Success Story

Management of long bone fracture in calves by Economical External Fixators

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https://doi.org/10.5281/zenodo.6993744

Fracture of long bones in calves occupies a substantial proportion among musculoskeletal disorders. This is an acute traumatic injury warranting immediate management of surgical intervention for its correction. Metacarpal & metatarsal fractures are most common fractures in cattle of all age (Greenough et al., 1972). These fractures are frequently comminuted & open due to limited soft tissue supporting structures covering the bone (Turner, 1984 & Ferguson, 1982). Statistical data of long bone fractures in cattle reveals that metacarpal & metatarsal fracture occurs up to 50%, tibial fracture 12%, radius & ulna fracture 7%, femur fracture uncommon & humerus fracture 5%, so more than 68% fracture reported are anatomically below the elbow joint in the forelimbs & below the stifle joint in the hind limbs.

A severely comminuted fracture closed by application of an ESF is preferable to open reduction & internal fixation (Langley Hobbs et al., 1997). Economical ESF device comes in less than 20% of the original price of the external skeletal fixator. So, economical skeletal fixations have emerged as boon to both farmer & ruminant veterinary surgery. Present study conducted to evaluate of epoxy ESF for the management of compound fractures of long bones in calves.

Under university project on Management of long bone fracture in calves by Economical External Fixators was started with objective to evaluate epoxy & acrylic ESF for the management of compound fractures in small ruminant & calf. Study conducted on 12 clinical cases of compound fracture in calves. Out of twelve clinical cases of compound fracture, four observed in tibia-fibula, three in radius-ulna & five in metatarsal bones. All animals were control under pre-anaesthetic agent xylazene at dose rate of 0.1mg/kg body weight & general anaesthetic agent ketamine at dose rate of 5.0mg/kg body weight. After reduction of fracture, open wounds were cleaned with povidone-Iodine (Betadene) mixed with o.9% normal saline solution.

In case of large wound, wound was closed with chromic catgut & silk in separate layer. All clinical cases of compound fractures were stabilized with epoxy external skeletal fixator by inserting four transfixation pins proximal to fracture & four distal to fracture. In each portion of fracture two pins inserted from medial side & two from lateral side (fig.ii). After pins insertion pins were bends & make a frame (fig.iii). Pins were supported with epoxy material (fig. iv). Post operatively all animals were treated with Ceftrixone in combination with tazobactum (Inj Intacef-tazo) at the dose rate of 10 mg/kg body weight intramuscularly for 7-10 day depending on the healing of wound. The therapy was also adjunct with Meloxicam along with paracetamol (Inj. Melonex plus) at the dose rate 1ml/10kg body weight for 2-3 day as per required & regular dressing up to healing of wound.

The fracture site seemed to be stable in most of clinical cases of fracture. After application of economical ESF eight calves were able to stand & bear weight on the treated limbs. The transfixation device was well tolerated by the animals & did not interfere in their routine activity in most of clinical cases. The animal could sit, lie down & get up without any problem throughout the period of transfixation device. Pin tract infection was noticed in all clinical cases of calves, but severe pin tract infection & loosening of pins were seen in four cases. The intensity of infection was relatively more around the proximal than that seen around the distal transfixation pins. It was difficult to control the infection till the transfixation pins remained in situ. However, after removal of transfixation pins at the 6^{th} post operative weeks, the infection could be controlled by meticulous cleaning & dressing with providone Iodine. Full functional weight bearing after device removal in six cases & partial in three cases observed. Mortality observed in three clinical cases of calves. Mortality occurred due to fumigating infection & continuous recumbency.

Economical external fixation technique was found effective & minimal invasive method for management of long bone fracture in calves with ensuring immobilization & better healing. It was also found that economical ESF is chief & easy than other method of management of compound fracture in calves.

Table I: Type of fracture & response of epoxy ESF management

Type of fracture	Animals Number	Percentage	Response of Survived	Epoxy ESF Dead
Tibia-fibula	4	33.33	2	2
Radius-ulna	3	25.00	2	1
Metatarsal	5	41.66	5	0
Total	12	100.00	9	3

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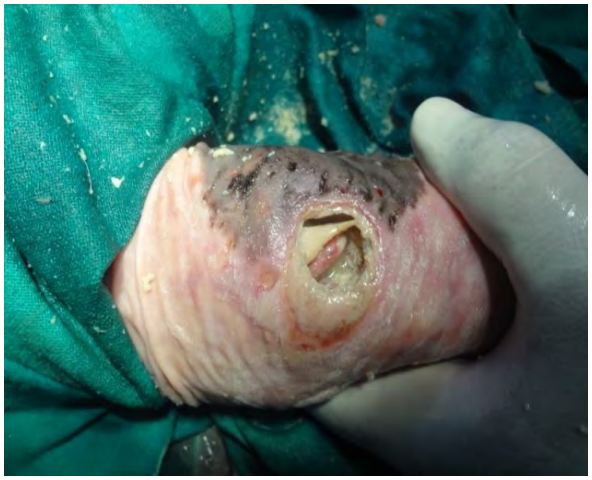


Fig I. Clinical Cases of compound fractures

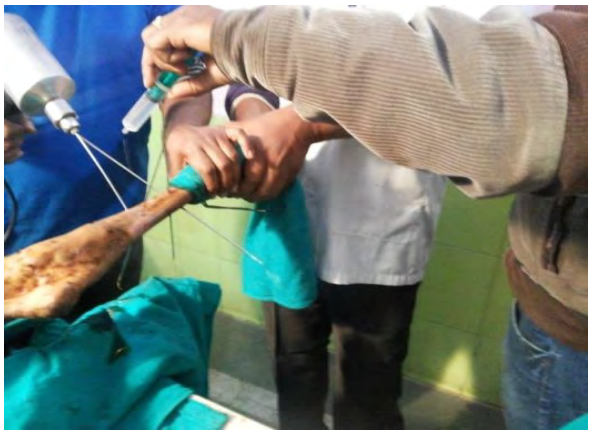
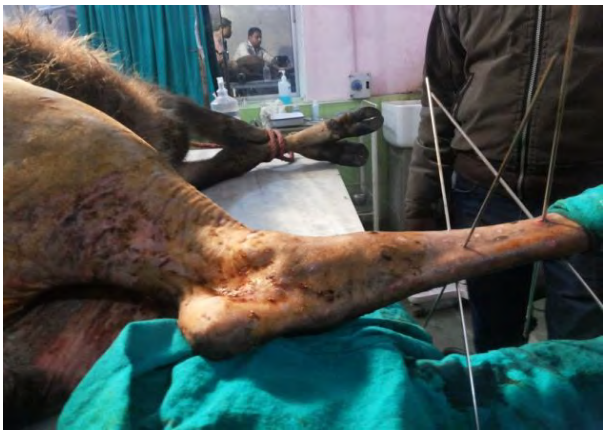

Fig .II Insertion of trans fixation Pins.


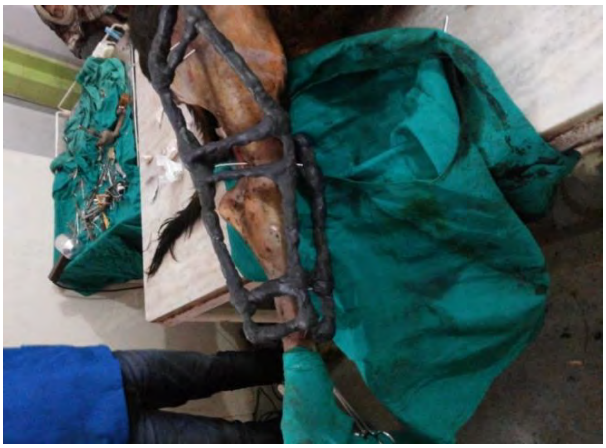

Fig III formation of frame by bending Transfixation pins

Fig IV Application of epoxy material

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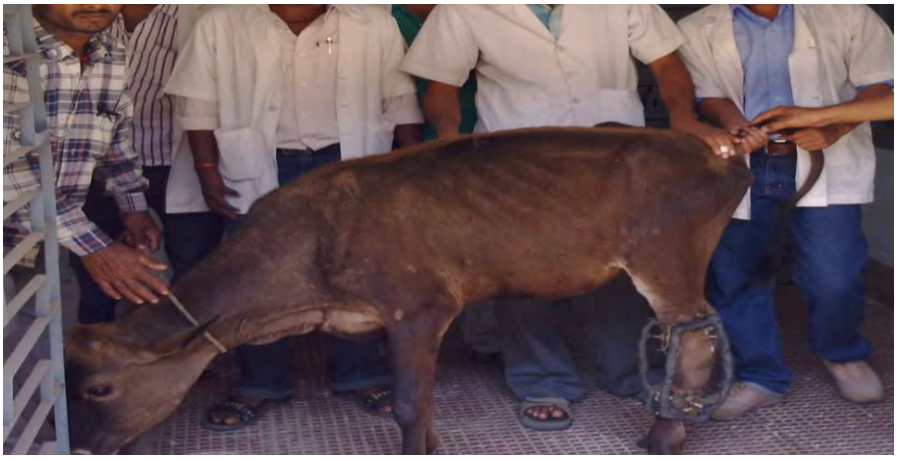

Fig V Complete weight bearing after 6th postoperative week.

THE SCIENCE WORLD
A Monthly e Magazine
August, 2022; 2(8), 1387-1391

Success Story

Aquaculture pond water aeration system

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https://doi.org/10.5281/zenodo.6993792

Introduction

Dissolved oxygen DO concentration is one of the most important water quality parameters affecting the quality of wastewater and aquaculture pond water. Various types of aeration systems have been developed over the years to maintain the desired level of DO concentration in the wastewater in an effort to improve the energy efficiency of the oxygen mass transfer process**.** In intensive aquaculture system increased fertilization, excessive feeding and high stocking density the natural aeration is insufficient and will be a limiting factor for production. Therefore, artificial aeration is very much essential for survival of intensively cultured aquatic flora and fauna. It is estimated that additional 500 kg of fish production can be achieved per kW of aeration. Aeration cost is the third largest cost in intensive aquaculture system after post larvae and feed cost representing about 15% of total production cost (Kumar *et al*., 2013). The selected aerator must be economically efficient and should be able to fulfill the requirement of oxygen supply in the pond water. Aerators contributes significant amount in the total production cost in intensive aquaculture. Mechanical Aeration enhances water quality and also improves the aqua-cultural yield. It also reduces the settlement of feed at the bottom of the pond. Dissolved oxygen (DO) is one of the most important water quality parameters affecting the quality of aquaculture water. Oxygen enters into the water body by absorption from the atmosphere or by plant photosynthesis. It is removed by respiration of organisms and decomposition of organic matter. The DO level of culture environment has direct influences on species growth fertility, survival rate, feed intake and digestion Drop in the DO level below the critical level can induce stress for aquacultural species. The growth of algae and bacteria also consume oxygen which also results in the reduction of DO level. The purpose of artificial aeration is to maintain the amount of oxygen level (DO) in aquaculture system within the permissible limit (6-8 mg/L). Aeration will also destroy the formation of any vertical temperature, salinity and chemical stratification by proper circulation and mixing of the pond water.

Aeration

The process of mixing air with water to increase the DO content in the pond water is known as aeration. The shortage of dissolved oxygen in water can be prevented by circulation of mechanical means, this is called as mechanical aeration. As mentioned initially, water aeration is the net movement of oxygen from atmosphere with higher pressure into the surface water. To keep the aquatic environment safely, the aeration equipment becomes the prior device, the aeration is significant to minimize the stress associated with oxygen concentration lower than 4 ppm. It functions to increase the area of contact between air and water, so that oxygen can enter into water surface. They also detailed that the aerator function is similar as the 'lung' to driving oxygen into water, stripping carbon dioxide out particularly for intensive aquaculture pond.

Principles of aeration

Aerating an aquaculture pond water basically involves transferring gaseous oxygen from the large reservoir in the atmosphere into the water of the pond, where DO concentrations have dropped to critical levels. Aerators help to mix pond water which can reduce thermal stratification and improve other water chemistry factors, most notably DO content. Finally, mixing by aeration can minimize organic matter accumulation that may increase BOD, reduce the density of algal blooms that can lead to oxygen depletion and fish health issues and shift the composition of algae blooms that may lead to flavor issues in finfish.

Types of pond aerator

Aeration is not new to aquaculture, but over the past few years interest in this process has been increased enormously. Various types of aerator systems have been developed over the years as an effort to improve energy efficiency of oxygen mass transfer process and to maintain the desired level of dissolved oxygen in wastewater. The types of aerator technique can be classified in three types (Thakre *et al*., 2008)

1. Surface or mechanical aeration method, which increase interfacial area by spraying water droplet into the air.
2. Diffuser aeration method, which release bubble beneath the surface of water.
3. Combine and turbine aeration method, which introduced larger air bubble into the water and reduce their sizes mechanically.

Paddle wheel Aerators

Paddle wheel aerators are the most broadly used method of aeration. These aerators consist

of an arrangement of paddles attached to a rotating drum or shaft. The pattern, length and shape of the paddles affect the aeration efficiency of the unit. They are considered as one of the most energy efficient device for increasing dissolved oxygen. They splash water into the air as the paddle wheel rotates. The splashed water comes in contact with air and falls back into the pond and thereby increasing the dissolved oxygen. Besides increasing the dissolved oxygen, they also increase both horizontal and vertical movement of pond water. The combined effect of strong circulation and aeration allows the formation of the important oxidized surface sediment layer.

Diffused-air aeration systems

Diffused-air aeration system use air compressors or blower to supply air and diffusers, porous pipe or other devices to release air bubbles into the water. Glass-bonded and silica stones are the most commonly used diffusers, however these diffusers constructed of porous plastic, synthetic perforated membranes and ceramic are also used. These are available in various shape and size such as rectangular or square stones, round or square disks or elongated tubes and pipes. The efficiency of diffused-air aeration systems is primarily a function of bubble size and diffuser depth. Diffusers that produce smaller bubbles, commonly known as fine-pore diffusers, are more efficient than diffusers that produce large or coarse bubbles. Because smaller bubbles have more surface area relative to their volume, which facilitates more efficient oxygen transfer. When the bubbles are released at a greater depth, these deeper release points allow more contact time for the bubbles to diffuse oxygen into the water column as they rise to the surface.

Propeller-Diffuser Aerators

Propeller-Diffuser Aerators also referred as Propeller-Aspirator Pumps consists of a submerged impeller-diffuser mounted on a rotating shaft contained within a hollow housing. The rotating shaft is connected to an electric motor that spins the shaft at speed up to 3,450 rpm. These are good circulators and aerators in pond but they designed more for deeper water (1-5 meter). When these are used in shallow ponds, they have a tendency to scour the basins where the water stream collides with the pond bottom, so consideration must be taken when it installed.

Vertical pump aerators

Vertical pump aerators also known as impeller aerators, consists of an electric motor with either a single or dual impeller attached to the motor shaft. These aerators are manufactured in size ranges from 1kW to over 100 kW, but those used for aquaculture are rarely larger than 3Kw.Typically, these entire unit is suspended just below the surface of the water by a float. The

float must have two anchor points to keep the unit in place and prevent rotation of the unit during operation.

Gravity Aerators

Gravity aerators are also known as waterfall aerators or cascades. These aerators utilize the energy released when water loses altitude to transfer oxygen. Gravity fall is the simplest way to aerate in flowing water aquaculture system if a sufficient gradient exists. Man-made gravity aerators consist of weirs, splashboards, lattices and screens. Transfer efficiencies of 1.2 - 2.3 kg O_2/kWh^{-1} are under possible standard conditions.

Aerator placement

Proper placement of aerator in ponds play a significant role in efficient mixing of water throughout ponds. If water mixing is important, aerators should be placed where they will improve pond water circulation patterns. For example, water circulation in large, rectangular ponds is optimized by placing paddle wheel aerators off the bank near the middle of the longer axis of the pond to direct currents across the short axis. Another factor that influences the efficiency of an aeration system is the placement of the aerators within the pond, relative to both the type of aerator used as well as the need for aeration. All aerators provide some level of water circulation within the pond. Depending on the type of aerator, this circulation can be primarily oriented horizontally or vertically to the pond surface. If the long axis of a pond is oriented along the direction of prevailing winds, locating aerators to take advantage of wind-driven currents will help to distribute oxygenated water and will improve circulation as well as transfer efficiency. **How much to aerate**

In commercial fishponds, aeration is commonly about 1.5 to 2 hp/acre in each pond. For example, two 20-hp electric paddlewheel aerators may be used in a 20 to 30/ acre pond. Clearly, mechanical aeration at 1 to 2 hp/acre will not improve the dissolved oxygen concentration in the entire pond, but is used only to provide a small refuge of aerated water near the aerator. When dissolved oxygen concentrations are low, fish congregate in that area and remain there until oxygen conditions improve throughout the pond.

When to aerate

The need to aerate varies seasonally because water temperature affects the rates of respiration and photosynthesis. Problems with low dissolved oxygen concentrations are rare when water temperature is consistently below 15 °C. Problems are common when water temperature is above 27 °C. Local climates and unseasonable temperatures will, however, alter the need to aerate

ponds. Episodes of low dissolved oxygen concentration usually occur at night during the summer. Note, however, that the duration of aeration varies greatly among ponds on a given day. Some ponds may need no aeration, while others require continuous aeration throughout the day. The length of time aeration is used also depends on weather conditions. For example, during periods of warm, cloudy weather most ponds may need continuous aeration for several days.

Conclusion

Aeration will affect directly the dissolved oxygen level in the pond water and sediments. The result is improved soil conditions and improved water quality. Circulation, on the other hand, results in temperature destratification, uniform mixing of DO from surface to bottom, reduction of the thickness of the pond bottom sediment layer, improvement of water quality, and increase of the available habitat for aquatic animals. These benefits translate to healthier animals, larger animals, higher production, higher selling price, higher quality product, and increased profits.

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THE SCIENCE WORLD
A Monthly e Magazine
August, 2022; 2(8), 1392-1394

Case Report

Management of Craniocephalic Trauma in a Neonatal Puppy : A Case Report

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https://doi.org/10.5281/zenodo.6993862

Abstract

A 16 days old male non-descriptive puppy was presented to the Teaching Veterinary clinical complex with the history of a dog bite. On physical examination the head appeared to be swollen and the puppy had stuporous mentation, recurrent seizures and a depressed respiratory rate. Emergency treatment was given after which pup regained normal mentation with normal vitals and the Episodes of seizures ceased to occur.

Keywords: craniocephalic trauma, cushing's reflex, mannitol, neonatal, intracranial pressure, cheyne stokes breathing

Introduction

Craniocephalic trauma is a serious and commonly presented emergency at veterinary clinics and hospitals. Quick diagnosis and immediate stabilisation are needed to prevent severe morbidity and mortality. Etiology can range from automobile trauma, fall from height (high rise syndrome) , trauma caused by bites on head and can be presented as isolate injury to head as well. external wound may or may not be present depending on the etiology. Craniocephalic trauma is mostly associated with traumatic brain injury due to which there's an increase in intracranial pressure which manifests as Cushing's reflex resulting in Cushing's triad (decreased heart rate (bradycardia), decreased & irregular respiratory rate and increased blood pressure). This increase in intracranial pressure can lead to brainstem herniation and death if immediate medical intervention is not provided.

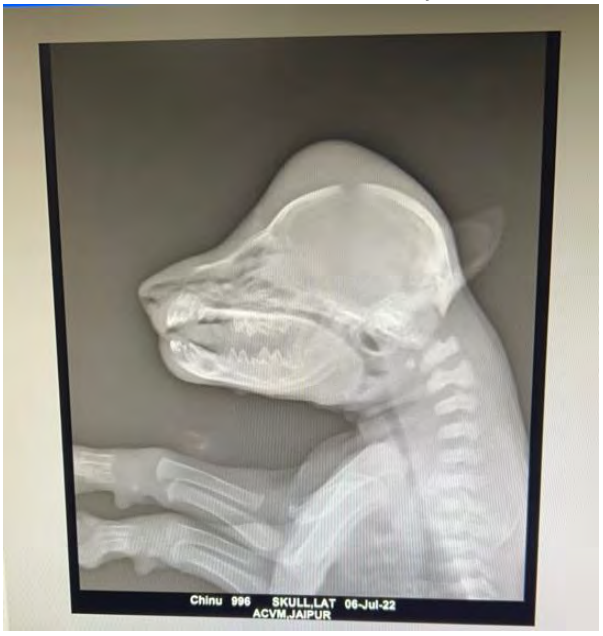

Fig:1 radiograph showing Defect in the cranium and the Soft tissue swelling on head.

Fig: 2 head is elevated at 30 degrees to aid in decrease the Intracranial pressure.

History and examination

A 16 days old neonatal puppy was presented to the Teaching veterinary clinical complex with a history of dog bite and un responsiveness and recurrent seizures. Clinical examination revealed a swelling at the head, mild hypothermia and irregular and depressed breathing rate consistent with cheyne stokes breathing. On the basis of history and clinical examination diagnosis of Craniocephalic trauma causing increased intracranial pressure manifesting as Cushing's triad was made.

Treatment and Management

Main goal of the treatment was to decrease the increased intracranial pressure. The head of the puppy was elevated between 15 to 30 degrees to aid in venous flow from the head and flow by oxygen was started. Intravenous Mannitol was given at 1gm/kg over 15-20 mins to decrease intracranial pressure (daniel j. Fletcher , 2009) . Intrarectal diazepam at 1mg/kg was administered to stop the ongoing seizure (carlos torrente artero , 2017) . Meloxicam at 0.2mg/kg PO was given for analgesia. Intravenous dextrose 20% was given at rate of 1ml/kg to maintain euglycemia. As there was no external wound antibiotics were not given. The puppy regained consciousness and the vitals became normal after 15-20 mins. Radiographs were taken after the stabilization to know the extent of cranial fracture. A discontinuity was observed in the cranium. The decision was made to manage it conservatively given

patient's age and extent of damage. After careful monitoring and no reoccurrence of clinical signs for 2 hours the puppy was discharged with oral meloxicam bid and intrarectal diazepam sos for seizure control. The owner was instructed to provide rest to the puppy and regular feeding to maintain euglycemia and to come back for a follow up the next day. The puppy was active with and the size of the swelling appeared to be decreased on the follow up next day and there was no complaint of seizure episodes. Meloxicam po was given for further two days and the puppy recovered uneventfully.

Reference

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THE SCIENCE WORLD
A Monthly e Magazine
August, 2022; 2(8), 1395-1397

Success Story

Management of compound fracture in long bone with economical ESF in Goats

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https://doi.org/10.5281/zenodo.6997431

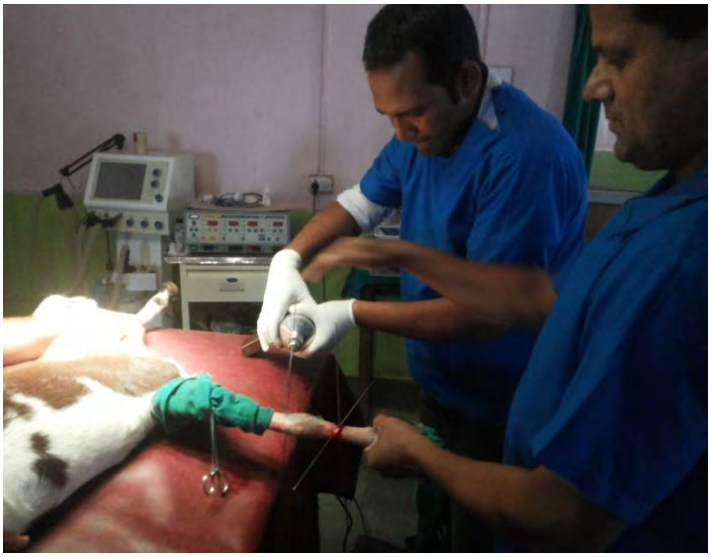
Fracture of long bones is one of the most common problems among orthopaedic condition encountered in goats and other small ruminants. It may treat either conservative management or surgical interference (Aithal *et al.,* 1998). In compound fracture conservative treatment is not applicable, so required surgical intervention. Most common constraints in management of fractures of these animals are the cost of the implants and postoperative management. Therefore, economical External Skeletal Fixation is one of most attractive choice as it is less invasive, requiring minimal equipment (kumar *et al.,* 2021) and relatively easy to perform. Economical external skeletal fixation device can be used in small ruminants as a successfully alternative to internal fixation. It is an external coaptation technique used to stabilize bone fragments or joints with percutaneous wires or pins held together by an external frame. Epoxy compound and acrylic material used rather than clamps and metallic connecting rods. Economical ESF device comes in less than 20% of the original price of the external skeletal fixator. So, economical skeletal fixations have emerged as boon to both farmer & ruminant veterinary surgery. Present study conducted to evaluate of epoxy ESF for the management of compound fractures of long bones in goats. Under university project on management of long bone fracture in goats with Economical External Fixators **was** performed in six clinical cases with objective to evaluate epoxy & acrylic ESF for the management of compound fractures in small ruminant.

All animals were sedated with inj. xylazine at dose rate of 0.05 mg/ kg body weight intramuscularly. Anesthesia was maintained with ketamine as per requirement. The fracture reduction and surgical procedure was performed in lateral recumbency in all the cases. Fracture fragments were reduced to their normal anatomical positions by application of traction and counter traction. The pins were drilled into the two cortices of the bone by using a low speed, high torque power drill from medial aspect to lateral aspect of bone after giving a small stab incision to the skin at their point of entry of pin. The most proximal and distal pins were drilled first then followed by others.

After pins insertion pins were bends & make a frame. Pins were supported with epoxy material. Post operatively all animals were treated with Ceftrixone in combination with tazobactum (Inj. Intacef-tazo) at the dose rate of 10 mg/kg body weight intramuscularly for 7-10 day depending on the healing of wound. The therapy was also adjunct with Meloxicam along with paracetamol (Inj. Melonex plus) at the dose rate 1ml/10kg body weight for 2-3 day as per required & regular dressing up to healing of wound. Economical external fixation device was well tolerated by all animals. However, pins tract infection was observed nearly all case, but they managed topical application of antiseptic and systemic application of antibiotic. All animal recovered within 45 days. So, economical external fixation device is effective in management of compound fracture in small ruminant. It was popularized by training of field veterinarian. Farmer also aware regarding economical external fixation device that it is not must costly and may save the life animals.

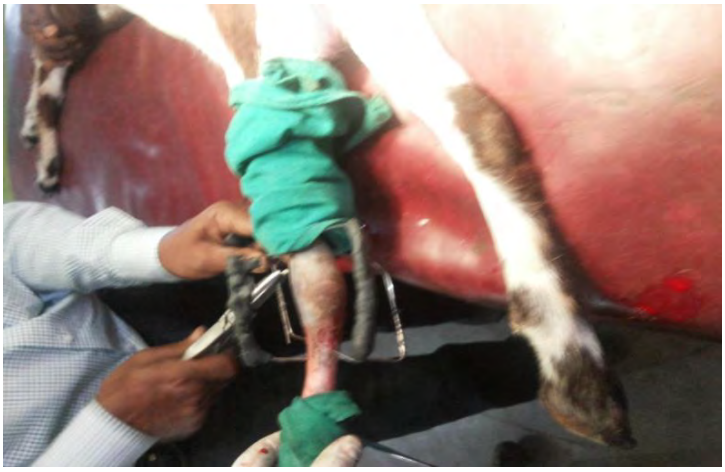
Clinical cases of compound fracture in Goats

Clinical cases of compound fracture

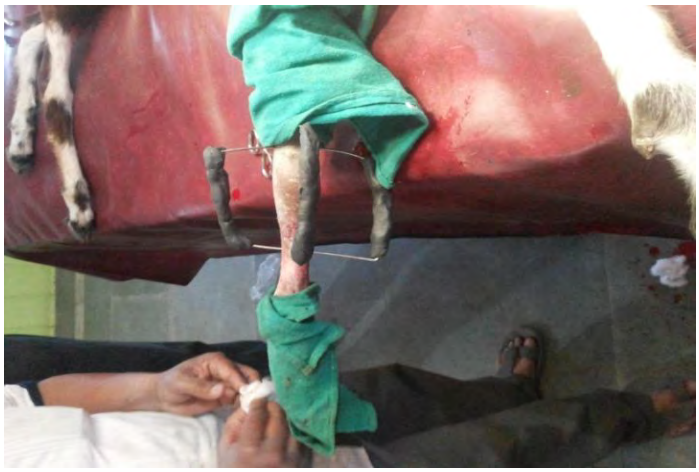


Medial insertion of intramedullary pins

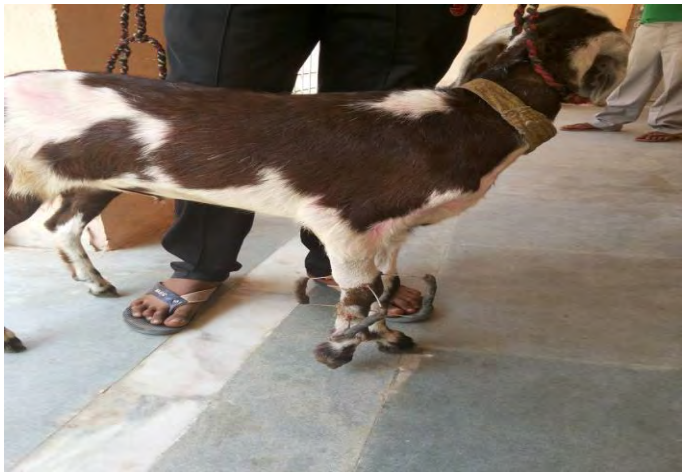
Lateral insertion of intramedullary pins



Remodeling the frame



Completion of frame



Weight bearing by animals

THE SCIENCE WORLD
A Monthly e Magazine
August, 2022; 2(8), 1398-1400

Success Story

Diagnosis and Surgical Management of Gid in Nondescript Goat

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https://doi.org/10.5281/zenodo.7007737

Coenurosis, also known as coenuruses, gid or sturdy, is a parasitic infection that developsin the intermediate hosts of some tapeworm species (Taenia multiceps, T. brauni, or T. glomerata). Coenurus cerebralisis the larval form of Taenia multiceps which is seen in the small intestines of carnivores. It is caused by the coenurus, the larval stage of these tapeworms. Infection occurs as a result of the oral intake of eggs spreading via fecal dumps of those animals by intermediate hosts. The disease occurs mainly in sheep, goat and other ungulates, but it may occur in humans by accidental ingestion of tapeworm eggs. Adult worms of these species develop in the small intestine of the definitive hosts (dogs, foxes and other canids), causing a disease from the group of taeniasis. Total 10 nondescript breed of goat were presented to the clinic of Bihar Veterinary College, Patna, Bihar (India) with the history of anorexia, bleating, ataxia, seizure, head pressing against the wall, circling movements, at times keeping the head upwards and walking in circle. Softening of skull bone at occipital region was seen. It was also diagnosed by the X-ray as radiolucent density above the occipital bone and a mild rarefaction was distinctly visible. Prior to reporting to the present clinic, it was treated with local veterinarian but no improvement was recorded. The case was tentatively diagnosed as of coenurosis and it was decided to remove the cysts surgically from subdural space after trephening the occipital bone. Goat was cast in lateral recumbency and site was prepared aseptically for surgical intervention. The exact site of cyst was the area between two horns. The goat was tranquilized with xylazine @ 0.1mg/kg body weight and anesthesia were obtained by local infiltration of 2% lignocaine hydrochloride solution at the central point of occipital region. A linear skin incision was made on the skin measuring 4-6 cm through fascia and periosteum at left side of occipital region. The bone and meninges were incised by a nick with scalpel blade and enlarged with scissors.

Few gentle jerks were given to the head by holding the horns to enable the protrusion of cyst from incision. However, it was difficult to visualize the cyst for a while but by constant physical maneuvering with finger and blunt forceps, we were able to retrieve the cyst by grasping with mosquito artery forceps ndwas gently pulled out from the brain as water balloon and the wound was closed with non-absorbable sutures. Postoperatively, the goats were administered antibiotics (Ceftriaxone @ 25 mg/kg) and non-steroidal anti-inflammatory agents (Meloxicam 0.3 mg/ kg) for 5 and 3 days, respectively. Besides, the fluid therapy (Ringer's lactate) was done to maintain the electrolyte and hydration status with provision of energy as goat was anorectic for five days. The goat recovered uneventfully. The skin sutures were removed on 12th post-operative day.

The outbreaks of Coenurosis in local breed of goats is documented but the cure rate was very low due to lack of knowledge of surgical procedure to remove the cyst form brain. The higher incidence of Gid was reported in sheep and goats than the other species. The field veterinarian and students were trained for performing this surgical procedure and being done at the field level. Due to adoption of this technique by the field veterinarian life of goat are being saved even in the rural areas of the state.

Fig.1: Onchosphere is visible after incision

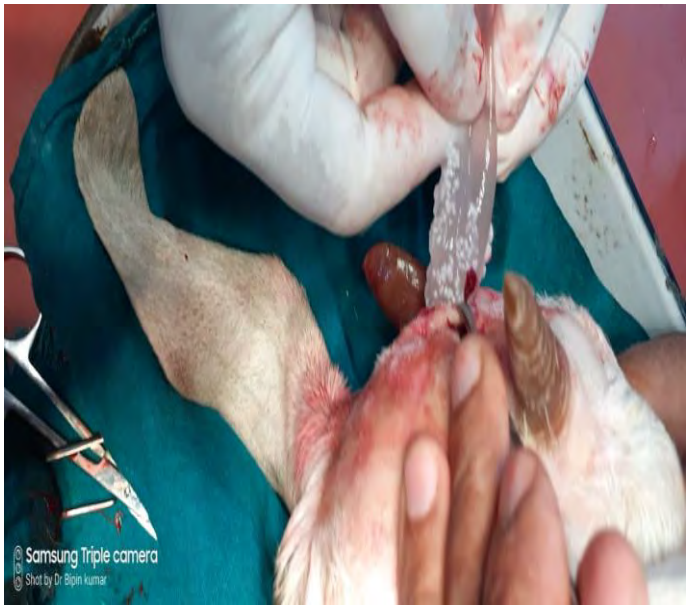

Fig. 2: Cyst is being pulled manually

Fig. 3: Cyst with Protoscolices

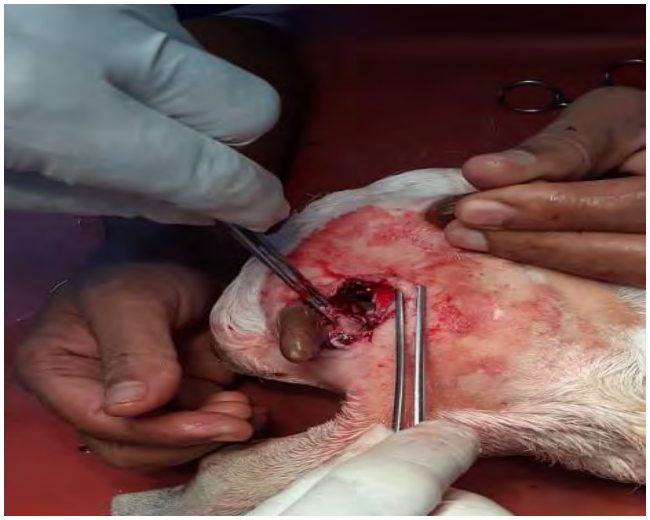

Fig. 4: Gap in cranium after cyst evacuation

Fig. 5: Skin incision closed with interrupted suture

THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
August, 2022; 2(8), 1404-1410

Popular Article

Emergence of Lumpy skin disease in India

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https://doi.org/10.5281/zenodo.7007877

Introduction

Emerging disease: "a new infection resulting from the evolution or change of an existing pathogenic agent, a known infection spreading to a new geographic area or population, or a previously unrecognized disease diagnosed for the first time and which has a significant impact on animal or public health". Lumpy skin disease (LSD) is a transboundary, arthropod-borne viral disease of cattle and buffaloes. Lumpy skin disease (LSD, Pseudo-urticaria, Neethling virus disease, exanthema nodularisbovis, and knopvelsiekte) is an infectious disease. It is caused by a virus (LSDV) in the family Poxviridae, genus Capripoxvirus. Currently the disease has been emerged as a devastating threat in Europe, Middle East and the southeast Asia. The economic implications of the disease are high due to morbidity (5%-45%) rather than mortality (usually under 10%). OIE has categorized Lumpy skin disease as a notifiable outbreak considering its transboundary potential and threat as agro-terrorism disease.

Aetiology

Lumpy skin disease (LSD) caused by lumpy skin disease virus (LSDV) which is related to that of sheep pox. LSDV is a member of the genus Capripoxvirus within the subfamily Chordopoxvirinae, family Poxviridae. The LSDV is quite resistant against high ambient temperature and desiccation. The virus retains its ability to infect for long periods (18–35 days) in dry necrotic nodule laden hides even after the animal is slaughtered. But the virus is destroyed immediately when exposed to direct sunlight or lipophilic detergents. Virus becomes inactivated in 2 h at 55 ˚C as well as it takes 30 min at 65 ˚C temperature. Virus is prone to highly alkaline or acidic conditions. It can however, withstand minor pH fluctuations ranging between 6.6 and 8.6 at 37 ˚C for five days without any substantial decrease in titers. Other disinfectants such as iodine compounds (1:33 dilution), formalin (1%), quaternary ammonium compounds (0.5%), phenol (2% for 15 min), ether (20%), chloroform and sodium hypochlorite (2–3%) are highly effective against this virus.

Epidemiology in India

In India, first outbreak of the disease was noticed in Odisha (August 2019) and reported to the OIE on 18 November 2019. India faced three primary outbreaks of LSD in Odisha. The first incident started on 12 August 2019, in the Mayurbhanj districts of Orissa, where in a farm 9 cases (135 animals) were reported. Second outbreak was reported from Patalipura, where in a farm 20 cases (441 animals) were reported. Third case outbreak was reported on 20 August 2019 in Bhadrak, where in a farm 50 cases (356 animals) were reported. In 2020, the disease is prevalent in Maharashtra and Madhya Pradesh and now as of August 8, 2022, Rajasthan has reported 2,111 deaths of cattle, followed by Gujarat at 1,679, Punjab at 672, Himachal Pradesh at 38, Andaman & Nicobar at 29 and Uttarakhand at 26.

Table- Current situation in India

Year	No. of animals	Area	Reported By
19 May, 2022	120 cattle died	Jaisalmer district of Rajasthan	The Times of India
24 May, 2022	10 cattle died, 517 infected	Jamnagar and Dwarka, Gujarat	Ahmadabadmirror.com
31 May, 2022	120 cattle died	Jalore, Rajasthan	Dainik Bhaskar

Hosts

Cattle and buffalo are susceptible hosts. Exotic cattle breeds are more susceptible than indigenous cattle breeds. Animals of all ages are susceptible but calves are more susceptible and develop lesions within 24 to 48 hours. Wild animals under natural conditions, are resistant to infection but experimental infection produced clinical lesions in Giraffe, impala, Arabian oryx, springbok, oryx, and Thomson's gazelle. Normally the role of wildlife in the transmission and maintenance of LSDV has been found almost negligible. Humans are also resistant to the virus.

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 Ethiopia, the disease incidences significantly increase with the onset of seasonal rains and summer season, coinciding with the peak activity of the vectors. Incidences decrease significantly with the onset of winters and reappears with arrival of spring and summer. It was

observed that despite restricted animal movements infection spreads to 80 to 200 km away through air movement of bitting insects. The tick *Amblyomma spp*., *Rhipicephalus decoloratus*, *Rhipicephalus appendiculatus* and *Amblyomma hebraeum* have been reported as a mechanical vectors and reservoirs of virus. The bitting flies (*Stomoxy calictrans* and *Biomyia fasciata*) and mosquitoes (e.g. *Culex mirificens* and *Aedes natrionus*), are also involved in mechanical transmission of disease. Virus is secreted in milk, nasal secretions, saliva, blood and lachrymal secretions forming indirect source of infection for animals sharing feeding and watering troughs. LSD virus transmission through intrauterine route has been documented in literature. The infection has been assumed to be transmitted from infected mother to calf via milk secretions and skin abrasions. The virus persists in the semen for up to 42 days post-infection and it has been established by experimental infection. Iatrogenic route can be another route of spread of virus when single needle used for mass vaccination that can acquire the virus from the skin scabs or crusts. Therefore, it suggests that quarantine could not be the only method to prevent the spread of LSD as movement of vector can blow out the disease.

Pathogenesis

Lumpy skin disease (LSD) virus enters the host body through skin or gastro intestinal tract mucosa resulting in viraemia accompanied by febrile reactions which persist for two weeks. The virus reaches the regional lymph nodes and causes lymphadenitis. The virus causes skin lesions due to its rapid replication in specific cells such as endothelial cells of lymphatic and blood vessel walls with development of inflammatory nodules on the skin.

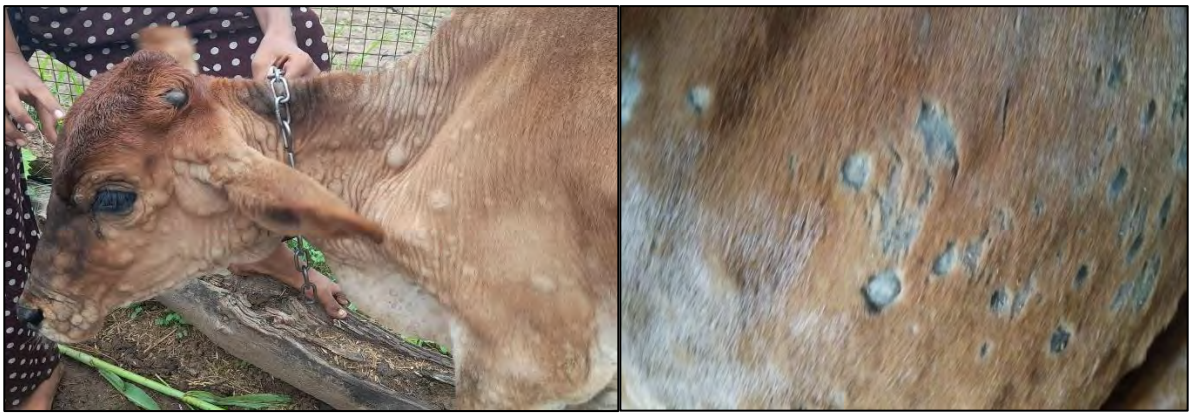
Clinical signs

- The clinical signs of LSD have two febrile phases (biphasic fever), which is appeared after variant incubation period 4-12 days (usually 7 days). The temperature of the infected animals raises to 40-41.5°C, which may persist for 6-72 hours or more and may rarely be up to10 days. The infected animals also show lacrimation, increased nasal and pharyngeal secretions, anorexia, dysgalactia, general depression and a disinclination to move.
- The initial clinical signs of LSD are varied in severity that depends on the management system of the herd but do not relate to animal sex or age. Multiple firm circumscribed nodules are developed in the skin of the animals.
- These nodules are suddenly erupted within 1-2 days. The erupted nodules may be widespread or restricted to just a few lesions. The head, neck, the perineum, the genitalia, udder, and the limbs are the predilection sites. The whole of the skin of the infected animal is covered with lesions

infrequent cases. Typical LSD lesions are round, irregular, about 5-50 mm in diameter, and appear as circumscribed areas of erect hair over a firm and slightly raised area of skin.

- The healthy skin is clearly recognized by the adjacent skin reaction. The affected skin is hyperaemic, and there may be beads of serum exuded from them. The lesions are of full skin thickness and involve epidermis, dermis and sub-cutis, often with some oedema. They slowly harden and form a (dimple) indentation in the center.
- The regional lymph nodes are easily palpable and enlarged to 3-5 times their normal size. Some masses (lumps) may be detected in the subcutaneous tissues and are often distributed throughout the connective tissue and muscle in the body.
- The disease lesions are also developed on the muzzle in the nares and the oropharynx. The muzzle shows a typical ring-like lesion due to sloughing of the necrotic lesions from the healthy surrounding epithelium. Larynx, trachea, alimentary tract particularly the abomasum may also develop lesions (necrosis and ulceration) that lead to develop severe gastro-enteritis.
- Keratitis is a common complication. Mucopurulent discharges appear from the nares, persistent dribbling from the mouth, coughing and often stertorious and distressed respiration, if the larynx and trachea are involved. After 2-3 weeks, the skin lesions gradually become harder and necrotic.
- Several lesions associated with the formation of hard edematous plaques, cause severe discomfort and pain and inhibit movement. Later on, the "sit fast" of LSD are developed from harder lesions (core of necrotic tissue forms a plug).
- There is a distinct ring of living tissue around the lesions. Some of "sit fast" may peel off, leaving a full skin thickness hole in the skin, which heals by granulation. Bacteria may invade the hole. The limbs are swelled to several times their normal size due to inflammation, oedema and large areas of necrotic lesions.
- Hard skin over chronically edematous limbs may peel off, leaving large areas that can become infected or susceptible to myasis. Lesions on the teats may falling away, predisposing animals to mastitis and loss of quarters. The common sequel of LSD is the pneumonia, associated with a large area of grey consolidation measuring 20-30 mm, which may be fatal.
- Abortion is a common sequel of the acute phase of the disease; aborted fetuses and live calves have been observed with skin lesions of LSD. Infertility is a problem following LSD infection; females remain in anestrous for several months and most infected cow suffering from cessation of ovarian activity mainly due to poor body condition.

- The infected bulls, which suffer from lesions on the genitalia, may also be infertile for months. Deterioration in the general condition occurs in the severely affected animals and under range conditions the mortality can be high. The recovered animals suffered from weakness and debility for up to 6 months. The majority of affected animals develop comparatively few nodules and recover uneventfully.



Treatment

No registered treatment for virus is present, although symptomatic treatment can be given to the animal which includes NSAIDS & antibiotics (topical +/- injectables) to protect from secondary infection.

Following proposed treatment protocols might help in lowering animals' suffering:

- Antihistaminic drug (Chlorpheniramine maleate) @ 0.4-0.5 mg / kg b. wt I.M./I.V. Anti-inflamatory (Inj. Meloxicam) @ 0.5 mg / kg b. wt I.M. in case of fever

- Antibiotics (Inj. Enrofloxacin @ 2.5 to 5 mg / kg b.wt I.M for 4 to 5 days and Amoxicillin @ 10 mg / kg b.wt I.M for 5 to 6 days.

- Supportive therepy- Vitamin A, D and E 10 ml I.M. Inj on alternate days for 4 times. Vitamin C 10 g per day per adult animal P.O Tab for 7 to 8 days. Liver tonics @ 50 ml per day orally.

Control and Prevention

To control the disease, effective control and preventive measures need to be implemented, which include: -

a) Restrict movement: Movement of infected animals with LSD should be strictly prohibited to prevent the spread of transboundary disease. Within countries, if animal with such lesions are observed, they should be quarantined for inspection to prevent the rapid spread of disease.

b) Restrict vector movements: Vectors movement due to prevailing winds may cause disease transmission. Vector control methods like use of vector traps, use of insecticides can also be used for preventing the disease.

c) Vaccination: A live attenuated vaccine is available for LSD. LSD virus closely resembles to sheep and goat poxviruses, hence vaccines against these two diseases can be used for LSD. For effective control and prevention of disease, long term vaccination with 100% coverage should be made mandatory as LSD virus being stable survives in environment for long time. Before introducing new animals to the affected farm, they should be immunized. Calves should be immunized at the age of 3 to 4 months raised from mothers, who are vaccinated or naturally infected. Adult animals should be vaccinated annually. Immunity starts to develop about 7 to 10 days after vaccination. Sheep Pox Vaccine is a live attenuated Sheep Pox Vaccine using an indigenous strain (SPPV Srin 38/00) was developed by the ICAR-IVRI and technology was transferred to the Hester Biosciences. Raksha Goat Pox is a live attenuated vaccine (Uttarkashi strain) was developed by ICAR-IVRI and technology was transferred to IndianImmunologicals Ltd (IIL). Live attenuated LSD Neethling strain.

ICAR-National Research Centre on Equines (ICAR-NRCE), Hisar (Haryana), in collaboration with ICAR-Indian Veterinary Research Institute (IVRI), Izatnagar, Uttar Pradesh has developed a homologous live-attenuated LSD vaccine Lumpi-ProVac^{Ind} (Ranchi strain).

Conclusions

- Until 19th century, the disease was endemic in Africa.
- But this disease now outstretched into the Middle East, Eastern Europe, and Russia and recently in south east Asia at a faster rate.
- Hence, it is needless to say, this is the high time to anticipate emergency preparedness to limit this trans-boundary disease from spreading enormously.
- Attention should be concentrated on vector control, movement restriction, harsh quarantine, improved vaccination programs, proper veterinary care, and overall farm sanitary management.

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THE SCIENCE WORLD
A Monthly e Magazine

ISSN:2583-2212
August, 2022; 2(8), 1419-1420

Success Story

Standardization of maintenance agent of general anaesthesia as constant Rate Infusion

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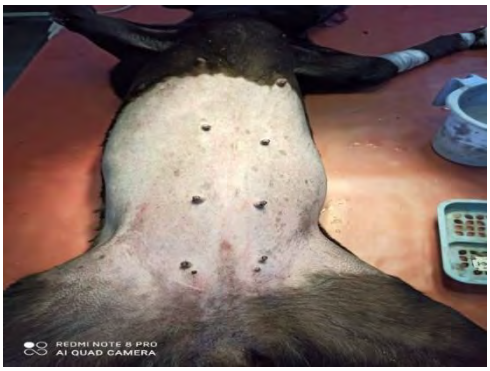
https://doi.org/10.5281/zenodo.7013024

Anesthesia and analgesia are interlinked and autonomic parameters like change in respiratory and cardiovascular responses are indicators of the depth of anesthesia or antinociception (Gruenewald and Ilies, 2013). The purpose of anesthesia is to produce a convenient, safe, effective analgesia, sedation, and reversible unconsciousness of the animals, so that surgical intervention may be conducted with minimum stress, discomfort, pain, and toxic side effects to the patients (Thurmon et al., 1996 and William et al., 2007). The objective of constant rate infusion (CRI) is to achieve a constant plasma concentration of drugs in the body. This state can be achieved by the administration of a constant rate of ketamine / propofol or ketofol. CRI prevents the sudden peaks and valleys associated with intermittent I/V boluses and I/M injection and also maintains a stable plane of anesthesia superiorly to boluses (Pablo, 2011). Therefore, the present study was designed to evaluate balance anesthesia along with maintenance for ovariectomy standardization of maintenance agent of general anaesthesia as constant rate infusion.

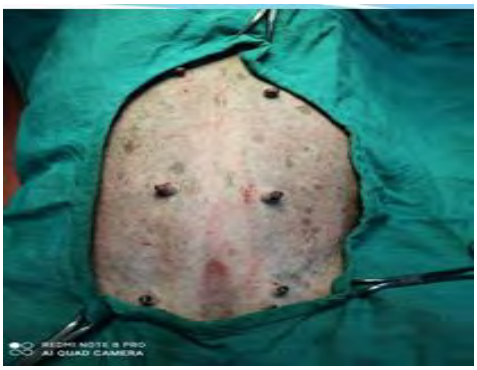
The study was conducted on 18 female dogs and these animals were randomly divided into three experimental groups, each group containing six animals. The groups were designated as Group I, Group II, and Group III on the basis of the induction and maintenance agent. The animals of different groups were administered the following drugs for induction and maintenance of anesthesia for elective ovariectomy. After preparation of the animal, blood was withdrawn at 0 min from the cephalic vein, and glycopyrrolate1was given @ 0.01mg/kg b.wt intramuscularly at right lumbar epaxial muscles followed by inj. butorphanol2 @ 0.2 mg/kg b.wt and xylazine3 @ 1mg/kg b.wt were injected intramuscularly after 5 minutes at left lumbar epaxial muscles by using different syringes. After premedication animal was placed on the operation table and canulate with 20 gauges (according to need) intravenous catheter and attached with normal saline infusion. After 10 minutes of butorphanol, animals were induced (till effect) with propofol, and immediately just after induction animals were intubated and constant rate infusion of ketamine4 , propofol5 , and ketofol 1:1 started along with normal saline @ 10ml/kg/hr by micro infusion set and infusion of anesthesia was stopped at last skin suture.

Physiological parameters showed that the values of rectal temperature in all three groups showed a decrease at different intervals during the observation period in comparison of the baseline values. The values of respiratory rate in all three groups decreased at different intervals during an observation period in comparison to the baseline values. All three groups showed that respiratory rate value decreased significantly (p0.05) higher in group I and III, however it become non-significantly lower in group II during maintenance of anesthesia in comparison to respective base values. Cardiovascular parameters showed that the value of systolic arterial pressure increased significantly (P0.05) in group III in comparisons to respective base values. Value of mean arterial pressure increased significantly (P0.05) in groups I and III in comparisons to respective base values

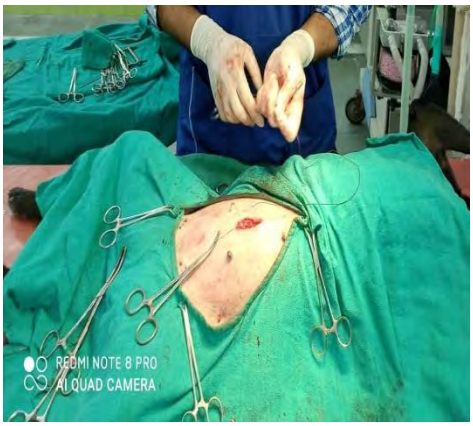
Physiological and hemodynamic observation revealed that pre-medication with glycopyrrolate, butorphanol, and xylazine followed induction with propofol and maintenance with CRI propofol was better in comparison to maintenance with CRI ketamine and ketofol in the present study. For field condition this protocol is very suitable as lack more than one technical person. In this technique no need for administration of intermediate dose and increasing or decreasing the dose. This protocol popularized among field veterinarian to perform soft tissue surgery.



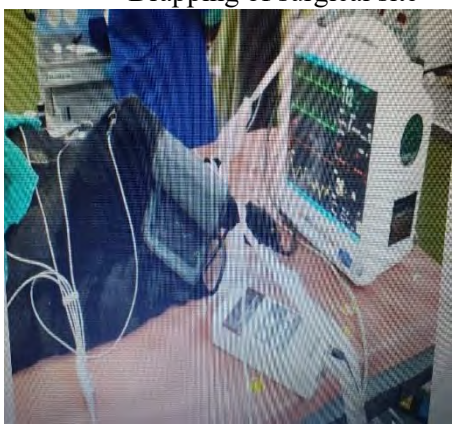
Clinical cases of soft tissue



Drapping of surgical site



Maintenance of anesthesia with CRI



Monitoring of Vital function

THE SCIENCE WORLD
A Monthly e Magazine
ISSN: 2583-2212
August, 2022; 2(8), 1421-1424

Popular Article

MONKEYPOX- A Global Emergency

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https://doi.org/10.5281/zenodo.7013046

Introduction

Monkeypox is a viral zoonosis (a virus transmitted to humans from animals) with symptoms similar to those seen in the past in smallpox patients, although it is clinically less severe. With the eradication of smallpox in 1980 and subsequent cessation of smallpox vaccination, Monkeypox primarily occurs in central and west Africa, often in proximity to tropical rainforests, and has been increasingly appearing in urban areas. Animal hosts include a range of rodents and non-human primates. Monkeypox virus, a zoonotic orthopox DNA virus related to the virus that causes smallpox. Sporadic outbreaks of infection have been reported in Africa, typically originating from contact with wildlife reservoirs (particularly rodents). Such outbreaks and travel-associated cases outside Africa have had limited secondary spread, and therefore human-to-human transmission has been deemed inefficient. Despite the fact that monkeypox virus has circulated for decades in regions where it has traditionally been endemic, research into monkeypox has been neglected and underfunded. Since early May 2022, more than 3000 monkeypox virus infections have been reported in more than 50 countries across five regions, prompting the World Health Organization to declare monkeypox an "evolving threat of moderate public health concern" on June 23, 2022. Monkeypox virus was first isolated and identified in 1958 when monkeys shipped from Singapore to a Denmark research facility fell ill. However, the first confirmed human case was in 1970 when the virus was isolated from a child in the Democratic Republic of Congo. Most cases of monkeypox occur in rural Africa.

Etiology

Monkeypox is from the family: Poxviridae, subfamily: chordopoxvirinae, genus: orthopoxvirus, and species: Monkeypox virus. Monkeypox virus is an enveloped double-stranded DNA virus.Monkeypox virus is relatively large (200-250 nanometers). Poxviruses are brick-shaped, surrounded by a lipoprotein envelope with a linear double-stranded DNA genome.

There are two distinct genetic clades of the monkeypox virus: the central African (Congo Basin) clade and the west African clade. The Congo Basin clade has historically causedmore severe disease and was thought to be more transmissible. The geographical division between the two clades has so far been in Cameroon, the only country where both virus cladeshave been found.

Natural host of monkeypox virus

Various animal species have been identified as susceptible to monkeypox virus. This includesrope squirrels, tree squirrels, Gambian pouched rats, dormice, non-human primates and other species. Uncertainty remains on the natural history of monkeypox virus and further studies areneeded to identify the exact reservoir(s) and how virus circulation is maintained in nature.

Outbreaks

Since 1970, human cases of monkeypox have been reported in 11 African countries: Benin, Cameroon, the Central African Republic, the Democratic Republic of the Congo, Gabon, Coted'Ivoire, Liberia, Nigeria, the Republic of the Congo, Sierra Leone and South Sudan. Since 2017, Nigeria has experienced a large outbreak, with over 500 suspected cases and over 200 confirmed cases and a case fatality ratio of approximately 3%. Cases continue to be reported until today. In 2003, the first monkeypox outbreak outside of Africa was in the United States of America and was linked to contact with infected pet prairie dogs. These pets had been housed with Gambian pouched rats and dormice that had been imported into the country from Ghana. This outbreak led to over 70 cases of monkeypox in the U.S. Monkeypox has also been reported in travelers from Nigeria to Israel in September 2018, to the United Kingdom in September 2018, December 2019, May 2021 and May 2022, to Singapore in May 2019, and to the United States of America in July and November 2021. In May 2022, multiple cases of monkeypox were identified in several non-endemic countries. Studies are currently underway to further understand the epidemiology, sources of infection, and transmission patterns.

Transmission

Animal-to-human (zoonotic) transmission can occur from direct contact with the blood, bodilyfluids, or cutaneous or mucosal lesions of infected animals either by being scratched or bitten by the animal or by preparing or eating meat or using products from an infected animal.. In Africa, evidence of monkeypox virus infection has been found in many animals including rope squirrels, tree squirrels, Gambian pouched rats, dormice, different species of monkeys and others. The natural reservoir of monkeypox has not yet been identified, though rodents are the most likely. Eating inadequately cooked meat and other animal products of infected animals is

a possible risk factor. People living in or near forested areas may have indirect or low-level exposure to infected animals. Human-to-human transmission can result from close contact with respiratory secretions, skin lesions of an infected person or recently contaminated objects. Transmission via droplet respiratory particles usually requires prolonged face-to-face contact, Direct contact with monkeypox rash, scabs, or body fluids from a person with monkeypox. Monkeypox can spread to anyone through close, personal, often skin-to-skin contact, including-Touching objects, fabrics (clothing, bedding, or towels), and surfaces that have been used by someone with monkeypox. Contact with respiratory secretions. A pregnant person can spread the virus to their fetus through the placenta.

Symptoms

People with monkeypox get a rash that may be located on or near the genitals (penis, testicles,labia, and vagina) or anus (butthole) and could be on other areas like the hands, feet, chest, face, or mouth.

- The rash will go through several stages, including scabs, before healing.
- The rash can initially look like pimples or blisters and may be painful or itchy.

Other symptoms of monkeypox can include:

- Fever, Chills, Headache, Exhaustion
- Swollen lymph nodes
- Muscle aches and backache
- Respiratory symptoms (flu-like symptoms)
- Monkeypox symptoms usually start within 3 weeks of exposure to the virus. If someone has flu-like symptoms, they will usually develop a rash 1-4 days later.

Prevention Steps

- **Avoid close, skin-to-skin contact with people who have a rash that looks like monkeypox like** do not touch the rash or scabs of a person with monkeypox, do not kiss, hug, cuddle or have sex with someone with monkeypox.
- **Avoid contact with objects and materials that a person with monkeypox has used like** do not share eating utensils or cups with a person with monkeypox, do not handle or touch the bedding, towels, or clothing of a person with monkeypox.

- **Wash your hands often** with soap and water or use an alcohol-based hand sanitizer

Treatment

There are no treatments specifically for monkeypox virus infections. However, monkeypox and smallpox viruses are genetically similar, which means that antiviral drugs and vaccines developed to protect against smallpox may be used to prevent and treat monkeypox virus infections.

Approved Monkeypox vaccines in the world

Canada, the European Union, and the United States have authorised a smallpox vaccine, MVA-BN, for use in monkeypox prevention. LC16 and ACAM2000, two more vaccines, are also being explored for monkeypox prevention. People under 45 who did not get the smallpox vaccination are considered to be especially at risk.

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THE SCIENCE WORLD
A Monthly e Magazine
ISSN: 2583-2212
August, 2022; 2(8), 1425-1429

Popular Article

Lumpy Skin Disease (LSD)

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https://doi.org/10.5281/zenodo.7013368

Abstract

All breeds of cattle and water buffalo (*Bubalus bubalis*) are susceptible to lumpy skin disease, LSD is highly host-specific, and caused by the lumpy skin disease virus (LSDV), it is closely linked to sheep pox virus (SPPV) and goat pox virus (GTPV) antigenically and genetically. The disease is characterized by nodules on the skin, lymph node enlargement, and fever. Direct exposure and mechanical transmission by vectors are the routes of spreading that virus. Strict quarantine procedures and vector control are used to stop the spread of LSDV. Although the vaccine is not available, India uses an attenuated goat pox vaccine. The first case in India was reported in August 2019 from Mayurbhanj, Odisha. The OIE classified it as a notifiable disease and it also has a terrible impact on the global cattle economy. Although the disease is endemic to African nations, but now it has been detected from new regions throughout the world.

Introduction

Lumpy skin disease is an infectious viral disease, which is caused by the LSDV (Lumpy skin disease virus) belongs to the Poxviridae family. The common synonyms of LSD are "Exanthema nodularis bovis", "nopvelsiekte", "Pseudo-urticaria", and "Neethling viral sickness".[1]

LSD is a non-zoonotic, vector-borne, and transboundary disease that only affects ruminants, such as cattle and water buffaloes.[12]

The disease is characterized by a fever, swollen lymph nodes, circumscribed nodules on the skin that cause acute anorexia, decreased milk production, and infertility. Overall, it lowers the economic worth of animals since it reduces their ability to produce meat and milk, high-quality hides, draught strength, and reproductive efficiency (abortion and infertility).[17] Initially, LSD symptoms were thought to be the result of either poisoning or an increased sensitivity to insect biting.

Etiology

The virus that causes lumpy skin disease (LSDV), along with sheeppox virus (SPPV), and goatpox virus (GTPV), belogs to the members of the genus Capripoxvirus (CaPV), which is part of the subfamily Chordopoxvirniae and family Poxviridae. The LSDV is an enveloped virus, with a double-stranded DNA genome and envelope is brick-like.[18]

Host Range

Buffalo (Bubalus bubalis) and cattle (Bos indicus and Bos taurus) are vulnerable hosts. Compared to local breeds of cattle, the Bos taurus is more susceptible. Animals of all age are vulnerable; however, calves are especially vulnerable and develop lesions within 24 to 48 hours.[3] However, skin lesions have been observed following experimental infection in sheep, goats, giraffes, Giant gazelles, and impalas, but natural infection of sheep and goats has not been documented, not even in close contact with diseased cattle and buffaloes.[4]

Wild animals are resistant to infection when living in natural conditions. Typically, it has been discovered that wildlife plays a very small role in the transmission and maintenance of LSDV. Similarly, humans are resistant to the virus.[14]

Epidemiology

LSD was first discovered in Zambia in 1929, and from there it spread to the rest of Africa with the exception of Libya, Algeria, Morocco, and Tunisia.[5] According to OIE, this condition is currently widespread in a number of African, European, and Asian nations.[6]

In India first outbreak of the disease is in the second week of August 2019, affecting 9 cattle in the Odisha state. Later in August, 79 cattle were affected by two further outbreaks in the same state (OIE). Overall, India had apparent morbidity and mortality of 7.1% and 0%, respectively.[18] According to recent studies from epidemic regions in the Middle East and Europe, disease morbidity ranges from 5 to 45%, while cattle fatality is often under 10% (FAO, 2017).

Other states where the disease has been reported include Karnataka, West Bengal, Chhattisgarh, Jharkhand, Assam, Maharashtra, Madhya Pradesh, Kerala, Tamil Nadu, Telangana, and recently Rajasthan and Gujarat.

Transmission

1. Primary route: -The principal means of transmission is believed to be by an arthropod vector.[19]Like insect vectors, Mosquitos, and Biting flies.
2. Secondary route: -The virus is also transmitted through direct contact, contaminated feed, and water and equipment's.
    - Direct contact to the skin lesions, Saliva and Nasal discharge.
    - Milk[1] or semen[2] of infected animals
    - Iatrogenic transmission[20]
    - Intrauterine route[16]

The main mode of disease transmission is by mechanical transfer by vectors. There have been reports of the ticks Amblyomma spp., Rhipicephalus decoloratus, Rhipicephalus

appendiculatus, and Amblyomma hebraeum serving as mechanical vectors and viral reservoirs.[20]

Clinical signs and lesions

The incubation period of LSDV lasts between two to five weeks, whereas in experimental conditions, it lasts between seven to fourteen days. There are three forms of LSD:-Acute, Subacute, and Chronic form.

The first indication of the sickness is Biphasic fever. Within 2 to 3 days of the fever's development, one or two lumps of nodules, emaciation, agalactia, reluctance to move, inappetence, salivation, lachrymation, and nasal discharge show as clinical signs in the mild type of infection. Infected cattle have swollen superficial lymph nodes (subscapular and pre-crural).[7]

Later, painful, hyperemic nodular lesions may appear over the animal's body, particularly on the skin of the snout, nares, back, legs, scrotum, perineum, eyelids, lower ear, nasal and oral mucosa, and tail.[7]

In a severe situation, more than 100 nodules spread throughout the body's skin and this stage lasts for 7 to 12 days. The nodules are distinct from the surrounding skin by a thin hemorrhagic ring and are firm and somewhat elevated. These nodules affect the muscle, surrounding subcutis, dermis, and epidermis. The lesions subsequently develop into papules, vesicles, pustules with exudate, and finally slowly form scabs. Healing of the lesions is very slow.

The distinctive lesion is known as "sit fast" may develop holes as a result of the lesions sloughing, which may then invite bacterial invasion and screwworm fly invasion, both of which can progress to septicemia.[8]

Lameness and edematous swelling in the limbs of infected animals are other common complications. The sequelae of LSD are pneumonia, Abortion happens in the acute phase of infection, and infertility is another sequela of the disease in both males and females.

DIAGNOSIS

Skin nodules might be used to provide a tentative diagnosis. To detect viruses, electron microscopy can be used on skin samples[9]. The confirming diagnosis in unknown habitats can be made via virus isolation. The primary and secondary cultures of pre-pubertal lambs and bovine testes are the most sensitive to viral isolation[15].

The most effective and rapid test for disease diagnosis is molecular diagnostics using PCR. For quick diagnosis, both traditional and real-time PCR have been developed.[10] It has been developed to distinguish LSDV from other Capri poxviruses using real-time PCR.[11] Virus neutralization, ELISA, or direct immunofluorescent staining can all be used for antigen testing.

Clinical symptoms of LSD might be mistaken for those of other illnesses such foot and mouth disease (FMD), an insect bite, demodicosis, and hypersensitivity.

Treatment and Control

There is currently no successful LSD treatment available. The sole known therapy is supportive care for cattle, which may involve administering antibiotics to control secondary skin infections and pneumonia as well as using anti-inflammatory drugs and wound care sprays to treat skin lesions[13].

Use some efficient preventative and control measures to manage the LSD, like:

a) Restrict animal movement

b) Restrict vector movements

c) Vaccination: Since there are no LSD vaccines available in India, so goat pox vaccine can be used. However, live attenuated vaccine for LSD is available in other nations. According to the OIE, different viral strains are used as vaccine strains, It is either based on the SIS Neethling type or the Neethling strain used in products like the Lumpy Skin Disease Vaccine for Cattle (Onderstepoort Biological Products; OBP, South Africa) or Bovivax (MCI Sante Animale, Morocco) and (Lumpyvax, MSD Animal Health-Intervet, South Africa) respectively. Live attenuated Gorgan goatpox strain provides effective protection in cattle with almost no adverse effects[16]. The sheeppox and goatpox vaccines can be used to treat LSD because these two viruses are closely related.[6]

Long-term vaccination with 100% coverage should be made necessary for disease control and prevention as the LSD virus is stable and may last a long period in the environment. New animals should be vaccinated before being introduced to the farm. At three to four months old, calves should have their first vaccination. At three to four months old, calves should get their first immunization, whether they are vaccinated or naturally infected. Bulls are used for breeding and cows that are pregnant can receive annual vaccinations.[6]

Conclusion

LSD is categorized as a notifiable disease because of its economic consequences. Due to its capacity to spread from Africa to other areas of the world, LSD has been considered an agent of agro terrorism.

Due to logistics and lack of knowledge, diagnosing exotic infections can be difficult. The distinctive clinical characteristics of the condition are used to make a field diagnosis of LSD. The reason for the disease spread in India is unknown, however, it might be related to the international movement of cattle and vectors from neighboring countries, including China and Bangladesh.

Due to considerable morbidity and typically low mortality, the condition has significant economic consequences. The whole trade of live animals and animal products will be affected by the animal's quality being reduced. The significant losses are a result of severe emaciation, hide

damage, male and female sterility, mastitis, a decrease in milk output, and abortions.

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THE SCIENCE WORLD
A Monthly e Magazine

ISSN:2583-2212
August, 2022; 2(8), 1430-1432

Popular Article

African swine fever: A threat to Indian pigs and food security

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https://doi.org/10.5281/zenodo.7013377

Abstract

African Swine Fever (ASF) is a highly contagious, fatal, re-emerging disease of domestic as well as feral pigs (including wild boar) causing 100% mortality. ASF was first detected in 1921 in Kenya. In India first outbreak of ASF was notified in January 2020 in the North Eastern States of Assam and Arunachal Pradesh. India has a considerable number of small pig holders in rural areas and pork meat is widely consumed by people especially in North Eastern part (NER) of the country. Moreover, pork meat is one of the primary sources of animal proteins, accounting for more than 35% of global meat intake. (FAO Food Outlook 2019). According to the 20th Livestock Census, there are 9.06 million numbers of pigs in the country, which is 1.7% of the total livestock in the country. Pigs are a primary source of household income in many countries. Due to the rapid spreading nature of the disease ASF Virus crosses the boundary and subsequently diseases have been also reported in different districts of Bihar. ASF continues to spread worldwide across Asia, Caribbean, Europe and the pacific regions and responsible for massive losses in pig populations and drastic economic losses. ASF has become a major crisis for pork industry in recent years.

Introduction

African Swine Fever (ASF) is a highly infectious and contagious hemorrhagic viral disease of domestic and feral/wild boar. All breeds, and all ages of pig species are affected. ASF is caused by DNA virus of genus Asfavirus in Asfaviridae family. Mortality rate of ASF disease is 100%. All pigs domesticated/captive wild and feral pigs having all age group and breeds are susceptible to the ASF. No other livestock species and human beings are affected with ASF. It is not a danger to human health, but it has devastating effects on pig populations and the farming economy. ASF is a severe threat to pig production system. It is not only threatened to food security and challenges the livelihoods of pig producers and other actors in the supply chain, but may also have affect international trade as a result trade restriction.

Epidemiology

The virus can transmit the disease through blood tissue, secretions and excretions of sick and dead animals. Disease can be transmitted by various modes such as direct transmission via contact with sick and healthy animals and indirect via by feeding of garbage containing ASF infected uncooked meat, fomites like premises, vehicles, equipments and clothes. The virus can persist for up to a month in contaminated pig pens and pork products for over 4 months. Disease may spread through soft tick of genus *Ornithodoros* and acts as a biological vector. Virus may be present in the carcass even if it is a single dead pig for long time and continue to the transmission of disease to the susceptible animal. Clinical symptoms are divided into four forms namely; per-acute, acute, sub-acute and chronic form varies according to different factors such as virulence of virus, route of exposure of disease, infectious dose, breed of swine affected and endemic status in the area. Incubation period in natural infection of disease varies from 4-19 days. In per-acute form pig shows high fever (41-42^{0}c) and sudden death within 1-3 days of infection. In acute form pig shows high fever (40-42^{0}c) with reddening of the whole skin, bloody secretions from nostril /mouth and bloody diarrhea Mortality rate up to 90-100%. Since there is no vaccine available, reliable and early diagnosis of disease is essential for the implementation of strict sanitary and biosecurity control measures to prevent the spread of disease.

Economic Impact

Across the world, the largest consumed meat is pork. However, in India pork production is only 1.7 % of the total meat production. Consumption of pork is only 2.95 lakh tones in India in 2022. India has 9.06 million of pigs and North Eastern state (NE) states of India are having more than 45% of Indian pig population mostly reared by economically poor people and pork is their staple food. North-eastern States consume more pork compared to other States. But domestic production is unable to meet the growing demand. Recent trends reveal that consumption of pork is increasing in the country. In India, gradually, the trend is moving towards a global consumption pattern taking into account geopolitical situation. OIE reported on May 21, 2020, a total of 11 outbreaks in Assam and Arunachal Pradesh states in India, wherein 3071 pigs were died due to ASF.

Pig production has a lot of challenges in India such as scarcity of superior germplasm, low productivity, conservation of local varieties of pigs, and increasing cost of production and outbreak of emerging disease of pig like African swine fever which may affect the Indian pig industry. Prevention is the only measure as there is no effective vaccine for the disease. Testing of infected

and in-contact pigs, rapid culling of all positive reactors and proper disposal of carcass, litter and infected feed are the way of preventing infection, but that eliminates large no. pigs in the affected area leading to economic losses to pig farmers. Thus, the pig farming can be saved from the threat of this disease by adopting strict biosecurity measures at farm as well as village/surrounding level is to be practiced and initiative should be taken towards rapid containment and focus towards eradication of the disease within the shortest possible time to avoid spread and progression to endemic status.

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THE SCIENCE WORLD
A Monthly e Magazine

ISSN:2583-2212
August, 2022; 2(8), 1432-1442

Popular Article

Electrocardiography In Dogs and Cats

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https://doi.org/10.5281/zenodo.7013383

Introduction

ECG is a three-letter acronym for Electrocardiography. The word is derived from electro (Greek for electricity), cardio (Greek for heart) and graph (Greek root meaning to write) It is a transthoracic interpretation of the electrical activity of the heart over time captured and externally recorded by skin electrodes. the device used to produce this non-invasive record is called the electrocardiograph. ECG is the gold standard for the noninvasive diagnosis of cardiac diseases and may occasionally be the only marker for the presence of heart disease.

Electrocardiograph

- Electrocardiograph (ECG machine) is a voltmeter (or galvanometer) that records the changing electrical activity of the heart between a positive and negative electrode.
- Electrocardiography is the process of recording this is electrical changes.

Indications for electrocardiogram

- Cardiac arrhythmias, Acute onset of dyspnoea, Shock., Fainting or seizures.
- Cardiac monitoring during and after surgery.
- Cardiac murmurs, Ventricular tachycardia, Cyanosis
- Cardiomegaly found on thoracic radiographs.
- Pre operatively in older animals.
- Evaluating the effect of cardiac drugs – especially quinidine and propranolol.
- Electrolyte disturbances, especially potassium abnormalities.
- Systemic diseases that affect the heart. Pericarditis, hydropericardium, myocardial inflammation, degenration, valvular disease, Edema, tumors (heart base), Sinus bradycardia, Biventricular failure, right-sided congestive heart failure, left-side congestive heart failure, mitral valve problems (stenosis or insufficiency), congenital abnormalities.

- Chronic heart failure, cardiac arrest, systolic myocardial heart failure, pressure overload heart failure, volume overload heart failure
- Serial electrocardiograms as an aid in the prognosis and diagnosis of cardiac disease.

Basic elctrocphsiagraphic

- Automaticity: ability to initiate an impulse.
- Excitability: ability to respond to a stimulus.
- Conductivity: ability to transmit an impulse.
- Contractility: ability to respond with pumping action.
- Depolarization and repolarization of a cardiac cell generates action potential.
- ECG is the composite representation of action potential of all cardiac cell.

Electrical conduction system of the heart

- The electrical discharge for each cardiac cycle normally starts in a special area of the right atrium called the 'sinoatrial (SA) node'.
- Depolarization then spreads through the atrial muscle fibers. There is a delay while the depolarization spreads through another special area in the atrium, the 'atrioventricular (AV) node'.
- Thereafter, the electrical discharge travels very rapidly, down specialized conduction tissue: first a single pathway, the 'bundle of His', which then divides in the septum between the ventricles into right and left bundle branches.
- Within the ventricular mass, conduction spreads somewhat more slowly, through specialized tissue called 'Purkinje fibers.
- Distal ventricular conduction system (Zidan, 2016).

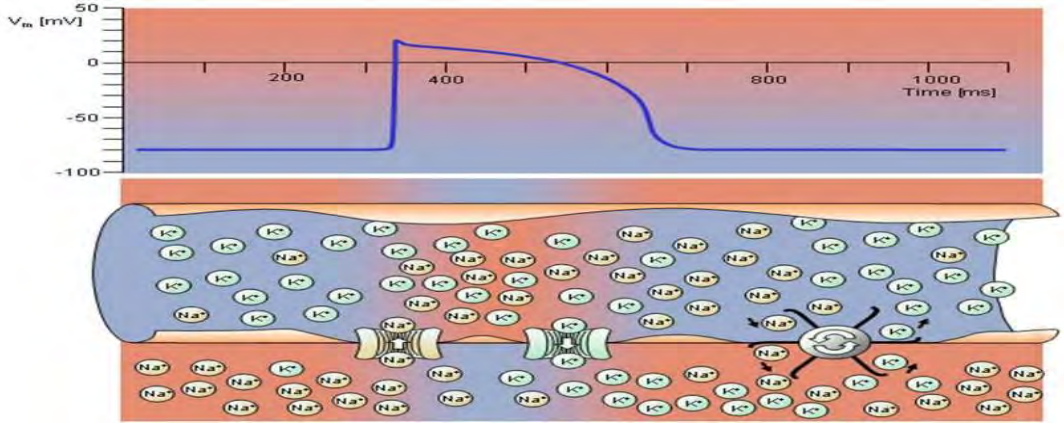
Conduction speed of cardiac tissue

TISSUE	CONDUCTION RATE (M/S)
SA node	0.05
Atrial pathway	1
AV node	0.05
Bundle of his	0.05
Purkinje system	4

Ventricular muscle	1

Conduction of the impulse

- Normal resting membrane potential=-90mv.
- If the potential rises from -90 to 0, then this excites a further rise of potential, called the action potential. The action potential is transmitted throughout the cell and forms the impulse.
- During the rise of potential, the membrane becomes permeable to Sodium ions and the potential rises to a positive direction. This phenomenon is called depolarization.
- The Sodium channels close and there is rapid diffusion of K+ ions into the exterior, reestablishing the resting membrane potential. This is called Depolarization is followed by muscle contraction and repolarization is followed by muscle relaxation.



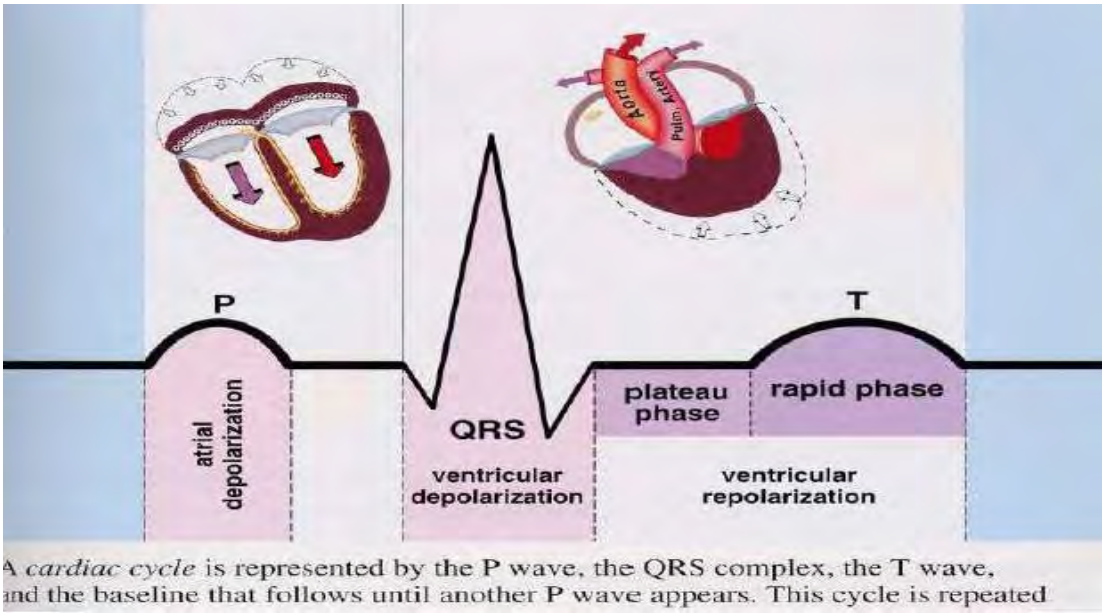
Depolarisation Repolarisation of ionic balance

Fig 1. depicting the mechanism of depolarisation and repolarization

Recording the electrocardiogram

The E.C.G Paper

- ECG machines record changes in electrical activity by drawing a trace on a moving paper strip.
- The electrocardiograph uses thermal paper, which is a graph paper & runs normally at a speed of 25mm/sec
- Time is plotted on the X axis & voltage is plotted on the Y axis.
- In X axis, 1 second is divided into 5 large squares each of which represents 0.2 sec. Each large square is further divided into 5 small squares which represents 0.04 sec.
- The ECG machine is calibrated in such a way that an increase of voltage by 1 mVolt should move the stylus vertically by 1cms.



A *cardiac cycle* is represented by the P wave, the QRS complex, the T wave, and the baseline that follows until another P wave appears. This cycle is repeated

Fig 2.

Positive and negative deflection in a lead

- A wave of electrical depolarization moves toward the positive pole of the - a+ ve deflection occurs

ECG Lead System

In animal body surface- limb ECG recording is used.

In human- mainly precordial (Chest) recording is used.

The three limb electrodes form a triangle called as Einthoven's Equilateral Triangle. (Benjamin Jin, 2012)

1. at the right arm (RA),
2. left arm (LA)
3. left leg (LL)

Preparation of animal for Dog

- Animal positioned in right lateral recumbency.
- No chemical restraint.
- Trained attendant or animal owner. (mudasi et al.,2014).

Electrodes /connectors - Crocodile clip

Connected to	Standard (colour)
Right fore limb	Red
Left fore limb	Yellow
Left hind limb	Green
Right hind limb	Black
Chest	White

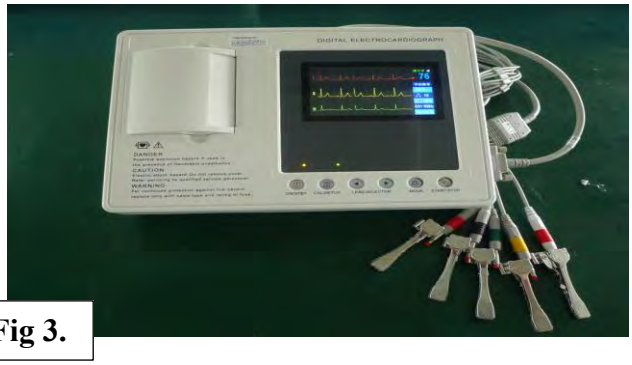


Fig 3.

Six limb lead system

Bipolar standard leads-

- Lead I: Right arm (-) compared with Left (+) arm.
- Lead II: Right arm (-) compared with Left (+) leg.
- Lead III: Left arm (-) compared with Left (+) leg.
- PR Interval: From the start of the P wave to the start of the QRS complex.
- PR Segment: From the end of the P wave to the start of the QRS complex.
- QT Interval: From the start of the QRS complex to the end of the T wave.
- QRS Interval: From the start to the end of the QRS complex.
- ST Segment: From the end of the QRS complex to the start of the T wave.

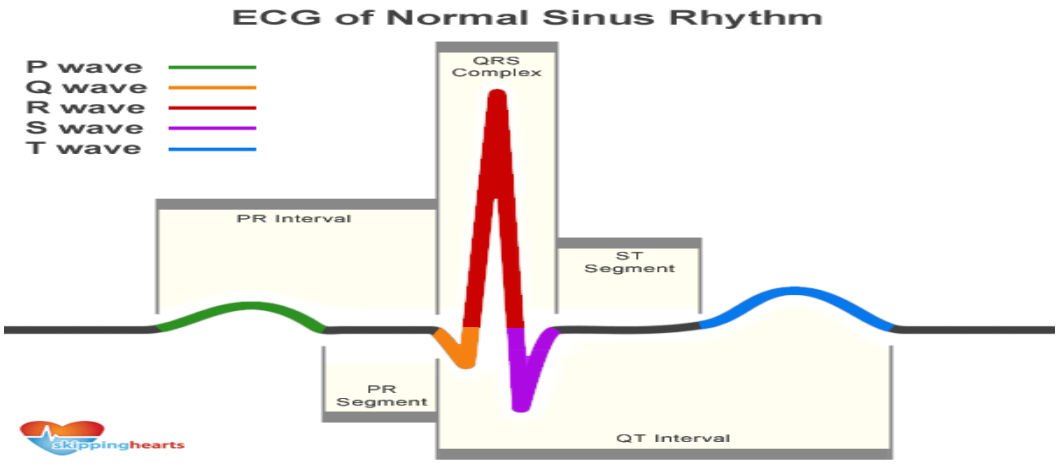


Fig 4.

Elements of the ECG

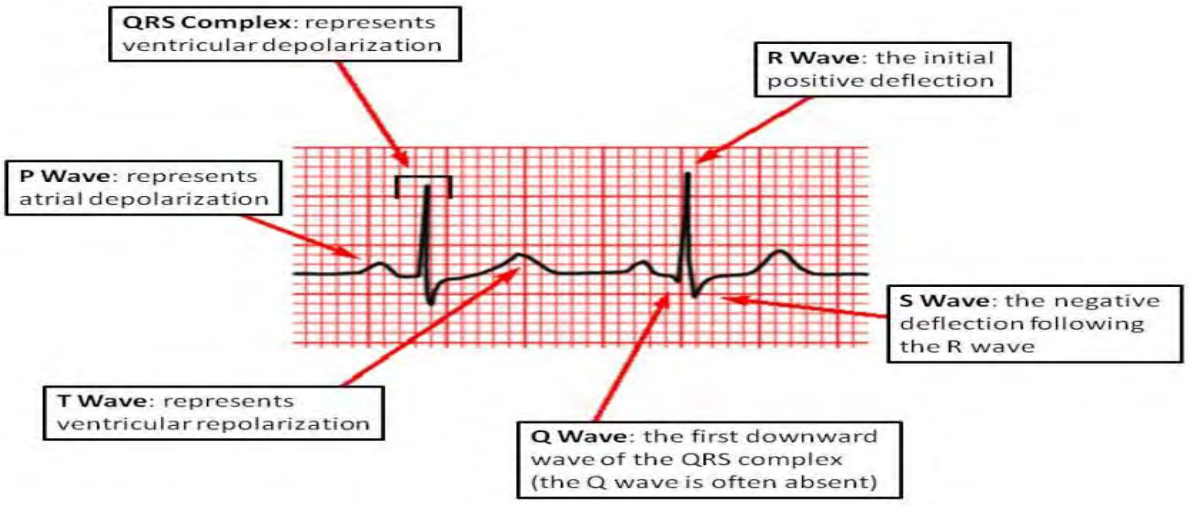


Fig 5.

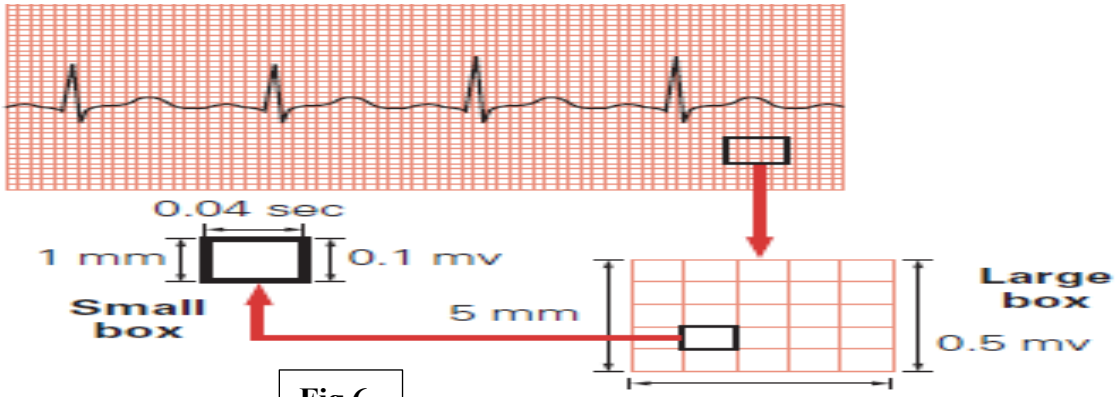


Fig 6.

0.2 sec.

ECG PAPER

Time and amplitude scale of ECG paper

es in ECG graph- -small box- 0.1mV & 0.04 sec.

-Larger box- 0.5mV & 0.2 sec.

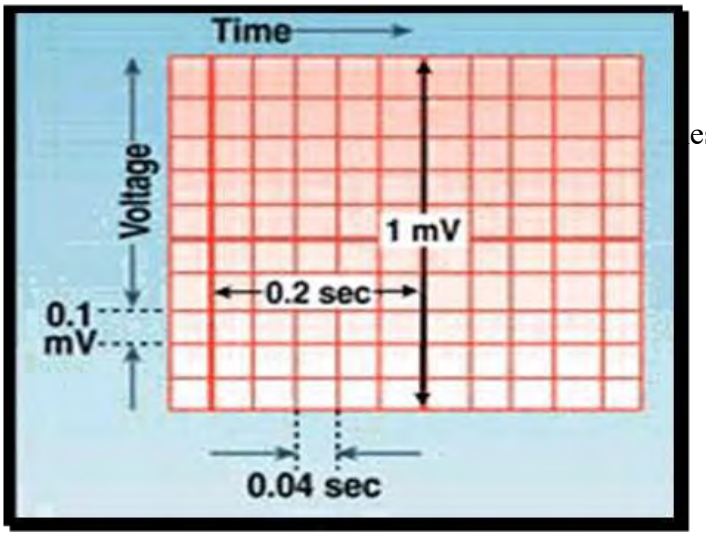


Fig 7.

Normal ECG parameters

Measurements	Normal values
Heart rate	dult (70 – 160/min) Puppy (70 – 220/min)
P wave duration	(Width- 0.04 sec Giant breeds<0.05 sec)
P wave amplitude	Height - 0.4 mv
P – R interval	width-0.06 to 0.13 sec
QRS duration	<0.05 sec Giant breeds<0.06 sec
R wave amplitudes	<2.0 mV Giant breeds<2.5 mV
S – T segment	Depression (<0.2 mV) and Elevation (<0.15 mV)
T wave	<0.25 of normal R wave amplitude
Q – T interval	width -0.15 to 0.25 sec

Abnormal ECG parameter	Significance
Wide p wave	Left atrial enlargement.
Tall, peaked p waves	Right atrial enlargement,
P waves tall, wide and often notched	Bilateral atrial enlargement.
Wide QRS complexes, tall R waves	Left ventricular enlargement
Deep S waves in lead I, II, III	Right ventricular enlargement
Prolongation of P-R interval	Excessive vegal tone
S-T segment depression	Myocardial ischemia, acute myocardial ischemia, digoxin toxicity, electrolyte abnormalities, cardiac trauma
S-T Elevated	Myocardial infarction, pericarditis, myocardial hypoxia
Q-T segment prolongation	Hypokalemia, Hypocalcemia, Hypothermia
Q-T segment shorting	Hyperkalemia, Hypercalcemia

How to calculate Instantaneous Heart rate

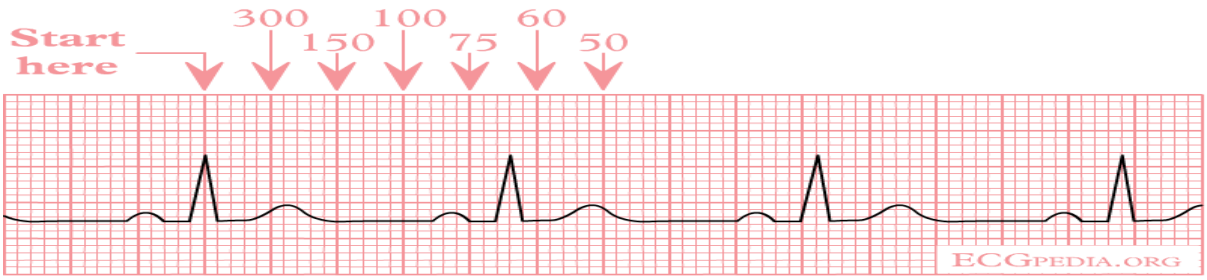


Fig 8.

To calculate Heart Rate- (in beats per minute):

HR was calculated by successive R-R interval (Mukherjee, J. 2015)

HR (at 25 mm/s) = 1500/R − R interval (mm)

Ex. 1500/23 = 65.21 beats per minute

At a paper speed of 50 mm/s, there is 3000mm per minute, thus:

HR (at 50 mm/s) = 3000/R − R interval (mm)

Calculating the average heart rate

Average heart rate 'bic pen method" At 25mm/sec. Strat at 1 QRS complex

Count the number of QRS complexes during 6 sec=15cm =1 pen

Multiply by 10 At 50 mm/sec Start at 1qrs complex Count the number of QRS complexes during 3 sec =15cm =1 pen Multiply by 20

MEA (Mean Electrical Axis)

Average direction and magnitude of the depolarization wave through the ventricles are together termed the mean electrical axis (MEA) or cardiac axis (Martin, 2015). The main objective of determining the MEA is to establish criteria for ventricular dilatation or hypertrophy, and to detect intraventricular conduction defects. (daCosta CF, 2017). There are three common methods of calculating the MEA in the frontal plane. The Vector Method: Using leads I, II or III and the frontal plane diagram, calculate the algebraic sum of the QRS deflections in any two leads. The Largest Net Deflection Method.

The Isoelectric Method

The net amplitude in lead I is +4.5 (Q = -0.5 and R = +5). Plot 4.5 points along lead I in the hex axial lead system diagram and draw a perpendicular. The net amplitude in lead III is +22 (Q=−4 and R=+26). Plot 22 points along lead III and draw a perpendicular. Draw an arrow from the center to where the two perpendicular lines intersect. This is the direction of the MEA.

Normal canine MEA is 40-100 degree

ECG- Mean Electrical Axis (MEA)

Calculating MEA by graph

calculating the net deflection in lead l - graph on ‘‘X axis’’

Calculating net deflection in lead AV - graph on ‘‘Y axis’’

Draw the vector between the two (MEA)

MEA (mean electrical axis

Largest Net Deflection Method.

(i) Using all six limb leads and the hexaxial lead system, find the lead in which the QRS complexes have the greatest (positive) net amplitude – the MEA is approximately in this direction.

(ii) Similarly, find the most negative complexes; the MEA is opposite indirections to this. The Isoelectric Method. Find the lead, in which the QRS complex is equally positive and negative (and usually small)-that is isoelectric lead. MEA will be perpendicular to this. find which of six limb leads that is perpendicular to the isoelectric lead. If the perpendicular lead is positive, then MEA is in this direction; if the perpendicular lead is negative, the MEA is in opposite direction to that lead.

Normal Sinus rhythm - A sequence of beats originating from the sino atrial node forms a rhythm, known as the sinus rhythm) Regular R-R interval ECG from a dog showing a normal sinus rhythm at a rate of 140/min (25 mm/sec and 10 mm/mV.)

Arrhythmia - Cardiac arrhythmias are defined as disturbances in rhythm and/or rate of heart, abnormalities of impulse formation and conduction Irregular R-R interval (Miller and Tilley, 1995).

Wandering atrial pacemaker - Wandering pacemaker characterizes by P’ wave of varying amplitude and configuration. The rate of impulse originate, varies in the large sinus node (Boineu *et al.,* 1990).

Disturbance of sinus impulse formation sinus arrest- When there is a failure of the SA node to generate an impulse, that is, the SA node has temporarily arrested – it is referred to as sinus arrest. There is a pause in the rhythm with neither a P wave nor, therefore, a QRS–T complex, that is, the baseline is flat. then the blood pressure will fall and syncope will occur.

Sinus bradycardia -characterizes by heart rate less than 70 beats per minute without appealable changes in R-R interval, Hyperkalemia, Hypoglycemia, Hypothyroidism, Hypothermia, enhanced parasympathetic tone as with: Increased inspiratory effort, Gastric irritation, Increased CSF pressure, More gap between R waves (Tilley,1985).

Sinus tachycardia- characterizes by regular sinus rhythm with a heart rate higher than 160 beats per minute and is considered most common in dogs Rapidly coming R waves (Tilley, 1985).

Disturbance in supraventricular impulse formation

- **Atrial premature complexes** -premature atrial impulse originating from ectopic arterial site other than SA node. seen in dogs and cat with atrial enlargement, electrolyte disturbances, drug's reaction, congenital heart disease and neoplasia a normal variation in older animals.
- **Premature p wave -** QRS complexes are normal unless the p wave is so immature that it overlaps to varying degrees

Disturbance of ventricular impulse formation

- **Ventricular premature contractions (VPC**). -Ventricular pre mature complexes are premature depolarization generated by an ectopic focus located in the ventricular tissue. (Cote and Ettinger, 2005). ECG Findings the QRS complexes are usually wide and bizarre. Artifacts
- **Muscle tremor artifact** -Movement artifact, Electrical interference.
- **Electrical alternans -**Alternation in the size of the QRS amplitude that occurs nearly every other beat.
- **Atrial fibrillations-**Normal QRS morphology. There are no consistent and recognizable P waves preceding the QRS complex. Ventricular heart rate is rapid and irregularly irregular.
- **Second degree av block-**Second-degree AV block occurs when conduction intermittently fails to pass through the AV node. The P wave is normal. occasional or a frequent failure (depending on severity) of conduction through the AV node resulting in the absence of a QRS complex
- **Complete (third) degree av block**- Complete AV block occurs when there is a persistent failure of the depolarization wave to be conducted through the AV node. P waves can be seen at a regular and fast rate, however, the QRS–T complexes are at a much slower rate and usually fairly regular. The P waves and QRS complexes occur independently of each other
- **Ventricular tachycardia**- Ventricular tachycardia is a series of three or more ventricular pre mature complexes occurring at a high rate. It may be continuous (sustained) or intermittent (paroxysmal) (Cote and Ettinger,2005).
- **Ventricular Fibrillation -** Depolarization waves occur chaotically and rapidly throughout the ventricles. Ventricular fibrillation (VF) is usually preceded by a very fast VT, typically with R-

on-T. ECG characteristics. the ECG shows coarse (larger) or fine (smaller) rapid, irregular and bizarre movement with no normal waves or complexed.

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THE SCIENCE WORLD
A Monthly e Magazine

ISSN:2583-2212
August, 2022; 2(8), 1411-1414

Popular Article

A review on African swine fever disease and its control

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https://doi.org/10.5281/zenodo.7013440

Abstract

African Swine Fever (ASF) is a highly contagious, fatal disease of domestic as well as wild boar transmitted through direct and indirect contacts, ingestion of contaminated feedstuffs and by biting of tick vectors. The disease does not infect humans (nonzoonotic) and any other livestock species. ASF was first detected in 1921 in Kenya and is generally prevalent and endemic in countries of sub-Saharan Africa, Europe and in some Caribbean countries. In India first outbreak of ASF was notified in January 2020 in the North Eastern States of Assam and Arunachal Pradesh. Due to the rapid spreading nature of the disease ASF Virus crosses the boundary and subsequently diseases have been also reported in different states of the country. This is the first time that ASF has been reported in India and hence all precautionary and emergency initiatives should be taken towards rapid containment of the disease with focus towards control and eradication within shortest possible period of time to avoid spread of the disease.

Introduction

African Swine Fever (ASF) is a highly infectious and contagious hemorrhagic viral disease of domestic/captive and feral/wild boar. All breeds, and all ages of pig species are affected. Mortality rate of ASF disease is 100%. No other livestock species are affected with ASF. ASF does not infect human (nonzoonotic) or other livestock species. Hence, it is not a public health risk. Due to the absence of vaccines with protective efficacy, ASF represents a serious threat to European countries and especially developing country like India.

Etiology

The causative agent of ASF belongs to genus Asfavirus of the family Asfaviridae. ASFV is enveloped Ds DNA virus is the only virus listed in the genus. . The virus can persist for up to a month in contaminated pig pens and pork products for over 4-1/2 months. The virus can transmit the disease through blood tissue, secretions and excretions of sick and dead animals. Disease can be transmitted by various modes such as direct transmission via contact with sick and healthy animals and indirect via by feeding of garbage containing ASF infected meat (uncooked pork products remain infectious for 3-6 months), fomites like premises, vehicles, equipments and clothes. Disease may spread through soft tick of genus *Ornithodoros* and acts as a biological vector.

Symptoms

Clinical symptoms of ASF varies according to different factors such as virulence of virus, route of exposure of disease, infectious dose, breed of swine affected and endemic status in the area. Clinical symptoms are divided into four forms. Incubation period in natural infection of disease varies from 4-19 days.

- Per-Acute form: In this form swine's having high fever (41-42^{0}c) and sudden death within 1-3 days of infection.
- Acute form: In this form of disease swine having high fever (40-42^{0}c) with reddening of the whole skin but mostly seen at skin of ear tip, tail, ventral aspects of chest and abdomen, and death of animal within 6-9 days (for highly virulent strain) and 11-15 days (for moderately virulent strain). Mortality rates up to 90-100%.
- Sub-Acute form: In this form swine showing slight fever, reddening of skin and death occur within 15-45 days. Mortality rates up to 30-70%.
- Chronic form: Pig shows irregular peaks of temperature, respiratory sings, necrosis in skin, ulcer, arthritis and joint swelling. Mortality rate less than 30%.

Diagnosis

Confirmatory diagnosis of disease has been done by identification and isolation of virus, detection of antigen in smears/section of tissue using fluorescent antibody test (FAT) and by PCR/real-time PCR. Serological test like ELISA, IFAT, IPT and Immunoblotting (IBT) are also used. Differential Diagnosis

from CSF and other related disease**,** the most important differential diagnosis of ASF is CSF also known as hog cholera, which is caused by *Pestivirus* in the Flaviviridae family. It is only way to distinguish between them by confirmatory laboratory diagnosis.

Prevention and Control

Prevention is the only measure as there is no effective vaccine for the disease. Since there is no vaccine available, reliable and early diagnosis of disease is essential for the implementation of strict sanitary and biosecurity control measures to prevent the spread of disease.

- Any suspected case/pathogenic gross lesions and clinical signs in dead and affected pigs, immediate isolation and restriction of movement should be followed.
- After declaration of disease epicenter and surveillance zone should be identified and immediate sealing and disinfection of affected animal shed and premises.
- The dead pigs should be disposed of by deep burial/incineration only and not thrown in rivers/canals/streams/water bodies. Carcass will destroy under official veterinary supervision with adopting all biosecurity measures.
- Thorough cleaning of farm/infected area with water and disinfection carried out with 2% sodium hypochlorite/sodium hydroxide or a detergent-based virucidal agent.
- Creating Public awareness among the animal health workers about the disease, trained them for early recognition, collection, and dispatches the suspected clinical samples, and intimation to the nearest dispensary are important steps towards the health care system.
- Area should be specified and demarcated into 3 specified zone Infected Zone (IZ) -1 km radius from epicenter/infected zone, Surveillance zone (SZ) - 10 km radius from infected zone/9 km outside the IZ, Disease free zone/non-infected area (FZ) – area outside the SZ. All pigs within IZ (1km of epicenter) will be humanely culled as soon as possible.
- Pig markets and abattoirs should strictly close and trade of pork meat and meat products is prohibited.
- Post operational protocol (POP) will be operational for 6 months after proper cleaning and disinfection operation. Fumigation once in every 15 days after completion of control operation, and pig is introduced into the area only after next 6 months after issue of Sanitization Certificate.

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THE SCIENCE WORLD
A Monthly e Magazine

ISSN:2583-2212
August, 2022; 2(8), 1448-1450

Popular Article

Rabbit as an alternative source of meat and wool production

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https://doi.org/10.5281/zenodo.7013446

Abstract

Rabbits are being reared in our country for a long time. The first record in the history of human's relationship with the rabbit was documented in early Roman times. 'Cuniculture' is the agricultural practice of breeding and raising domestic rabbits as livestock for their meat, fur or wool, cuniculture has been practiced since at least from 5th century. China has emerged as the lead country and has emerged as a major producer of rabbit meat, fur and angora wool in the world. Rabbit is regarded as one of the most useful among 'micro livestock' as considered by FAO and other organization. Rabbit rearing is popular for meat, fur, skin and wool production. Rabbit meat is wholesome; tasty which is rich in protein, certain minerals and vitamins but low in fat and cholesterol. In India North Eastern Hill region is one of the highest meat consuming zones, considering high demand of meat and meat products, farming of rabbit in this region has more scope as an alternative source of meat.

Introduction

Domestic/modern rabbit belongs to genus *Oryctolagus* (*Oryctolagus cuniculus*). Rabbit meat has great potential in meeting worlds need in general and developing countries in particular. The increasingly important role of rabbit, breeding/farming and its potential to improve food security and nutrition in developing countries has been increased by the FAO, because it is a low-cost proposition, the meat is nutritious and there is less social, cultural, and religious restriction against it. Broiler rabbits are reared for meat and fur and Angora rabbits for wool production.

Introduction

Domestic/modern rabbit belongs to genus *Oryctolagus* (*Oryctolagus cuniculus*). Rabbit meat has great potential in meeting worlds need in general and developing countries in particular. The increasingly important role of rabbit, breeding/farming and its potential to improve food security and nutrition in developing countries has been increased by the FAO, because it is a low-cost proposition, the meat is nutritious and there is less social, cultural, and religious restriction against it. Broiler rabbits are reared for meat and fur and Angora rabbits for wool production.

Breeds of Rabbit

There are 38 breeds of domestic rabbits recognized throughout the world, but only 8-10 breeds are available in India. For Indian weather White Giant, Grey Giant, Flemish Giant (largest domestic breed), New Zealand White (Best meat breed), New Zealand Red, California, Soviet and Dutch Chinchilla breeds are suitable.

House of Rabbit

Selection of site for construction of shed should be preferred as elevated area having easy drainage system and well protected from predators (dog, fox and cat) of rabbit. For rearing of rabbit generally deep litter and battery/cage systems are applied. To get maximum production, housing cost must be low, well ventilated, ideal temperature (10^0-25^0c) and knowledge on floor allowance is very important. Floor space requirement is depending according to different body weight of rabbits-up to 2 kg-0.04 m^2, 2-4 kg-0.28 m^2, 4-5 kg-0.37 m^2 and over 5.5 kg-0.46 m^2 floor space is required.

Benefits of Rabbit farming

There are many advantages of commercial farming in India. Bunnies are cute, small sized and soft therefore are a good source of meat.

- The initial investment cost for rabbit farming is low and gave quick return, just after 6 months of establishment of the farm. Small groups 40-50 in numbers can rear in the backyard of the house with kitchen waste and some grasses as feed.
- Rabbits are highly prolific, and give birth of 25-50 young ones (Kits) per year. The gestation periods of rabbits are 28-32 (average 30 days) days and selling age of rabbit is 90-100 days.

- Rabbit meat is widely popular meat throughout many different cultures of the world. Rabbit meat is rich in polyunsaturated fatty acids (PUFA) and comes under category of white meat, which is exceptionally lean, lower calories, lower fat, and higher protein and very palatable excellent quality. Rabbit meats can be processed at the age of around 12 weeks.
- Rabbits are best producer of wool (require 30% less digestible energy to produce 1 kg of wool as compared to sheep). Angora rabbit is used for production of one of the finest wools in the world. Rabbit's wool is 6-8 times warmer than contemporary sheep wool.
- They also provide good source of income from sale of Pelt, Kits, and manure other than meat. Rabbit skins are used for making fur garments, hats, and hand gloves etc.
- The use of Rabbits in biomedical research as animals is extensive now-a-days. Rabbit blood is one of the best medium for growing the AIDS virus.
- Rabbit manure used as organic manure, it is richer in Nitrogen, Phosphorous, Potassium which are remaining in proportion of (3.7: 1.3: 3.5) as compared to the cattle manure (2.9: 0.7: 2.1)

Conclusion

Rabbits are highly prolific, low body size, rapid growth rate, short gestation period, early maturity, high genetic potential, efficient feed and land utilization, ability to utilize forage and fibrous agricultural byproducts. Therefore, it is considered that if scientific management and hygienic practices of rabbit farming are followed it can be established as a highly profitable business. In India, there has been a rising awareness in recent years as a broiler rabbit production act as an alternative means of alleviating food shortage.

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THE SCIENCE WORLD
A Monthly e Magazine

ISSN:2583-2212
August, 2022; 2(8), 1453-1458

Popular Article

Phage therapy: An alternate biomedicine against bacterial pathogens in aquaculture

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https://doi.org/10.5281/zenodo.7014724

Abstract

Aquaculture endows the rising tide of antimicrobial resistance among bacterial pathogens along with increasing incidences of bacterial disease outbreaks which calls for the urgent requirement of alternative anti-bacterial agents than antibiotics. One such promising treatment is the use of phage therapy in aquatic farming, which is re-gaining huge scientific attention since the past few decades and great bactericidal potential is reported by extensive *in vitro* and *in vivo* studies. Phage therapy holds potential as a relatively inexpensive and low environmental impact biocontrol approach. Therefore, we aim to document the important aspects of phage therapy including the advantages as well as possible drawbacks associated with their use. A logical selection of phages based on the outlined characteristics is necessary to meet requirements of a successful treatment and global acceptance.

Keywords: Bacteriophage, phage therapy, antimicrobial resistance, fish diseases, aquaculture

Introduction

The cultivation of different species of fish, shrimps, and crustaceans has made the aquaculture industry a major contributor to the economy and an important food source worldwide. Of the global production of aquatic animals i.e., 178 million tonnes (MT) in 2020, 49% was harvested in aquaculture, which further retrieved 61.8% from inland waters and 37.6% from marine waters (FAO, 2020). Total aquaculture production of 88 MT in 2020 was up from 85.2 MT in 2019 and 82.5 MT in 2018. The total first sale value of the global production was estimated at USD 265 billion for aquaculture (FAO, 2022). In India, the fish production has increased from 8.67 MMT in FY 2011-12 to 14.73 MMT in 2021-22 (GOI, 2021-22). However, along with great development in this industry, from disease management practices to quality production methods, there has been a surge in the infectious diseases accompanied by the emergence and re-emergence of multidrug-resistant MDR bacterial pathogens, which limits the further intensification and causes severe economic loss. According to estimates, 34% of infections are caused by bacteria (Lafferty et al., 2019).

Table: Nota

Bacterial pathogen	Disease
Aeromonas spp.	Furunculosis and motile aeromonas septicaemia
Edwardsiella spp.,	*Edwardsiella* septicaemia
Flavobacterium spp.,	Columnaris, rainbow trout fry syndrome, and bacterial cold-water disease
Lactococcus spp.,	Lactococcosis, hyperacute, and haemorrhagic septicaemia
Pseudomonas spp.,	Red skin disease
Streptococcus spp.,	Haemorrhagic septicaemia
Vibrio spp.	Luminous vibriosis

These bacterial causative agents may also be responsible for human diseases transmitted from fish used as food or through the handling of culture systems. The major disease protection mechanism of aquaculture farming i.e., administration of antibiotics as prophylactic (as well as growth promoters) and therapeutic agents, due to their extensive use, has resulted in the selection, prevalence, and spread of antibiotic-resistant bacteria. The selection pressure is further intensified by a disturbed pathogen-host-environment, large-scale production facilities, and high-density cultivation conditions. Considering growing global concerns about the marked antibiotic resistance genes, antibiotic-resistant bacteria, and demand for consumable products free of chemical residues, also, regarding the "one health concept" of Govt. of India, there is an urgent need to look for more natural and environment-friendly approaches for prevention and control of fish bacterial diseases in aquaculture.

1. Bacteriophages: the nano-medicines

Among several biocontrol strategies, one noteworthy biomedicine is the use of bacteriophages (phages), which are the natural viral predators of bacteria and obligate intracellular parasites (Abedon, 2009). Bacteriophages are the most abundant candidates in the ecosystem, widespread in every possible habitat ranging from the depth of oceans to the soil, the water we drink, and the food we eat, with total numbers estimated to be more than 10^{30}. The concept of phage therapy was introduced in the early 1900s, but the studies were largely discontinued due to a surge in active interest in antibiotics but now the research concerns in phage therapy have regrown owing to several advantages over antibiotics and other antibacterial strategies.

Bacteriophages are highly host specific through ligand-receptor interactions which limits

their spectrum of activity and prevents unwanted damage to the normal healthy microflora of the host. They multiply only if a specific host is available, otherwise are degraded in the environment itself. Phages deploy two mechanisms for their replication- lytic cycle (virulent phage) or lysogenic cycle (temperate phage). While virulent phages infect, multiply and cause "lysis" of the host bacterial cells, temperate phages do not immediately kill the cell and establish a permanent infection in the host cell by incorporating part of their genome into that of the host cell and multiplying with the process of host cell division. The lytic action releases them free to invade other susceptible bacteria in the surroundings i.e., single dose potential, which requires no booster dosage and is an auto replicative mode of action, unlike vaccines. To date, bacteriophages have been employed as novel therapeutic and biosensing tools and find various applications in biotechnology and medical science such as quick bacterial detection and disease diagnosis (phage typing), disease prophylaxis (phage vaccine), treatment (phage therapy), and biocontrol agents. Whole phage virions, as well as phage derived products such as endolysins can be explored as potent bactericidal agents. In aquaculture, phages are well known for long to selectively inhibit fish pathogens and reduce fish mortality.

Advantages of phage therapy

- No/minimal disruption of the normal host microflora
- Targets AMR strains and able to eradicate biofilms
- Stimulation of host immune response
- Auto-dosing, able to multiply in *in vivo* conditions
- Abundantly present in the environment, easy detection protocols and inexpensive isolation
- No known inherent toxicity to humans, plants, animals and environment
- Lacks cross-reactivity with antimicrobial agents

Challenges for phage therapy

- Narrow host range; poorly applicable to treat systemic diseases
- Phage resistance development; horizontal gene transfer; difficulty of lifecycle determination
- Production of exotoxins by some phages
- Clearance of phages from the organism by the immune system
- Requirement of an effective phage formulation for targeted phage delivery

- Possible sensitivity to various physico-chemical parameters resulting in loss of phage viability
- Lack of standardized regulatory guidelines for phage licensing and approval for use

2. Phage-preparation formulations and mode of phage administration

Essentially, one should take into account variables like the titre of bacteriophages, timing of phage administration, availability of a bacterial host, their stability, uniqueness of biological systems, and phage kinetics among others, when planning phage therapy or phage-based prophylaxis in aquaculture.

Phage delivery methods in aquaculture include injection, bath immersion, feed formulation, and topically applied phages with varying levels of success (Gon Choudhury *et al*., 2017). The type of disease and the stage of infection progression have a significant impact on the process. Additionally, an appropriate selection of phages includes aspects such as their strictly lytic nature, toxin free metabolism, capacity to survive in the stomach or cross the epithelial barrier. Low pH levels in the fish stomach environment, where the pH ranges from 2 to 7, may greatly reduce the action of phages during therapy.

3. Phage sensitivity to environmental variables

Although it is not difficult to discover new bacteriophages in the environment, their stability poses a considerable obstacle to their use in commercial products. The solution's composition (the presence or absence of specific ions), production process variables (temperature, pressure), or the environment's pH can all have an impact on the activity or native structure or adequate stability of bacteriophages. This could, for instance, change how the phage tail is assembled and affect how well it can connect to host receptors, or it could even completely destroy the bacteriophage structure. The salt concentration is another element crucial for phage stability in aquaculture water. Some bacteriophages are said to require low salt concentrations for the infection process since high amounts may cause osmotic shock, which would render the bacteriophages inactive. Using best practices makes it easy to extract and multiply phages, and sequencing in combination with cutting-edge bioinformatics techniques makes it quick to choose viruses that may be able to combat bacterial diseases.

4. Phage resistance mechanisms and other safety elements

The appearance of bacterial mutants that are insensitive to bacteriophages, on the other hand, is one of the challenges faced by phage therapy. Nevertheless, phage-resistant bacteria are not resistant to other phages with a comparable target range, and the likelihood for bacteria to develop resistance is approximately ten times slower than in the case of antibiotics. Because establishing resistance to more than one phage would result in a higher fitness cost for the bacteria, the use of bacteriophage cocktails or mixtures of bacteriophages with other antimicrobials appears to be a successful method to prevent bacterial resistance. The possibility of horizontal gene transfer during the processes of conjugation, transformation, or transduction (general/specialized) should be taken into account as another crucial safety factor while designing phage therapy.

5. Host pharmacokinetics, immune response and removal from the body

It is well known that phages cause the body's immune system to respond by triggering both specific and general immunological reactions resulting in fast clearance from the body organs. The effectors include most importantly the phagocytes, lymphocytes and antibodies among others which checks the virus from targeting the bacteria. However, it is also important to note that because lower vertebrates are thought to be resistant to endotoxic shock, no negative side effects have been reported to date when the phage therapy has been used in aquaculture. Studying each case and selecting the method of delivery, dose, buffers, and period of exposure to phages with care are some potential answers to the immune response problem. To keep the phages unaltered in the system they could be microencapsulated, protective agents could be used, or the right buffers might be used, among other options. Another concept involves searching for phage mutants (using genetic or chemical techniques), with reduced immunogenicity of surface proteins to make phages evade the host immune system and use of phage cocktails to enable phage survival even in presence to antibody-mediated neutralization.

6. Regulatory approvals and future perspectives

Overall, bacteriophages appear to be a good option in a future pool of antimicrobials due to unique properties. The current regulatory system is the impediment, which necessitates a new analysis for each case and largely restricts the widespread use of phage therapy. Phage cocktail registration is highly challenging because, in the majority of nations, phages could only be registered individually. Few recognized phage preparations exist currently for aquaculture such as

BAFADOR® (against *Aeromonas hydrophila* and *Pseudomonas fluorescens*). The biggest barrier to the widespread acceptance of phage cocktails is still their safety, thus additional research is required in this area, particularly the issues of gene transfer and the environmental impact of phages which may lead to unintended consequences. A better understanding of the fish immune system, phage-host interactions, collaboration with high-throughput technologies, and comprehensive food safety regulations are required altogether to design an adequate phage therapy strategy for application in aquatic food production systems.

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THE SCIENCE WORLD
A Monthly e Magazine

ISSN:2583-2212
August, 2022; 2(8), 1459-1462

Popular Article

Challenges in the Eradication of FMD

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https://doi.org/10.5281/zenodo.7014796

Abstract

The foot-and-mouth disease virus has a wide host range, seven serotypes, and over 100 serosubtypes, a high proportion of genetic variation, and significant antigenic changes. Cross protection is not present in this serotype. Additionally, only a limited level of cross protection between various subtypes within the same serotype is reported. Failure to vaccinate, a break in herd immunity, FMDV persistence in recovered animals, maternally derived antibody inhibition, and a short duration of protective immunity are all obstacles to FMD eradication.

Keywords: Carrier, FMD, Herd immunity, Serotype, Vaccine

Introduction

Foot and mouth disease (FMD) is a highly contagious disease that affects livestock and is caused by the genus Aphthovirus. It has a significant detrimental impact on farmers as well as the national economy. FMDV (family Picornaviride; genus Aphthoviridae) consists of seven immunologically unique serotypes: A, O, C, Asia 1, SAT 1, SAT 2, and SAT 3. India currently has a high prevalence of the serotypes O, A, and Asia 1. Serotype C has never been spotted in India since 1995, whereas SAT serotypes have not been found. Serotype O is most frequently responsible for outbreaks in countries in Southern Asia, followed by serotypes A and Asia 1. FMD is a persistent threat to India's 192.4 million cattle, causing annual losses of between 14,000 and 20,000 crores. Chemically inactivated vaccinations are more expensive to employ, which is a significant issue in developing nations. Additionally, using chemically weakened or killed vaccines does not tackle the problem of disease reservoirs in wild animals. India is currently on the FAO/OIE progressive control pathway at Stage 3 (PCP).

Problem in FMD Eradication

1. Failure to Vaccinate:

Due to administrative or technological reasons, a sizable segment of the populace is still unvaccinated despite vaccination initiatives. Lack of vaccination can occur for a number of reasons, such as a lack of vaccine availability, poor shipment of vaccines (a breach in the cold chain), a lack of skilled employees for vaccination, or a few animal owners' anti-vaccine attitudes.

2. Vaccination Failure:

After receiving recommended vaccination, if animal show clinical signs of FMD referred as vaccination failure. Even though vaccination failure is a rare occurrence. Following are the possible reason of vaccination failure.

a. Matching of Vaccine Strain with Circulating Virus:

To confer protective immunity against all strains of virus and understand the epidemiology of disease, vaccine strains should be antigenically close to circulating viruses. Variations in strain can prevent vaccination from providing protection against the divergent field strains because of the high pace of viral mutation. The vaccine strain must be antigenically related to the viruses that are currently circulating in order to provide protective protection.

b. Duration of Protective Immunity:

A primary round of immunization often provides protection for 4-6 months, depending on the vaccine's potency. Animals are therefore re-vaccinated based on the epidemiological state of the nation. It has been shown in India that rapid antibody degradation in immunized animals, particularly against serotype O, might result in a breach in herd immunity with an infection window at 5 to 6 months after immunization.

c. Break in the Herd Immunity:

When a substantial portion of a population develops immunity to an infection, herd immunity enables indirect protection from infectious disease, hence giving some level of protection for individual animals who are not immune. If we are unable to re-vaccinate susceptible animals after 4-6 months due to short-duration immunity, that means we are providing a window period for opportunistic pathogens. For the identification of low levels of herd immunity, we can use post-vaccination sero-monitoring of that area. The two key elements in achieving the appropriate degree of herd immunity towards FMD in the field are vaccine efficacy and vaccination coverage. During a vaccination drive, calves less than 4 months old and pregnant animals in the third trimester are not immunized. A decline in herd immunity could result in the dissemination of the virus infection due to the significantly longer FMD carrier status (>8 months) and the short duration of vaccination protection.

Gap Between an Ideal and a Conventional FMD Vaccine

S.No.	Feature	Ideal Vaccine	Traditional FMD Vaccine (Inactivated Vaccine)
1.	Long-lasting immunity	Yes	No, The inactivated vaccine provides only 4-6 months of protection.
2.	Sterile immunity	Yes	No, Only prevent from clinical infections
3.	Carrier status	No	Yes, animal become carrier after vaccination also
4.	Maintenance of the cold chain	No	Yes, Thermostability is an issue in the FMD vaccine
5.	Differentiated infected from vaccinated animal (DIVA)	Yes	Non-structural protein may be present in vaccine because purification is sometimes incomplete.
6.	Requirement of multiple doses	No	Yes, due to the short duration of immunity
7.	Multivalent and protects against serotypes, even subserotypes	Yes	No, lack of cross protection
7.	High level biosecurity is required for the formulation of vaccines	No	Yes, because due to handling of live virus
8.	Interference with maternal-derived antibody	No	Yes, young calves hamper vaccine efficacy due to the presence of maternal antibodies
9.	Safe	Yes	Vaccine may cause outbreaks due to incomplete inactivation
10.	Rapid onset of immune response	Yes	No, it will take time

d. FMDV Persistence in Recovered Animals:

Animals are regarded as FMDV carriers if they have shed the virus in oropharyngeal fluid for longer than 28 days following infection. In endemic situations with vaccination, the detection of antibodies against FMDV structural and non-structural proteins makes little sense because the serological profiles of carriers and infected animals are identical. Even on farms where animals have received vaccinations, a small fraction of animals may still be carriers, able to release FMDV into the surroundings

despite showing no signs of the disease.

e. Impaired Immune Response to Vaccine:

Animal species differ from one another and within their own families in their immunological reactions to inactivated FMD vaccinations, which could be attributed to a number of causes. It is challenging to design an appropriate laboratory model for the assessment of potency because various animals exhibit antibody diversification in fundamentally different ways.

f. Virus Circulation in Other Ruminant Species:

The FMDCP programme targets only cattle and buffalo, but other ruminants like sheep and goats are randomly vaccinated. Swine are not vaccinated under this plan, but swine can amplify the virus to a large extent.

Conclusions

The fight against FMD in India needs to be intensified in order to control and eradicate it. There are remarkable tales about the management and ultimate removal of FMD in Latin American and European nations by using inactivated vaccines. It was apparent that before they could be put into practise, the FMD control rules introduced in European nations needed to be altered to fit the circumstances in India. India's large ruminant population complicates the epidemiology of FMD. The majority of outbreaks are attributed primarily to a failure to vaccinate. To prevent financial losses, the Indian government launched the FMD Control Programme (FMD-CP). Under this plan, every cow and buffalo must receive two doses of the trivalent FMD vaccine each year. FMD has a wide host range, but this plan only includes cows and buffalo, so there is a good chance of breaking herd immunity.

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THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
August, 2022; 2(8), 1467-1471

Review Article

Chimeric Antigen Receptor T-cell Therapy (CAR T)

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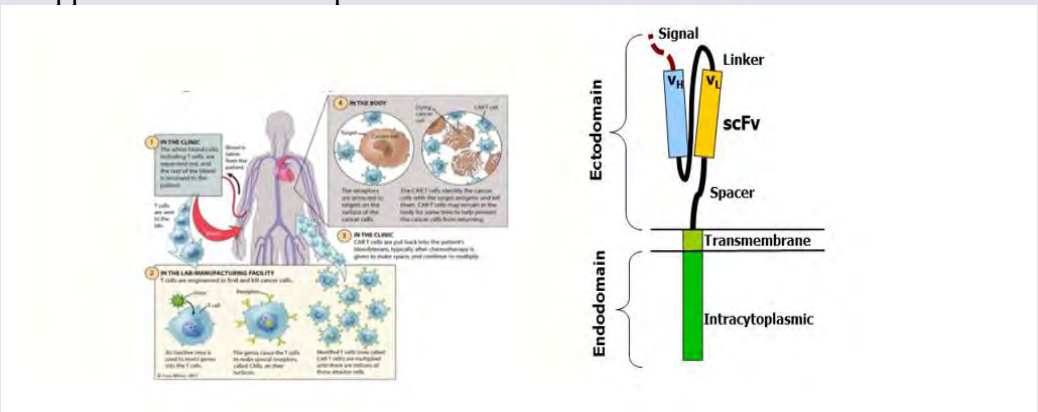
https://doi.org/10.5281/zenodo.7015559

Introduction

This is an adoptive T-cell therapy which uses engineered T-cell. In which they are obtain from a patient's immune system by its own to attack cancer cells through targeting proteins expressed on the cellular membrane, that process involves obtaining T-cells via a leukapheresis procedure. These cells are sent to a centralized manufacturing facility where they are genetically modified to produce specific chimeric antigen receptors and expanded in a cell culture. This process may take up to few weeks. This product is then returned to the treating facility and re-infused into the patient recovery. **(Srivastava & Riddell, 2018)** Chimeric antigen receptor T-cell therapy is used to treat certain blood cancers, and still being studied in the treatment of other types of cancer. This is also called as CAR-T Immunotherapy. The first CAR T cell therapy was approved by FDA in 2017, and there are now 6 approved CAR T therapies.



Chimeric antigen receptor structure-Chimeric antigen receptors are composed of four regions

- Antigen recognition domain
- Extracellular hinge region
- Transmembrane domain
- Intracellular T cell signalling domain.

Chimeric antigen receptors combine many facets of normal T cell activates a link between an extracellular antigen recognition domain to an intracellular signalling domain.

Immunotherapy

Immune cells or antibodies can be produced in the laboratory under tightly controlled conditions and then given to patients for the treatment of cancer.
Lymphocytes, a subtype of white blood cells- There are three types of lymphocytes

1. B lymphocytes (B cells) -for fight infection.
2. T lymphocytes (T cells) -including helping B lymphocytes to make antibodies to fight infection, and directly killing infected cells in the body.
3. Natural killer cells - attack infected cells and eliminate viruses.

- For treatment that utilizes the body's own immune system to fight cancer.
- This improves the body's ability to detect and kill cancer cells.
- This involves immune cells or antibodies can recognize and kill cancer cells.

Chimeric antigen receptors are the receptor proteins that have been engineered to give new ability to target a specific antigen to the T cells. The receptors are chimeric because they have ability to combine with both antigen-binding and T cell activating functions into a single receptor.

Procedure for CAR-T Cells Development: -

CAR T-cells are generally produced within 10 days to three weeks of the ex vivo culture. Mfg. of CAR T-cells as investigators seeks to encode CARs into T-cells that preserve the functional capacity of T memory stem cells.

- T cells are reengineered in a laboratory, T cells are sent to a lab. or a drug mfg. facility for the modify to genetically engineered, to produce chimeric antigen receptors on the surface of the cells.
- After that, the T cells are known as "chimeric antigen receptor (CAR) T cells." that allows the T cells to recognize an antigen on targeted tumor cells.
- The reengineered CAR T cells are then multiplied, at the research center, the CAR T cells are thawed and then infused into the patient. Many patients are given a brief course of one or more chemotherapy agents, called "lymphodepletion," where the "attacker" cells that will recognize, and attack, cells that have the targeted antigen on their surface.
- The CAR T cells may help guard against recurrence. CAR T cells may eradicate all of the cancer cells and may remain in the body months after the infusion; the therapy has resulted in long-term remissions for some types of blood cancer.

- After the infusion of CAR T cells into a patient, they act as a "living drug" against cancer cells. When contact with their targeted antigen on a cell, CAR T cells bind to particular target and become activated then proliferate and become cytotoxic.

- CAR T cells destroy cells through stimulated cell proliferation, cytotoxicity and by causing the increased secretion of factors which affect other cells such as cytokines, interleukins and growth factors.

❖ Contraindications

The following are considered contraindications to CAR T-cell therapy regardless of the product: -

- Pregnancy
- Members receiving immunosuppressive therapy for an autoimmune disorder.
- Any active, uncontrolled infection.
- Uncontrolled Human Immunodeficiency Virus (HIV) infection.
- Active hepatitis B or hepatitis C infection for lymphomas.
- Active hepatitis B or hepatitis C or CMV infection for multiple myeloma.
- Hepatitis B or C infection.
- Active graft vs. host disease in members with a history of allogeneic hematopoietic stem cell transplant.
- Primary central nervous system lymphoma.
- Solid tumors.

FDA approved T-cell (CAR) therapies: -

Generic Name	Brand Name	Target Antigen	Targeted Disease
Tisagenlecleucel	Kymriah	CD19	B-cell acute lymphoblastic leukemia (ALL)
			B-cell non-Hodgkin lymphoma (NHL)
Axicabtagene ciloleucel	Yescarta	CD19	B-cell non-Hodgkin lymphoma (NHL)
			Follicular lymphoma
Brexucabtagene autoleucel	Tecartus	CD19	Mantle cell lymphoma (MCL)
			B-cell acute lymphoblastic leukemia (ALL)
Lisocabtagene maraleucel	Breyanzi	CD19	B-cell non-Hodgkin lymphoma (NHL)
Idecabtagene vicleucel	Abecma	BCMA	Multiple myeloma
Ciltacabtagene autoleucel	Carvykti	BCMA	Multiple myeloma

Clinical Evaluation of CAR T Immunotherapy for Solid Tumor Markers: -

CAR T-cells have been evaluated for the treatment of a various solid tumors. The proportions of patient's response with a measurable objective in these trials are variable, major hurdle in implementing CAR T-cell therapy against solid tumors is target selection. CAR molecule can engage in two separate TAAs (tumor-associated antigens) can also be used to overcome antigen escape. CAR T-cells targeting fibroblast activation protein (FAP- alpha) which is expressed on the surface of cancer associated fibroblasts have shown efficacy in controlling tumor growth. FAP+ stromal cells also play important roles in the periphery, off-tumor targeting of these populations by CAR T-cells results in cachexia and hematological toxicities in murine models, raising potential concern over FAP as a target. The CAR T-cell therapy is emerging as a powerful therapy to be incorporated into mainstream oncologic treatment very soon, the optimal conditioning for CAR T-cell therapy to delineate optimal combinatorial strategies to improve the therapeutic potential of CAR T-cells. This identifies the active "ingredients" of the CAR T-cell product. Thus, T cell therapy undoubtedly marks a new era in cancer and the beginning of personalized cell therapy with targeted specifications.

Various side effects of CAR T-cell therapies: -

1. CAR T-cell therapies can cause severe side effects like other cancer therapy, One of the most frequent and serious side effects is cytokine release syndrome (CRS).
2. It can also cause dangerously high fevers and precipitous drops in blood pressure, in some cases, severe CRS can be fatal.
3. The other side effects of particular concern with these therapies are neurologic effects, including severe confusion, seizure-like activity, and impaired speech.
4. **Macrophage Activation Syndrome (MAS),** this one is closely associated with severe CRS. It is a condition caused by the excessive activation and multiplication of T cells and macrophages.
5. **Tumor Lysis Syndrome (TLS) is the** side effect of CAR T-cell therapy in which a group of metabolic complications can occur due to the breakdown of dying cells at the onset of toxic cancer treatments.
6. CAR T-cell therapy targeting antigens found on the surface of B cells not only destroys cancerous B cells along with normal B cells that cause **B-Cell Aplasia.**
7. Other general side effects can include:
   - Tremors, Headaches, Loss of balance, Trouble speaking, Seizures.

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THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
August, 2022; 2(8), 1472-1475

Popular Article

Drug Safety Matters: Pharmacovigilance- Concept and Future

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https://doi.org/10.5281/zenodo.7016647

Abstract

Medicines and vaccines are of utmost importance as they form core of nation healthcare system. Deadly incidents in the past like thalidomide tragedy in 1950, use of lash lure mascara, ethylene glycol poisoning in the children necessitated and high lightened the importance of safety of medicines and vaccines. Branch dealing with safety of drugs is known as pharmacovigilance and is a rigorous process throughout the life cycle of drug. Intrinsic limitation up to phase III of drug discovery process, strongly emphasizes the necessity of pharmacovigilance. Present article tries to highlight key aspect of safety process during drug development and its future, and will help drug prescribers and users to a certain extent about efficacious and safe use of drugs in day-to-day life.

Introduction

Medicines and vaccines are the core of healthcare system and have transformed our lives by prevention and treatment of diseases. In addition to their benefits, medicinal products may also have side effects, some of which may be undesirable and / or unexpected (Who.int). Medicines safety is of utmost importance and its monitoring is a continuous and dynamic process throughout all the phases of the life cycle of a drug (Trifirò and Crisafulli, 2022). Deadly incidents in the past like thalidomide tragedy in 1950, use of lash lure mascara, ethylene glycol poisoning in the children due to Elixir Sulphanilamide paved the way for assessment of safely of chemical before their direct authorization for use (National Research Council (US) Committee, 2004). The branch dealing with this matter is known as "pharmacovigilance''. Pharmacovigilance is the science and activities relating to the detection, assessment, understanding and prevention of adverse effects or any other medicine/vaccine related problem (Who.int). Interindividual variations accounting for variation in drug response and to the adverse effect, makes this science interesting, as when it comes to global pharmacovigilance, there is rarely a one-size-fits-all. Overall safety matters related to the drug are therefore assessed at various phases of drug development process.

The overall drug development process occurs in five different stages viz., discovery and development, preclinical research, clinical research, regulatory authority reviews, and finally post marketing safety studies (FDA, 2018). Although, all medicines and vaccines undergo rigorous testing for safety and efficacy through clinical trials before they are authorized for use, these trials were conducted in a relatively small number of selected individuals for a short period of time (Who.int). So, a true picture of drug including its side effects is evident only when these products were used by a heterogenous population, including people with other concurrent diseases, and over a long period of time. This article therefore tries to highlight key aspect of safety process followed during drug development and its future, and will help to drug prescribers and users to a certain extent about efficacious and safe use of drugs in day-to-day life.

Safety Evaluation of Drug in Drug Development Process

After target identification and validation, the drug safety was assessed in pre-clinical studies, where the primary goal of safety evaluation is the identification of a safe dose safety parameters in humans for clinical monitoring (Trifirò and Crisafulli, 2022). In line with this, recently in May, 2022 FDA has made a new initiative termed "Project Optimus" instead of earlier maximum tolerated dose approach employed for cytotoxic chemotherapeutics in order to highlight the importance of characterizing the dose and schedule of the anti-cancer drugs, to maximize efficacy and safety (FDA, 2022). Preclinical safety studies were done using two different animal species, with animals receiving maximum tolerated dose (MTD) of the new drug for 30 or 90 days (National Research Council (US) Committee, 2004). Careful assessment of animals was then done throughout the study to check any side effects. After the study period, toxicity potential of drug was then assessed by conducting post mortem examination if any. All these procedures were carried out as per guidelines laid by FDA or various regulatory authorities.

After finalizing dose drug enters into the clinical phase, consisting of four phases. Phase I studies are carried out in healthy human volunteers to estimate the tolerability of the dose range expected to be needed for later clinical studies. Phase II studies are done in patients with a disease or condition of interest to find suitable dose range. Phase III clinical trials are large multicenter trials involving number of patients with an emphasis on assessment of drug's effectiveness and to continue to monitor for any side effects. Till phase III, drug remains in the premarket phase and despite very rigorous and thorough nature of safely evaluation process, pre-marketing clinical trials will not be in position to extensively evaluate drug safety profile due to intrinsic limitations involving limited number of subjects, confounding the overall results of the study (Trifirò and Crisafulli, 2022).

The next penultimate phase is phase IV (post-marketing surveillance), wherein drug actually enters in the market. In this phase rigorous and exhaustive safety evaluation of drug profile is possible due to exposure of drug to a heterogenous population. This safety profile was analyzed by drug maker and by FDA for the presence of side effects which are likely to arise on account of interindividual variation in the population (National Research Council (US) Committee, 2004). Conclusively phase IV of trial plays an important role for better defining drugs' safety profile in real-world setting, which helps to further strengthen results of pre-

marketing studies, thereby filling the evidence gap.

Importance of Pharmacovigilance

Thalidomide tragedy in 1950, use of lash lure mascara, ethylene glycol poisoning in the children due to Elixir sulphanilamide created a need for assessment of safely of chemical before their direct authorization for use (National Research Council (US) Committee, 2004). Despite this, in the last two year, with first wave of COVID-19 pandemic further highlights the importance of pharmacovigilance wherein absence of vaccines and drugs for treatment/prevention of COVID-19, lead to repurposing of several drugs. Various drugs like hydroxychloroquine, ivermectin and azithromycin has been off-label used for the treatment of COVID-19 patients, in the absence of scientific evidence (Sultana et al., 2020a). Risk associated with off label use of these drugs are the important step for pharmacovigilance monitoring. Elucidating further, azithromycin, a macrolide antibiotic that has been widely used, for the treatment of COVID-19 patients despite its proarrhythmogenic activity, led regulatory agencies to issue warnings against the use of this drug, unless in case of bacterial superinfection occurrence (Crisafulli et al., 2021). Global health emergencies like pandemic COVID-19 accelerated the process of drug approval, and of safety evaluation in post-marketing setting with an emphasis on patient safety. Besides this, role of communication between health care providers and patients in relation to appropriate use of medicines/vaccines, further supports and validate the role of pharmacovigilance as number of studies has reported accelerated inappropriate drug use associated with the risk of serious adverse reactions, the best example being the hydroxychloroquine (Sultana et al., 2020b).

Pharmacovigilance-Conclusion and Future Directions

Pharmacovigilance has played crucial role in the safety of medicines all of which at certain extent possess some risk. It has grown in the pharmaceutical industry as well as is recognized as a discipline. With emphasis on reporting of individual cases in the past (Talbot and Nilsson, 1998), we must be ready for the current and future challenges as far as safety and drug regulations are concerned. Medicinal side effects or associated risk can be minimized by the use of good quality, and efficacious medicines. Besides this, rational use of medicines, enhancing communication between the health professionals and the public and educate health professionals to understand the effectiveness or risk of medicines that they prescribe are important steps to take into account (Jeetu and Anusha, 2010). More stringent measures during drug development process and proper risk communication throughout the drug chain since its production to its ultimate use are necessary steps to undertake. In addition, consideration must be given to newer techniques like artificial intelligence, machine learning, use of digital therapeutics and creation of electronic healthcare data ((Trifirò and Crisafulli, 2022). This will offer opportunity for optimizing drug benefit-risk profile evaluation in real world setting. Advanced therapy medicinal products (European Medicines Agency, 2021) are based on genes, cells or tissue engineering is emerging discipline and encompasses personalized or precision medicine also warrant need for post marketing surveillance. In addition to drugs, other biologicals like vaccines may require special pharmacovigilance monitoring in recent years. Lastly, important consideration must be given to adverse effect occurring to nature on account of presence of pharmaceuticals in the environment, although a separate branch

called as “Eco pharmacovigilance” (Velo and Moretti, 2010) is dealing with all this aspect and is a very important issue now a days.

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THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
August, 2022; 2(8), 1474-1477

Popular Article

Functional benefits of Ghee

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Introduction

India ranked first in milk production in the world with per capita availability of milk is 225 grams per day in the year 2001- 2002 to increased 355 grams per day in the year 2016-17 (NDDB, 2018). In ancient time, ghee was produced far back as 1500 BC (Achaya, 1997). Ghee is considered as traditional Indian milk products. The market of ghee is about 37% in urban areas as well as about 21% in rural areas. Cow Ghee is recognized to be digested about 96% which is best as compared to all different types of vegetable and animal supply fats (Mahakalkar *et al*., 2014). Cow Ghee is also utilized in Ayurveda for different medical applications. Ayurveda medicine suggests different treatment protocols for different ailments using medicated ghee manufactured with different herbal extracts. Ghee is one of the highly nutritious, costlier and most acceptable ghee of fat on the Indian subcontinent, because of its high nutritional and sensory characteristics. In ghee preparation, the fermentation of milk to curd may or may not be performed to render fat from the medium. It can also be prepared directly by separating the cream form the milk followed by heat treatment by different methods. Desi ghee is generally manufactured for milk fat obtained from fermented milks whether from cow or buffalo in which curd has to be churned in the form of butter by heat clarification method to separate out fat from non-fat medium. Ghee is considered as an important cooking medium, because of its taste, pleasant flavour and also promotes good health. Ghee is nutritionally more reliable than the other oils or fats due to the fact of its content medium chain fatty acids, which are absorbed directly by the liver and burned to supply energy (Kumar *et al*., 2018). Ghee is highly shelf stable food due to presence of low moisture and also content natural antioxidants (den Berg, 1988). Ghee remains a important choice among households food in India as compared to the other fats or oil. It is popularly known by different brands like Gowardhan, Anik, Madhusudhan, Verka, Amul, Gopaljee, Nestle, Patanjali and Britannia in the market. However, ghee is essential for good health and consuming it beyond the individual limit may show detrimental health effects, because of ghee having cholesterol content and is also contains highly saturated fat.

Health benefits of ghee

Ghee and Ayurveda medicine has very closed relationship since thousands of years. According to Modern Ayurvedic health science, ghee is known by its various properties like ghee is a health booster, offers cooking benefits and is good for the mind and spirit. Ghee content various constituents of fat, phospholipids etc. So, it possesses various health benefits:

1. Ghee is considered as an ideal medium for deep frying because ghee has high smoke point at 250°C which is above the normal cooking temperatures of 180-200°C and also having higher than most of the vegetable oils (Bader, 2010; Deosarkar *et al*, 2016).
2. Ghee is not kept at refrigeration temp.; therefore, it is not spoiled easily. It is not to affect with a dairy or casein intolerance people. Ghee is made from butter but the milk solids and impurities have been removed, so most people who are lactose or casein intolerant have no issue to consume ghee.
3. It is rich in the fat-soluble vitamins A and E (Achaya, 1997) and it is also rich in vitamin K2 and CLA (Conjugated Linoleic Acid).
4. It is better source of essential fatty acids such as linolenic acid and arachidonic acid.
5. It possesses an antioxidant with anti-viral and anti-cancer properties (Dhiman *et al*, 1999, Dhiman *et al*., 2000).
6. Ghee is nutritionally rich to other fats because of its content medium chain fatty acids (MCFAs), which are absorbed directly by the liver. So, for athletes' ghee can be of consistent source of energy. Also, the energy from medium chain fatty acids can be used to burn other fats in the system and to lose weight (St-Onge and Jones, 2008: Nokasa *et al*, 2009). Ghee has the anti-obesity properties of these MCFAs contents.
7. Ghee contains a short chain fatty acid like butyric acid (Kumar *et al*, 2015), which is responsible to its distinct flavour and easy digestion. The intestinal bacteria are converting fibre into butyric acid and then use for energy and intestinal support (Maurice Bugaut, 1987).
8. A healthy body makes its own form of 'ghee' but we are aiding that greatly by consuming of ghee. People with unhealthy digestive tracts do not produce butyric acid and the adequate production of butyric acid supports the production of killer T cells in the gut so a strong immune system developed (Chang *et al*, 2014).
9. Ghee based formulations are well scripted in Ayurvedic system of medicine, it is used for wound healing purposes (Vure and Dorle, 2006).
10. It was also reported that when rats fed with diets containing greater than 2.5% of ghee showed lower levels of serum cholesterol as compared with rats fed diets containing groundnut oil (Matam *et al*, 2000).

11. Ayurvedic physicians have been using ghee enemas for centuries to decrease inflammation.
12. Ghee stimulates the secretion of gastric acid and it also possess the aiding in the digestive process.
13. In Ayurveda medicine, it is considered under most satvic foods, and also to promote positivity, growth and expansion of consciousness. The positive subtle effects of ghee come from the fact that it comes from cows.
14. Cows are domestic animal in most parts of the world, but these are special considered and holy in Hindu religion of India. So, the milk from cows contains the essence of all those energies, and ghee is the essence of the milk.
15. Ghee is considered as a suitable carrier for many herbs and spices with different medicinal properties, which are to be absorbed and transported to targeted areas of the body.
16. Daily consumption of ghee in an adequate amount, it imparts various health benefits like binds toxins, enhances complexion and glow of the face and body, a great rejuvenator for the eyes, increases physical and mental stamina etc.

Conclusion

Ghee is prepared from cow or buffalo milk. Cow Ghee is utilized in Ayurveda for various medical applications. Ghee fat has been considered superior to other fats mainly because of the presence of characteristic short chain fatty acids (SCFA), carrier of fat-soluble vitamins and essential fatty acids such as linolenic acid and arachidonic acid. Daily consumption of ghee in an adequate amount imparts various health benefits. Ghee is a fat-rich dairy product. So, natural antioxidants and other constituents such as phospholipids and protein residues play important role in preventing rancidity. Generally, synthetic antioxidants are also used in ghee to increase the shelf life for preventing oxidative deterioration. Ghee is one of the costlier dairy products; hence ghee manufacturing could be a profitable business for rural India. So, ghee is considered as most suitable fat rich product for health promoting.

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THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
August, 2022; 2(8), 1478-1481

Popular Article

Rapid and Emerging Technology for Antibiotic Susceptibility Testing

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https://doi.org/10.5281/zenodo.7029409

Abstract

Antimicrobial resistance (AMR) is a global problem resulting in a year-on-year increase in the incidence of drug resistant infections. AMR is expected to be responsible for 10 million deaths annually by 2050. The emergence and spread of antibiotic-resistant bacteria are aggravated by incorrect prescription and use of antibiotics. A core problem is that there is no sufficiently fast diagnostic test to guide correct antibiotic prescription at the point of care.

Introduction

Nowadays increasing emergence and spread of antibiotic-resistant bacteria, a key factor in correct treatment of infections is the ability to rapidly identify the antibiotic susceptibility profile of the infecting species to assure the use of an efficacious antibiotic and reduce the need for broad spectrum drugs. Phenotypic antibiotic susceptibility tests are typically based on the detection of differential bacterial growth with and without antibiotics in liquid cultures or on solid agar plates. In broth tests, detection is based on the change in OD, whereas the disk diffusion method is used on solid agar plates to identify inhibition zones. These methods are generally reliable for detecting resistance and determining the antibiotic concentration that prevents bacterial growth, making them predictive of the therapeutic utility of different antibiotics. However, because it typically takes 1–2 d to get a reliable readout, these methods fail to guide treatment in the early, often critical, stages of infection.

Genotypic ASTs are based on detection of a specific genetic marker (plasmids, genes, or mutations) associated with resistance phenotypes by using the common genetic tools (e.g., sequence-specific amplification by PCR, probe-mediated rolling circle amplification, or whole-genome sequencing). These tests are highly sensitive and can limit the detection time to what is needed to amplify selected DNA sequences to detectable levels, but they require detailed advance knowledge of which resistance markers to test for.

Limitations

If new resistance mechanisms arise, these would go undetected and result in false negatives. The presence of certain resistance genes/mutations does not necessarily translate into phenotypic resistance.

Microfluidic chip-based susceptibility testing

Antibiotic susceptibility testing is done in less than 30 minutes using direct single-cell imaging in the microfluidic chip. In this method, capture bacterial cells directly from samples with low bacterial counts (104 cfu/mL) using a custom-designed microfluidic chip and monitor their individual growth rates using microscopy. By averaging the growth rate response to an antibiotic over many individual cells, push the detection time to the biological response time of the bacteria.

Raman Micro spectrometry-based susceptibility testing

Raman micro spectroscopy has been proposed as a means to achieve antibiotic susceptibility testing. Raman micro spectrometry is a particularly attractive option. The microbial Raman information is known for long to provide identification information down to the strain level. More recently, it was used to probe the differences between resistant and susceptible phenotypes of microbial cell clusters in the presence of antimicrobials.

MALDI-TOF MS-based susceptibility testing

MALDI-TOF MS (Matrix- Assisted Laser Desorption Ionization-Time of Flight Mass Spectrometry) is an innovative tool that's has been recently integrated into the microbiology laboratory workflow as an easy to use, rapid, accurate, and cost-effective technique-with more specificity which has revolutionized bacterial identification in clinical microbiology laboratories. MALDI-TOF MS, introduced in 2000, is another sensitive method for bacterial identification. The newly developed MALDI Biotyper antibiotic susceptibility test rapid assay (MBT-ASTRA) is a more-straightforward and cost-effective modulation of MALDI-TOF MS used for both AST and MIC determination.

Table 1: Technologies for rapid phenotypic growth-based antimicrobial susceptibility testing

S. No.	Technology	Short description
1.	Disk-tube method	Growth-based method in liquid medium with visual evaluation of turbidity
2.	Colorimetric method utilizing a pH indicator	Bacterial growth is measured by using a medium containing a pH indicator (phenol red)
3.	Colorimetric method utilizing a redox indicator	Bacterial growth is detected by using a medium containing a redox indicator (resazurin)
4.	Microfluidic agarose channel system with microscopic single cell growth tracking	Bacteria immobilized in the agarose matrix in a microfluidic channel; the growth of single cells is monitored using microscopy
5.	Forward laser light scattering	Optical growth detection in a liquid sample by the laser scattering method
6.	Digital time lapse microscopy	Optical growth detection by serial imaging in a liquid sample
7.	Microbial cell mass measurement	High resolution mass measurement using microchannel cantilevers
8.	Real-time PCR	After an incubation in liquid medium, real-time PCR is used for quantification of DNA copies of either the 16SRNA genes or rpoB
9.	ATP-bioluminescence	Luciferin-luciferase assay produces light in the presence of ATP. The produced light is proportional to the bacterial ATP and, thus, to the microbial concentration
10.	Morphokinetic cellular analysis	Bacterial cells are immobilized on a surface, digital microscopy records microbial response to a single concentration of an antibiotic and software derives MIC values
11.	Flow cytometry	Assessment of drug-induced microbial lesions that lead to changes in morpho-functional parameters (e.g. membrane potential, cell size, amount of DNA)

Conclusions

Overall, the rapid antibiotic susceptibility testing approach shows utility for the rapid detection of antibiotic susceptibility across a range of clinically important pathogen–antibiotic combinations. The simplicity of the technique suggests that the method is suitable for a new generation of rapid tests for the clinical laboratory. Only affordable and easy-to-use rapid antibiotic susceptibility testing methods will have the chance to become widely accepted.

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THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
August, 2022; 2(8), 1482-1484

Monograph

Nerium Oleander poisoning in farm animals

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https://doi.org/10.5281/zenodo.7029456

Introduction

Nerium oleander (oleander, kaner, rose laurel) is a drought-tolerant, evergreen flowering shrub that belongs to the Dogbane family, *Apocynaceae*. It is frequently grown as an ornamental plant in gardens and parks as well as highway median divider or hedge around yards or orchards. Oleander is originally a Mediterranean and Asian plant and is widely distributed in the world, especially in tropical and subtropical regions. (Aslani, 2004). Two common oleanders are Nerium oleander (common oleander) and Thevetia peruviana (yellow oleander). All parts of the plant either fresh or dried are toxic to humans, animals and certain insects (Langford and Boor, 1996).

Red flowered varieties of oleander appear to be more toxic. A single leaf can be lethal to a child eating it, although mortality is generally very low in humans. The lethal dose of the green oleander leaves for cattle and horses has been found to be 0.005% of the animal's body weight. The minimum lethal dose of oleander for cattle was found to be 50 mg/kg body weight. Horses given 40 mg/kg body weight of green oleander leaves via nasogastric tube consistently developed severe gastrointestinal and cardiac toxicosis.

Mechanism of toxicity: -

Oleandrin and **nerine** are two very potent cardiac glycosides (cardenolides) found in all parts of the plant. Cardiac glycosides that act by inhibiting the cellular membrane sodium-potassium (Na+-K+ ATPase enzyme system) pump with resulting depletion of intracellular potassium and an increase in serum potassium. This results in progressive decrease in electrical conductivity through the heart causing irregular heart activity, and eventual complete block of cardiac activity, and death.

Clinical Signs: -

The clinical picture of oleander poisoning is characterized by polymorphous symptoms, whose onset and severity vary according to the number of active principles ingested (Galey *et. Al*.,1996). Indeed, we observed a rapid onset of symptoms within the first 24 h after the ingestion of the plant, followed by the death of the animal within 24 h, and death is due to ventricular fibrillation. The main clinical signs are related to disorders of the **cardiac, gastrointestinal, and nervous systems** (Ozdemir *et. Al*., 2011, Soto-Blanco *et. Al*., 2006).

- **The cardiac vascular sign:** alterations of the cardiac rhythm i.e., premature ventricular complexes and paroxysmal ventricular tachycardia with S-T segment slanting and followed by complete heart block.
- **The gastrointestinal tract sign:** involvement in ruminants results frequently in abdominal pain, atony and tympanism; however, diarrhea has been observed in acute accidental oleander poisoning in cattle as well as in other animal species (Galey *et. Al*., 1996, Aslani, 2004).
- **The nervous systems sign:** Confusion, dizziness, drowsiness, weakness, visual disturbances, mydriasis and convulsions are central nervous system manifestations of toxicity (Langford *et al.,* 1996).

Postmortem findings: -

- Microscopically, indications of hepatitis and nephrosis
- Hemorrhages on the gastric and intestinal mucosae, heart, gall bladder, meninges etc.
- Severe gastroenteritis.
- Generalized congestion.

Diagnosis: -

- Based on the history.
- Based on clinical Signs.
- PM lesions: reveals presence of obnoxious material/plant in the stomach/rumen.
- Lab diagnosis: detection of cardiac glycosides in urine or tissues.

Treatment: -

- There is no specific treatment for the poisoning.
- Administered a single dose of activated charcoal (5g/kg) to bind the toxin in the rumen and prevent further absorption, can be efficient in the early stages.
- Tachycardia can be treated by application of the adrenergic blocking drugs such as propranolol, which can be accompanied by atropine to reverse atrium-ventricular block. Other antiarrhythmic drugs include potassium chloride, procainamide, lidocaine, dipotassium EDTA and atropine sulphate.
- Complementary therapies include rehydration of animals suffering from diarrhoea and acidification of the rumen content.
- Elimination of ingested oleander from rumen can be obtained by rumenotomy.
- The digoxin specific antibodies must be given early in the course of poisoning to be effective for acute poisoning.
- Fluid for intravenous therapy should not contain calcium because this improves the action of cardiac glycosides (Cheeke, 1998; Knight and Walter, 2001).

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THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
August, 2022; 2(8), 1493-1494

Success Story

Soft tissue wound management using Platelets rich plasma

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https://doi.org/10.5281/zenodo.7037333

Platelet-rich plasma (PRP) is defined as a portion of the plasma fraction of autologous blood having a platelet concentration above baseline. PRP has received significant homage and growing attention in the fields of tissue engineering, wound healing, bone grafting, trauma surgery, and angiogenesis. PRP is an autologous concentration of platelets in concentrated plasma, which is extensively used to promote soft and hard tissue healing and to significantly reduce wound-healing time. The significance behind its use refers to the abundance of growth factors (GF) present in a well-prepared PRP concentrate. These GF enhance the quality of wound healing and reduce healing time by expediting tissue regeneration. GF are a form of biological mediators that have local and systemic effects. These factors are known to regulate cell migration, attachment, proliferation, differentiation, and promote extracellular matrix accumulation via binding to specific cell surface receptors. This receptor-ligand interaction has been identified as the underlying mechanism behind the regulatory process, which then triggers complex and specific molecular cascades. The presence of GF in high concentration in a PRP concentrate is directly responsible for increasing cell proliferation, higher collagen production, initiate angiogenesis, and inducing cell differentiation.

Concentration of platelets in PRP is approximately six times higher than platelets concentration in blood. Platelets release a large number of growth factors when they arrive at a site of tissue injury, which includes platelets include platelet-derived growth factor, transforming growth factor-β and clotting factor, platelet factor-4, interleukin-, platelet-derived angiogenesis factor, vascular endothelial growth factor, epidermal growth factor, epithelial cell growth factor, insulin like growth factor etc., which have both mitogenic and chemotactic properties. These growth factors aid healing by attracting un-differentiated cells in the newly formed matrix and triggering cell division. PRP decrease release of cytokine and also limit inflammation process. It interrelating through macrophages to promote tissue healing and regeneration. It promotes fresh capillary progression and hasten the epithelialization process in chronic wounds. Platelets in PRP also play a role in host defense mechanism at the wound site by producing signaling proteins that attract macrophages PRP also may contain a small number of leukocytes that synthesize interleukins as part of a non-specific immune response.

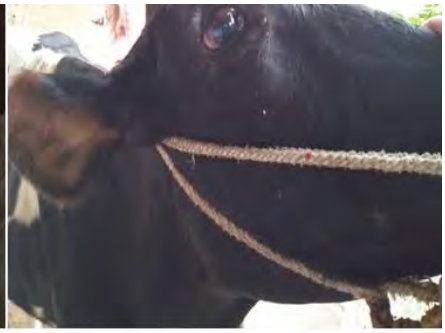
Use of antibiotic and anti-inflammatory for chronic wound is not very much effective but blood derived products are known to be very effective and safe options for chronic cases. This type of study is adequately convincing that use of platelet rich plasma is an efficacious medical treatment modality for chronic conjunctivitis.

Wound healing cases of cattle, goat, dog and horses presented to veterinary clinical complex was treated with PRP.

PRP was prepared by double centrifugation method. Ten ml blood was collected in vial containing sodium citrate anticoagulant, 0.5 ml was kept for platelets count and immediately centrifuge at 3000 rpm for 15 min. Plasma along with buffy coat, platelets and superficial erythrocyte was transfer to another tube and again centrifuge at 3000 rpm for 15 min. Plasma containing buffy coat and platelets i.e., PRP was isolated in another tube. PRP was activated by adding 1 M calcium chloride. Before activation, platelets were also counted in PRP. The autologous platelet rich plasma was applied locally on wound surface. All animal recovered fully without using any antibiotic and analgesics.

Chronic conjunctivitis before application of PRP

Application of PRP



Conjunctiva after PRP treatment

THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
August, 2022; 2(8), 1495-1497

Success Story

Successful treatment of clinical cases of Hip Dysplasia in dogs with uncultured autologous bone marrow mono nuclear cells and activated platelets.

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https://doi.org/10.5281/zenodo.7037352

Hip dysplasia (HD) is an inherited, non-congenital orthopedic disease with the highest incidence and heritability of up to 95% in the canine species that is particularly prevalent in large and giant breeds of dogs. It is characterized by a degenerative joint disease that can progressively trigger the development of osteoarthritis (OA) of the affected joints. It is characterized by articular cartilage lesions, bone remodeling with the presence of osteophytes, and inflammation in the hip joint. The most common symptom of OA is joint pain, and gait abnormalities, such as stiffness, the reduced height of the step, shortened stride length, bunny hopping, difficulty in rising, climbing stairs or jumping over obstacles. The condition is mainly noticed at the age of 4 months to 2 years of age and once it happened it is an ongoing process and situation aggravated with the advancement of age. The animal required treatment for the rest part of its life, sometimes a few dogs reluctant of taking regular oral medication, the major disadvantage of this treatment is, that it slows down the progression of diseases but there is no permanent cure.

The treatment aim is to reduce or eliminate pain, thereby improving or restoring limb function to normal. Two approaches to canine HD management have been described: conservative management and surgery. In dogs, one of the principal conservative therapeutic approaches involves oral administration of nutraceuticals, whose formulation is primarily composed of glucosamine and chondroitin sulfate together with the use of nonsteroids anti-inflammatory drugs (NSAIDs). However, prolonged use of NSAIDs can be associated with side effects, especially in the digestive system and kidneys. Bone marrow mononuclear cells and cultivated bone marrow stromal cells represent a phenotypically and functionally heterogeneous population of mesenchymal precursors and contribute to the physiological regeneration of bone.

It could be a valid alternative to the more invasive traditional techniques to correct large bone defects. Cartilage has limited capacity for regeneration, and when lesion is limited to the articular cartilage only and does not extend to the underlying bone, it fails to heal spontaneously leading to the osteoarthritis, lameness, and permanent disability. Intra-articular implantation of uncultured bone marrow derived nucleated cells

Platelet-rich plasma (PRP) is an autologous product that concentrates a large number of platelets in a small volume of plasma. PRP accelerates endothelial, epithelial, and epidermal regeneration, stimulates angiogenesis, enhances collagen synthesis, promotes soft tissue healing, decreases dermal scarring, enhances the hemostatic response to injury, and reverses the inhibition of wound healing caused by glucocorticoids. The high leukocyte concentration of PRP has an added antimicrobial effect and carries no risk of transmitting infectious disease. PRP is obtained following the centrifugation of whole blood, yielding a product highly concentrated with platelets. The α-granules within the concentrated platelet solution contain growth factors and proteins vital to the coagulation cascade which, upon activation, may aid in the regeneration of tissues. To combat the catabolic environment of joints affected by OA, PRP counteracts cartilage erosion by inhibiting the catabolic cytokines of IL-1β and TNF-α and by promoting factors associated with cartilage matrix synthesis including fibroblast growth factor, transforming growth factor-β (TGF-β), insulin-like growth factors and others cytokines.

Based on above existing problems of hip dysplasia and the role of uncultured bone marrow mono-nucleated cells (BMNCs) and activated platelets a total of ten clinical cases of dogs diagnosed for mild to moderate form of hip dysplasia were one time treated with a combination of (4.5 ± 0.07) x 10^6) autologous BMNCs and activated platelets mixed together and implanted under ultrasound guidance in the affected hip joint as therapy in canine hip dysplasia. The BMNCs were isolated in 5ml bone marrow isolated from the iliac crest and mono-nuclear cells were isolated from bone marrow by centrifuging on lymphocyte isolation density gradient media. This protocol for treatment was planned with the hypothesis that bone BMNCs contain mesenchymal stem cells and activated platelets have growth factors that may further help in the proliferation and differentiation of BMNCs cells implanted in the joint. So, one-time treatment of such conditions with cell therapy may be useful to overcome the complications related to conventional treatment. All treated cases were recovered completely and the last two years of follow-up, not showed any complications, further no supplementation and treatment related to hip dysplasia have been given to the animals.

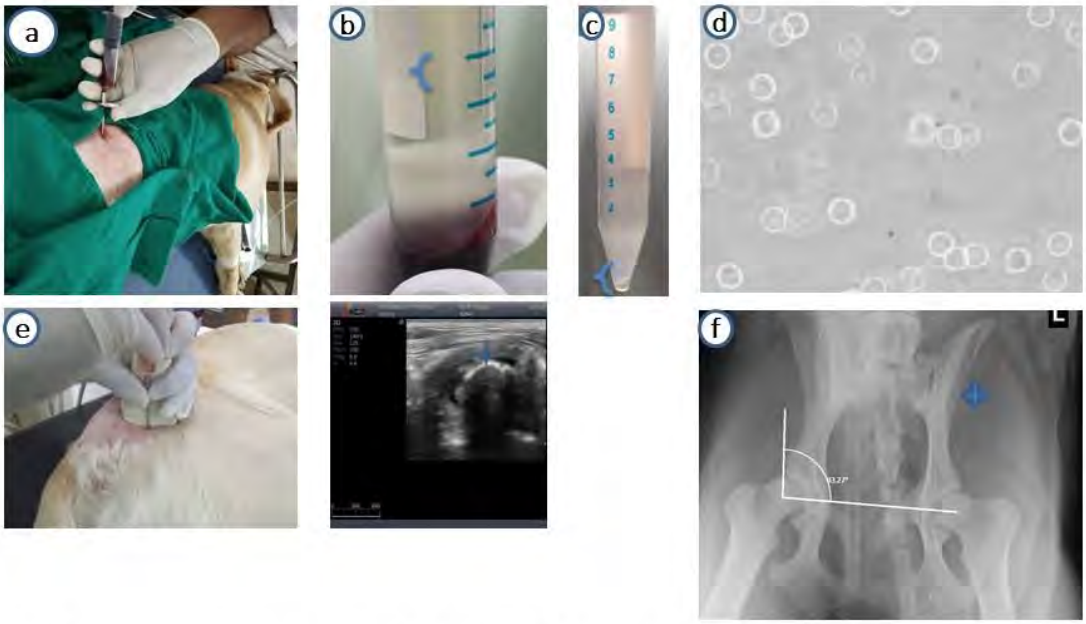

Fig. Bone marrow mono-nuclear cells (BMNCs) isolation (a) Bone marrow collection from iliac crest of a dog with Jamshidi biopsy needle, (b), Translucent ring showing BMNCs after centrifugation, (c) BMNCs pellets ready for implantation, (d) Isolated uncultured BMNCs under microscope 40x (e) Ultrasound guided implantation of BMNCs in hip joint( ) (f) Radiographic image of ilium the site for bone marrow collection

THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
August, 2022; 2(8), 1498-1501

Popular Article

Single Intradermal Tuberculin testing

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https://doi.org/10.5281/zenodo.703752

Abstract

Single Intradermal tuberculin test is one of the standard diagnostic tools for detection of tuberculosis and paratuberculosis. It has sensitivity of 68-95% and specificity of 96-99%. It generally involves measurement of the swelling at injection site after 72 hours post injection. It is used at base of tail i.e., caudal skin also called as common fold test in United States, Canada, and New Zealand whereas at cervical skin fold on lateral aspect of the neck in Europe and United Kingdom. It is used primarily for detection of carriers in flock and

Introduction

Single intradermal tuberculin test is one of the indirect and standard diagnostic tools for detection of tuberculosis and paratuberculosis. It is generally based on the principle of delayed hypersensitivity. It involves intradermal injection of bovine tuberculin purified protein derivate (PPD) or human **tuberculin into** a skin fold of a specific location (caudal skin also called as common fold test in United States, Canada, and New Zealand whereas at cervical skin fold on lateral aspect of the neck in Europe and United Kingdom). and measurement of thickness of swelling after 72 hours (Radostits et al.2007). This technique has been used primarily for detection of tuberculosis in humans after detection of element 'tuberculin' by isolating it from tuberculosis bacilli. After this, it was applied in bovine and found that thermal response is present in animal as a result of injecting 0.2-0.5 ml tuberculin subcutaneously.

It was earlier done by double intradermal technique, i.e., injecting second dose of tuberculin after 48 hours of first tuberculin dose. This technique was utilized for developing Stormont test but later on, this technique was found ineffective and replaced by single intradermal comparative testing (SICT). (Monaghan et al. 1994).

It could be a valid alternative to the more invasive traditional techniques to correct large bone defects.

Cartilage has limited capacity for regeneration, and when lesion is limited to the articular cartilage only and does not extend to the underlying bone, it fails to heal spontaneously leading to the osteoarthritis, lameness, and permanent disability. Intra-articular implantation of uncultured bone marrow derived nucleated cells

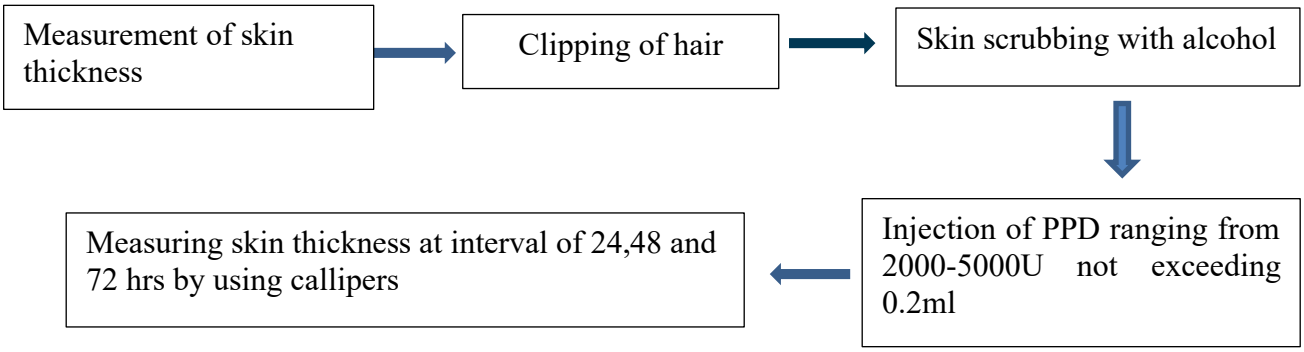
Platelet-rich plasma (PRP) is an autologous product that concentrates a large number of platelets in a small volume of plasma. PRP accelerates endothelial, epithelial, and epidermal regeneration, stimulates angiogenesis, enhances collagen synthesis, promotes soft tissue healing, decreases dermal scarring, enhances the hemostatic response to injury, and reverses the inhibition of wound healing caused by glucocorticoids. The high leukocyte concentration of PRP has an added antimicrobial effect and carries no risk of transmitting infectious disease. PRP is obtained following the centrifugation of whole blood, yielding a product highly concentrated with platelets. The α-granules within the concentrated platelet solution contain growth factors and proteins vital to the coagulation cascade which, upon activation, may aid in the regeneration of tissues. To combat the catabolic environment of joints affected by OA, PRP counteracts cartilage erosion by inhibiting the catabolic cytokines of IL-1β and TNF-α and by promoting factors associated with cartilage matrix synthesis including fibroblast growth factor, transforming growth factor-β (TGF-β), insulin-like growth factors and others cytokines.

Based on above existing problems of hip dysplasia and the role of uncultured bone marrow mono-nucleated cells (BMNCs) and activated platelets a total of ten clinical cases of dogs diagnosed for mild to moderate form of hip dysplasia were one time treated with a combination of (4.5 ± 0.07) x 10^6) autologous BMNCs and activated platelets mixed together and implanted under ultrasound guidance in the affected hip joint as therapy in canine hip dysplasia. The BMNCs were isolated in 5ml bone marrow isolated from the iliac crest and mono-nuclear cells were isolated from bone marrow by centrifuging on lymphocyte isolation density gradient media. This protocol for treatment was planned with the hypothesis that bone BMNCs contain mesenchymal stem cells and activated platelets have growth factors that may further help in the proliferation and differentiation of BMNCs cells implanted in the joint. So, one-time treatment of such conditions with cell therapy may be useful to overcome the complications related to conventional treatment. All treated cases were recovered completely and the last two years of follow-up, not showed any complications, further no supplementation and treatment related to hip dysplasia have been given to the animals.

SICT involves simultaneous injecting two separate antigens intradermally at different side of neck with 12cm distance apart. After 72 hours, difference in swelling at both sides are compared. It can help in differential diagnosis between vaccination against Johne's disease and tuberculosis.

This test is based upon principle of delayed hypersensitivity reaction as a result of interaction

between the injected antigen, antigen presenting cells and T cells (cell mediated). These reactions are not induced by circulating bodies but by the sensitized T cells which on contact with specific antigen release lymphokines and exert biological effects on lymphocytes, inflammatory cells and tissue cells. This technique is performed as shown below:



There are different approaches to performing single intradermal tuberculin testing, such as single intradermal tuberculin testing involving administration of bovine PPD at the caudal fold of the tail skin in the US, Canada and New Zealand, while the cervical skin fold in Europe. Single thickness is measured after 72 hours using callipers. Another approach involves a single intradermal comparison test (SICT), which involves the simultaneous administration of bovine and avian tuberculin at two different sites, either on the same site or one on either side spaced 12 cm apart. After 72 hours, the results of both antigens are compared. The Johnin test is one of the applications of the intradermal tuberculin test with an antigenic difference, i.e., H. Mycobacterium paratuberculosis. It is slightly modified by intravenous injection of the Johnin's agent, and a 1.5 °C rise in temperature is considered a positive reaction. It can also be done by demonstrating the in vivo cell-mediated reactivity of IFN-released from bovine white blood cells in whole blood cultures incubated with PPD-tuberculin (Wood et al. 1991).

Reference value in animals (bovine, ovine & canine)

Species	Site of SID	Reference value of skin thickness in positive animals
Pigs	Base of the ear	5-10mm
Horses	Not reliable	-
Bovine	Cervical region of neck or caudal base of tail	4mm or more
Sheep and Goats	Anal fold and inside of thigh	5mm

Interpretation and Clinical Significance

- Presence of hard or oedematous swelling in caudal fold of the tail after 72 hours are considered positive reaction in caudal fold test.
- Increase in skin thickness by 4mm in bovine PPD intradermal administration as compared to skin thickness resulting from avian PPD is considered positive reaction in SICT and animal is considered reactor.
- There may be presence of other clinical signs like extensive edema, exudation, pain in lymphatic glands in case of positive ones in bovines.
- In swine thickness of 5 mm or more considers as positive reaction. while the skin thickening exceeding 10 mm or more shows superficial necrosis and sloughing.
- In horses, these tests should be used with caution as it may cause anaphylactic reaction in these species.
- In bovines and small ruminants, skin thickness 5mm or more is considered positive.

Conclusion

The detection of infected animals depends largely on the use of the intradermal tuberculin test. All animals older than 3 months should be tested and positive reactors discarded according to local legislation. Suspect reactors are retested at intervals appropriate to the test used. A careful clinical examination of all animals should be performed at the initial test to ensure that there are no advanced clinical cases leading to negative reactions to the test. Doubtful cases and animals likely to have reduced susceptibility, particularly old cows and those that have calved within the last 6 weeks, can be tested with one of the specific sensitivity or serological tests described previously, or retested later. The Single Comparative Intradermal Test (SCIT) should be used when M. avium infection is expected or when there is a high incidence of reactors in a flock that shows no clinical signs of the disease.

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THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
August, 2022; 2(8), 1502-1505

Popular Article

A Simple and Rapid HPLC Method for the Multi-Determination of Residue in Veterinary and Dairy Industries

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Abstract

Food safety issues have been attracting increasing public attention with the occurrence of large numbers of food safety incidents in recent. Veterinary drugs, pesticides and other chemical contaminants have become some of the most serious food safety problems. Different analytical methods have been applied to multi-residue detection of veterinary drugs and pesticides in animal-derived. To date, high performance liquid chromatography (HPLC) coupled with mass spectrometry (MS) techniques has offered abundant qualitative and quantitative information from ‘‘target’’ to ‘‘non-target’’ analysis of these residues in foodstuffs. distinction between vaccination against paratuberculosis and tuberculosis.

Introduction

Until last two decades exposure of pharmaceuticals to environment has not been considered a big concern because they were thought to be safe. Nowadays, however, they are referred to as the emerging contaminants. The fact that these compounds are not in the regulatory list of environmental pollutants resulted in comparatively little attention paid to them. These drug residues may present great hazards to human health, and thus, veterinary drug and pesticide residue analysis is necessary for the protection of consumer health. Additionally, residue analysis also plays important roles in guaranteeing high-quality food products and international trade.

Rapid methods and automation for the detection and characterization of chemical and veterinary drug residues in foods of animal origin constitutes a dynamic area in food processing and is experiencing important developments mainly from the standpoint of food safety. Residues from these substances may be present in edible tissues, milk and eggs for human consumption and may exert different levels of toxicity on consumers when consuming them.

Antibiotics act as growth promoters but can contribute to an increased human exposure to antibiotics, development of pathogens with antibiotic-resistance and increased allergies due to its presence in foods. In fact, the presence of residual antibiotics in animal foods constitutes an important health risk because the increased microbial resistance detected in latest years.

Table 1. Lists of veterinary drugs and substances with anabolic effect, with some examples (Council Directive 96/23/EC)

Group A: substances having anabolic effect	Group B: veterinary drugs
Stilbenes (diethylstilbestrol) Antithyroid agents (thiouracils)	Antibacterial substances Sulfonamides and quinolones
Steroids; Androgens (trenbolone acetate), Gestagens (melengestrol acetate), Estrogens (17-b estradiol)	Other veterinary drugs; Antihelmintics, Anticoccidials, Carbamates and pyrethroids, Sedatives, Non-steroideal anti-inflammatory drugs, Other pharmacologically active substances (dexamethasone)
Resorcycilic acid lactones (zeranol) Beta-agonists (clenbuterol) Other compounds (nitrofurans)	

Chromatography is a common term used for a family of laboratory techniques, used for separation of the components of complex mixtures. Chromatography involves a sample being dissolved in a mobile phase, which may be a gas (in case of gas chromatography) or a liquid (in case of liquid chromatography). The mobile phase is then forced through an immobile stationary phase called the column. The mobile and stationary phases are chosen such that components of the sample have differing solubility in each phase. A component which is quite soluble in the stationary phase will take longer to travel through it than a component which is not very soluble in the stationary phase but very soluble in the mobile phase. As a result of these differences in mobility, sample components will become separated from each other as they travel through the stationary phase.

Different analytical methods have been applied to multi-residue detection of veterinary drugs and pesticides in animal-derived. To date, high performance liquid chromatography (HPLC) coupled with mass spectrometry (MS) techniques has offered abundant qualitative and quantitative information from ‘‘target’’ to ‘‘non-target’’ analysis of these residues in foodstuffs.

The separation principle of HPLC is based on the distribution of the analyte (sample) between a mobile phase (eluent) and a stationary phase (packing material of the column). Depending on the chemical

structure of the analyte, the molecules are retarded while passing the stationary phase. The specific intermolecular interactions between the molecules of a sample and the packing material define their time "on-column". Hence, different constituents of a sample are eluted at different times. Thereby, the separation of the sample ingredients is achieved.

A detection unit (e.g. UV detector) recognizes the analytes after leaving the column. The signals are converted and recorded by a data management system (computer software) and then shown in a chromatogram. After passing the detector unit, the mobile phase can be subjected to additional detector units, a fraction collection unit or to the waste. In general, a HPLC system contains the following modules: a solvent reservoir, a pump, an injection valve, a column, a detector unit and a data processing unit. The solvent (eluent) is delivered by the pump at high pressure and constant speed through the system. To keep the drift and noise of the detector signal as low as possible, a constant and pulse less flow from the pump is crucial. The analyte (sample) is provided to the eluent by the injection valve.

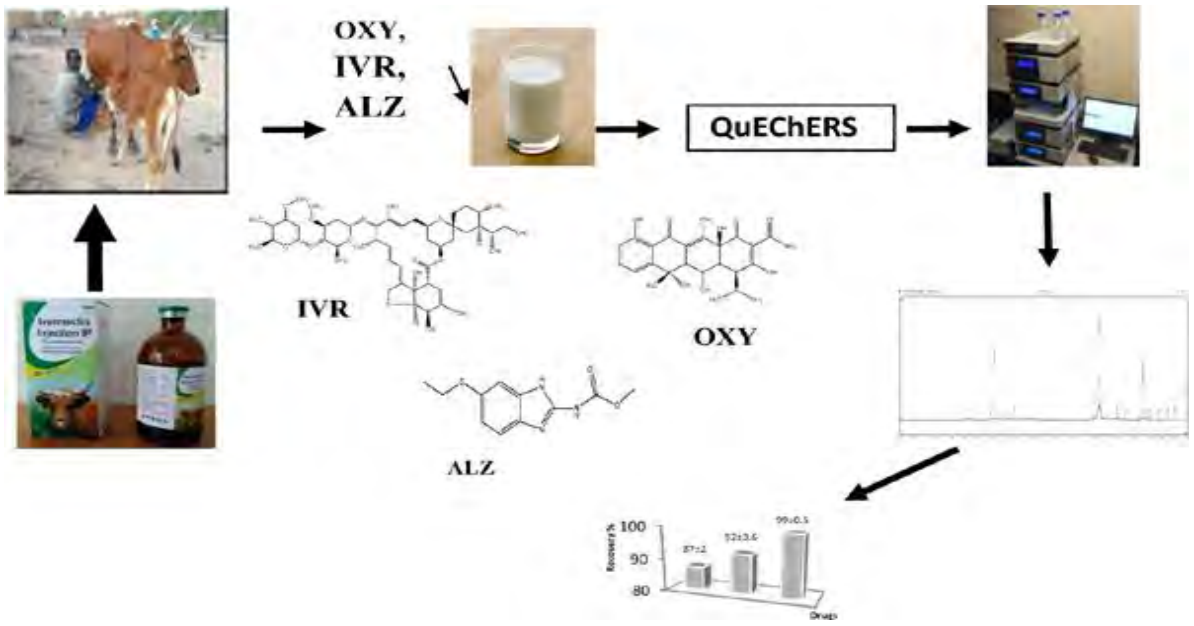

Figure 1: Method of Veterinary Drug Residue Analysis in Raw Milk by RP-HPLC-UV (Lekweiri *et al.,* 2020)

The highly toxic Aflatoxin M1 (AFM1) is most often detected in milk using an Enzyme-Linked-Immunosorbent Assay (ELISA) for screening purposes, while High-Performance Liquid Chromatography with Fluorescence Detector (HPLC-FL) is the reference method used for confirmation.

Table 2. Main advantages and disadvantages of HPLC

Advantages	Disadvantages
Short time (few min/sample) to obtain the results	Expertise required
Sensitive	Need of sample preparation (extraction and filtration, addition of internal standard, etc.)
Specificity depending on detector	High initial investment (equipment)
Automatisation leading to higher productivity	Cost of column
Possibility to find more information from spectra when using diode array detector	

Conclusion

The HPLC method is accurate, simple, rapid, and economic, and can be applied as a screening method in the determination of drug residues in veterinary and dairy products. So, it might be possible to be protected from residues, which are important for public health, and to reduce economic risks.

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THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
August, 2022; 2(8), 1502-1508

Popular Article

Impacts of A1 milk and A2 milk on human health

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https://doi.org/10.5281/zenodo.7038458

Abstract

In the last decade there was much discussion related to the consumption of A1 and A2 milk. There was much discussion about the health issues related to it. A2 milk is the milk that contains only the A2 type of beta-casein protein whereas A1 milk contains only A1 beta casein or A1A2 type variant. A1 and A2 α-casein are genetic variants of the beta-casein milk protein with different chemical structures. A1 protein variant is commonly found in milk from crossbred and European breeds of cattle. A2 milk is found basically in indigenous cows and buffaloes of India (Asia as a whole). Studies suggest that A1 milk consumption may lead to type -1 diabetes among children, cardiovascular disease (IHD), delayed psychomotor development among children, autism, schizophrenia, sudden infant death syndrome (SIDS) auto-immune diseases, intolerances and allergies but all these differ individually. This article summarizes the reality related to A1 and A2 milk.

Introduction

Milk is the sole source of nutrition for infants. It provides the critical micronutrients required for the growth and development of human and newborn animal health. People used to take milk according to their needs and utilise milk such as A2 milk, since A2 milk is harmless for health while A1 milk is detrimental. Therefore, our future breeding programmes for dairy animals should be conducted methodically, with a focus on generating A2 Milk, which is clean and healthy milk. Milk is approximately 85 percent water. The remaining 15% of milk is composed of lactose, protein, fat, and minerals. Approximately 30% of the total protein content in milk is beta-casein. According to the kind of -casein contained, milk can be divided into two groups: A1 AND A2. A2 milk includes just the A2 beta-casein protein type, whereas A1 milk contains only the A1 beta-casein protein type or the A1A2 variant. A1 and A2 -casein are genetic variations with distinct chemical structures of the beta-casein milk protein. A1 protein variation is typically seen in the milk of hybrid and European cow breeds. A2 milk is mostly produced by India's indigenous cows and buffaloes (Asia as a whole). The A2 Milk Company primarily sells A2 milk in Australia, New Zealand, the United Kingdom, and other developed nations under the A2 Corporation brand. There is no unanimity about the benefits of A2 milk versus A1 milk.

Composition and functional properties

A genetic test created by the A2 Corporation determines whether a cow's milk contains A2 or A1 protein. This is determined using hair from the cow's tail. The test enables the A2 Corporation to provide licences to milk producers who can demonstrate their cows generate A2 -casein in their milk. A2 beta-casein is the beta-casein generated by cows since before they were domesticated more than 10,000 years ago. There are no documented negative health effects. In the last several thousand years, a spontaneous mutation has caused a part of European breed cows to produce a casein variety known as A1 beta-casein. Gradually, this protein variation dominated milk, resulting in A1 milk. The 67th amino acid of the 209-amino-acid beta-casein proteins was altered from proline to histidine by modifying the gene producing the protein. This newly developed beta-casein is known as A1 beta-casein and is found in the milk of numerous crossbred cows, including Holstein, jersey, and Friesian.

Normal milk contains A1 beta-casein, which is partially broken down in the stomach into beta-casomorphin-7 (BCM-7). BCM-7 has been associated with a variety of undesirable health consequences. At amino acid position 67, the A1 and A2 versions of bovine -casein differ, having histidine in A1 and proline in A2 Milk. This polymorphism causes significant conformational changes in the secondary structure of -casein protein when it is produced. Due to the presence of histidine at position 67, digestion of A1 -casein milk releases a 7 amino acid bioactive peptide called beta-casomorphin 7 (BCM-7), but proline at position 67 in A2 milk prevents the split at this location and creates peptide BCM-9. The production of BCM-7 is the primary factor responsible for A1 milk-related health conditions. However, A2 -casein has not been associated with any of these health problems.

The essential to human evolution is change, but messing with nature can produce unanticipated outcomes. The same holds true for our meals, such as milk and dairy. Cross-breeding has resulted from industrialization and increased milk demand, causing genetic polymorphisms. On the basis of their DNA, there are two types of cows: the high-yielding kind that generates A1 milk protein and the other type that produces A2 milk protein. Recently, a correlation between disease risk and the consumption of A1 or A2 genetic variations was discovered. Studies indicate that milk from cows with A2 genes is significantly healthier than milk from cows with A1 genes. Increasing evidence links A1 milk to bad health. Among these include type 1 diabetes in infants, cardiovascular disease (IHD), delayed psychomotor development in children, autism, schizophrenia, sudden infant death syndrome (SIDS), auto-immune illnesses, intolerances, and allergies. Certain individuals are at a greater danger than others. Those with digestive diseases such as stomach ulcers, ulcerative colitis, Crohn's disease, and Celiac disease, as well as those using long-term medications or antibiotics, are at a greater risk. This may also explain the growing anti-

dairy sentiment and the growth in the number of people choosing vegan diets. On the contrary, milk with A2 protein is known to provide numerous health benefits. It has been proven that the A2 milk variation prevents childhood and adult obesity, improves brain function, promotes digestion, and increases breast milk production in nursing women.

Conclusion

Drinking A2 milk safeguards us from milk related health concerns coming primarily from A1 milk. Although this type of issues also varies from person to person since every human being has diverse power to bear the complications because of their distinct physiological qualities. Regular milk contains both A1 and A2 beta-casein, but A2 milk has just A2 beta-casein. There is no evidence to show that having A2 milk rather than the commonly eaten commercial milk, which contains both the A1 and A2 proteins, confers any kind of benefit on individuals who do not have any difficulties as a result of milk consumption.

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THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
August, 2022; 2(8), 1509-1512

Popular Article

Chemical and Technological application of Protein Based Fat Replacers in Food

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https://doi.org/10.5281/zenodo.7038476

Introduction

Fat is an important constitute of food. So, in the food component, it contributes important role in sensory and physiological benefits. Fat contributing various functions like flavour, mouthfeel, taste, and aroma/odour (Lucca and Tepper, 1994; Mistry, 2001; Sampaio, 2004). In addition, fat also contributes to other functions such as creaminess, appearance, palatability, texture and glossiness of foods and increases the feeling of satiety during meals (Romanchik-Cerpovicz, 2002; Sipahioglu, 1999). Fat can carry lipophilic flavour compounds, act as a precursor for flavour development and helping to stabilize the flavour in food (Romeih, 2002; Tamime, 1999).

Fat Replacer

A fat replacer is an ingredient that can be used to provide all the functions of fat and it also contributing fewer calories. Fat replacers are able to replicate some or all of the functional properties of fat in a fat modified food (Schwenk and Guthrie, 1997).

Types of fat replacer

Fat replacer are classified in two groups: fat substitutes and fat mimetic. Fat substitutes are lipid like substance proposed to replace the fat on mass-to-mass basis. Fat mimetics are protein or carbohydrate ingredients which are imitating the various functions such as physical, textural, mouth feel and organoleptic properties of true fats (Owusuapenten, 2005). Fat substitutes are further classified in two types such as emulsion and structural lipids. Similarly, Fat mimetics are also classified in two types such as microparticulate protein and microparticulate carbohydrates.

Protein Based Fat mimetics

The protein in fat replacement is determined by the degree of denaturation, which effects flavour, as well as the protein solubility, gelling properties and temperature stability. Proteins are responsible for whipping agents, emulsion stabilizers, and dough formation. The fat mimetics are derived from a various protein sources like whey, egg, milk, soy, gelatine, wheat gluten and corn zein. Protein-based fat mimetics are commonly used in many forma like butter, cheese, dairy products, salad dressings, sour cream, mayonnaise containing products, soups, sauces, baked goods, and frozen desserts. These protein-based fat mimetics are generally giving a better mouthfeel than carbohydrate-based replacer.

Many protein-based fat mimetics are used in foods and their applications-

Type of fat replacer	Commercial names	Applications
Microparticulated Protein	Simplesse®	Milk and milk products (ice cream, butter, sour cream, yogurt, cheese), Baked goods, salad dressings, frozen desserts, mayonnaise type products, margarine, coffee creamer, soups, sauces
Modified Whey Protein Concentrate	Dairy Lo™	Dairy Products, mayonnaise-type products, baked foods, frostings, salad dressing
Others	K-Blazer®, ULTRA-BAKETM, ULTRA-FREEZETM, Lita®, Trailblazer	Frozen desserts, baked foods, spreads, butter, salad dressing

Microparticulated Protein (Simplesse®) properties

Microparticulated Protein is manufactured from whey protein concentrate by the patented micro-particulation process. In this process, these are undergone heating and blending, egg protein and milk protein are combined and formed into minute particles and their size are 1–1.5 mm. These particles are spherical and smooth, which allows the mouth to perceive them as fat. The product was introduced by the NutraSweet Corporation in 1988. Simplesse® replacer is approved for use as a thickener or texturizer in ice creams and other frozen dessert dairy products by FDA GRAS in the year 1990. This replacer is also suitable for use in many dairy products like yogurt, cheese spreads, cream cheese, and sour cream as well as use for oil-based products such as salad dressings, mayonnaise, and margarine. The caloric value of Simplesse® replacer is 1–2 kcal/g. It used for flavour and fatlike creaminess. It is made from proteins, so it cannot be used in foods that require high-temperature applications like frying or baking. When Simplesse® replacer is heated, then protein gel and texture effects are lost. People who are allergic to milk proteins may have an allergic reaction to this fat replacer.

Modified Whey Protein Concentrate (Dairy Lo™) properties

Modified whey protein concentrate (Dairy-Lo) is manufactured from high-quality whey protein concentrate and it is recognized as generally recognize as safe (GRAS), Dairy Lo™ contributes 4 kcal/g.

Modified whey protein helps in various forma to improve texture, flavour and stability of low-fat foods. It is used in many dairy products like sour cream, frozen dairy desserts, cheese, yogurts and sauces. Its ability is to prevent shrinkage and iciness in frozen dairy foods makes it desirable as a fat replacement ingredient in those products.

Other protein-based fat mimetics

Other than Simplesse® and Dairy Lo™, there are other recently developed fat replacer: It is derived from xanthan gum, egg white, whey protein and LITA from Corn Zein.

Application in dairy foods

In the prepared dairy products such as low-fat cheese using Simplesse® fat replacer, it was found that Simplesse® had improving effect on cheese appearance (Romeiha *et al*., 2002). Yazici and Akgun, (2004) has used Simplesse® and Dairy Lo™ replacer in yoghurt preparation and they it was found good appearance, flavour and colour score to Dairy Lo™ than Simplesse®. The Simplesse® D-100 and Raftilines HP can improve the sensory and texture properties of low-fat fresh kashar cheese (Koca and Metin, 2004). Zoulias *et al*., (2002) has analysed textural properties of low-fat cookies. They have reported that an increase in polydextrose or Dairytrim content resulted in harder cookies, while an increase in C-deLight, Simplesse® or Raftiline content has the opposite effect. So, C deLight, Simplesse® or Raftiline could be used as fat replacers to prepare tenderer lowfat cookies. It was also found that the increase in brittleness of the cookies with increase of all fat mimetics, but a moderate increase was obtained with C-deLight, Simplesse® or Raftiline. The whey protein-based fat replacer on sensory characteristic of low fat and non-fat Ice cream (Prindiville *et al*., 2000). The Simplesse® was more similar to milk fat than Dairy Lo™ in its effect on brown color, cocoa flavor, cocoa character, and textural stability but was less similar in terms of thickness and mouth coating.

Conclusion

A fat replacer is an ingredient can be used in food to provide all the functions of fat. Fat replacers are able to replicate some or all of the functional properties of fat in a fat modified food. It was concluded that the fat replacer is imitating the various functions properties of food such as physical, textural, mouth feel and organoleptic properties of true fats.

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THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
August, 2022; 2(8), 1512-1520

Popular Article

Nanotechnology-Based Therapeutic Approach in Veterinary Medicine: An Adjunct to Conventional Treatment

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https://doi.org/10.5281/zenodo.7038584

Abstract

Nanotechnology is an emerging area of research interest in the present era. A number of nanomedicines has been by approved by United States Food and Drug Administration (FDA or USFDA) for clinical use in humans. Nanomedicine also has potential applications in veterinary medicine which can act as an adjunct to the conventional treatment available. Nano drug delivery system offers benefits such as low particle size, decreased drug dosage, increased solubility and bioavailability, reduced side effects and degradation of drug. There are number of nanocarriers developed overtime such as liposomes, nano emulsions, micelles, lipid nanoparticles, polymeric nanoparticles, metallic nanoparticles, dendrimers and others. The nanocarriers have proved to be beneficial in administration of drugs which are highly hydrophobic or have large particle size in a sustained release manner which thereby decreases the risks of toxicity and increases the therapeutic potential of the drug. In conclusion, the use of nanomaterials in veterinary medicine can produce beneficial effects and thus improve animal health and production

Introduction

Pet and food-producing animal populations have been gradually increasing around the world. In the present times, the field of nanotechnology has become an emerging scientific area of importance. Nanotechnology plays an important role in the development of new materials and tools that aid in the enhancement of animal health and output. In veterinary medicine, the production of effective and safe products is highly required which upon administration to the animal produces minimum pain and adverse effect which is a priority of pet owners. In the case of livestock products, ensuring the residual number of drugs is at a safe minimum level is of great importance to the veterinary pharmaceutical industries (Hill and Li, 2017). However, the drugs used for veterinary patients are similarly designed as in human medicine, regardless of the difference in the biochemical, anatomical and physiological systems between the species. For the sake of animal health and welfare, it is highly required to develop novel pharmaceutical products having the potential to enhance animal health and livestock production. Therefore, along with the conventional treatment, a new strategy has to be developed to design new products veterinary, justifying the interest nanotechnology as effective therapeutics in veterinary medicine.

The applications of nanotechnology include improved disease diagnosis and treatment, enhanced drug delivery and sustained release of the active component, increases the solubility of hydrophobic agents, reduces drug dosage and degradation of the active constituents. In order to highlight the importance of nanotechnology in veterinary medicine, the present article covers the aspect of nanomedicines, different types of nanomaterials of pharmaceutical importance and their application in various ailments.

Nanomedicine

The medicinal products which are synthesized or produced by using nanocarriers or nanomaterials are termed as nanomedicine (Tinkle *et al*., 2014) and the nanoparticles used to synthesize nanomedicine are called as nanocarriers. Nanoparticles have hydrodynamic diameter less than 1000 nanometers (nm) and their diameter have greater impact on their physical and chemical interactions with the biomolecules (Kreuter, 2007). In case of conventional therapy, due to the low bioavailability or rapid metabolism of drug, a high dose is required to produce the desired pharmacological effect which increases the risk of side effects or toxicity. Nano-compartmentalization provides benefit over conventional therapy as the time-release profile and other pharmacokinetic parameters of the therapeutic agent can be modulated without any change in the pharmacological properties of the drug (Suri *et al*., 2007). Nanomedicine includes the development of nanoparticles capable of targeted delivery of active biomolecules, synthetic drugs, nutrients, immunotherapeutic agents and natural bioactive compounds (Lombardo *et al*., 2019). The nanocarriers have two types of system i.e. reservoir

or matrix system. In the case of the reservoir system, the nanoparticles have an aqueous or oily core in which the therapeutic agent is trapped (Fig. 1A), while in the matrix system, the therapeutic agent is dispersed throughout the nanocarrier's matrix (Fig. 1B). For targeted drug delivery, the functionalization of the nanoparticle surface is carried out in which the therapeutic agent is attached to the surface of the nanoparticle (Fig. 1C) (Rani and Paliwal, 2014). Nanomedicine is targeted to the specific target in two ways: active and passive (Fig. 2). In passive nano-delivery, there is accumulation of drug at the specific site while in the active process the surface of the nanoparticle is tagged with a specific marker or therapeutic agent itself which specifically interact with the receptor at the target site (Aiacoboae *et al*., 2017). Another system of nanomedicine is the stimulus responsive nanoparticles which release the active drug in presence of a stimuli such as pH, temperature, light, electric or magnetic field, and electrolytes (Sharma *et al*., 2015). The present article addresses the nanocarriers which can/are used to synthesize nanomedicines of veterinary importance.

Nanocarriers

Number of nanocarriers are used for the delivery of drugs, as of veterinary importance, the nanocarriers which are used and addressed in the present article include liposomes, micelles, lipid nanoparticles, nanoemulsions, polymeric nanoparticles, dendrimers and metallic nanoparticles. With the help of these nanocarriers, reformulation of the traditional dosage forms can be done. Many therapeutic agents have great pharmacological potential, but due to their large particle size and toxic effect, the dosage of that particular drug is reduced, leading to a decrease in its therapeutic effect. On the other hand, some drugs are highly hydrophobic in nature and insoluble in aqueous solution and require toxic solvents for its administration. Nanocarriers have proved to be beneficial in the administration of such drugs. One such example is the Abraxane®, approved by the FDA in 2005. The anti-tumor drug paclitaxel is capable of inducing an anaphylactic reaction in susceptible patients, while the nanoparticle albumin-bound paclitaxel formulation has proved to be more tolerable than the conventional paclitaxel therapy (Caster *et al*., 2017). The principal objective of using nanocarriers in Veterinary medicine is that it enables the delivery of therapeutic agents with dose reduction, decreased risk of adverse reactions or toxicity and discomfort in chronic therapy.

Potential application of different nanocarriers in Veterinary medicine

Liposomes

Liposomes have a double lipid layer consisting of phospholipids and have a varying hydrodynamic diameter ranging from 25nm to 1000nm. Liposomes are useful in the delivery of both hydrophilic and lipophilic compounds; its surface charge and size can be modulated easily along with its functionalization capacity.

This nanoparticulate system is widely described and used in the veterinary application. B and T cell epitope peptides were entrapped in the liposome having hydrodynamic diameter of 127-141nm and zeta potential of -25.1 to -31.8 millivolts (mV) were used as vaccine against the influenza virus (H1N1) in pigs (Dhakal *et al*., 2018). The liposomes improved haemagglutination, IgA response and protected from adverse effects caused by influenza A virus H1N1, such as fever and lesions. There are reports where liposomes were used as a nanoparticulate system for the treatment and prevention of tumors.

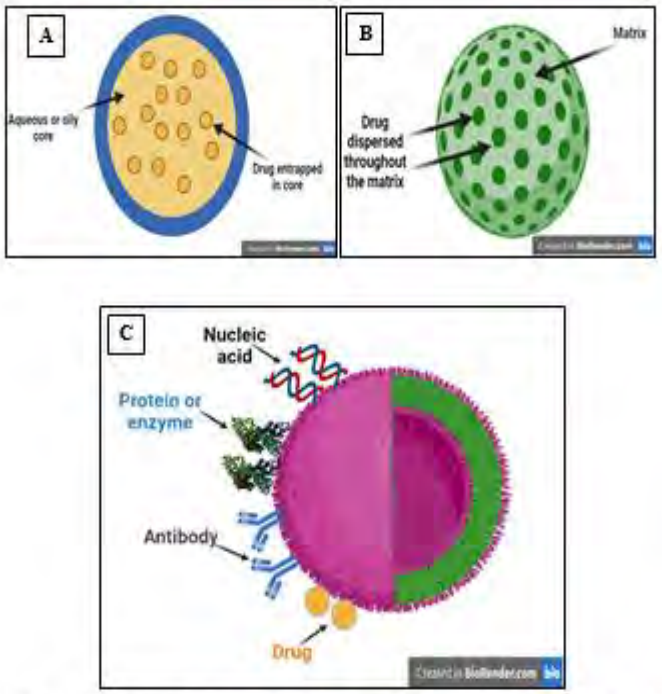

Fig 1. Nanoparticulate system: A. Reservoir system, B. Matrix system, C. Functionalization of the nanoparticle surface [Pictorial representation is designed manually by using an online tool (Biorender)]

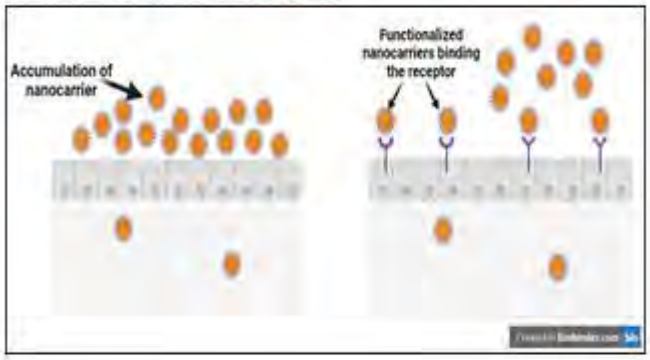

Fig 2. Nano-delivery system: Passive process (left), Active process (Right) [Pictorial representation is designed manually by using an online tool (Biorender)]

Curcumin was encapsulated in liposome and its effect was studied against naturally induced canine cancer. The liposomes exhibited good anti-tumor effect in *in vitro* as well as in *in vivo* studies (Withers *et al*., 2018).

Nanoemulsion

Nanoemulsion is a nanoparticulate system which consist of at least oil, water and an emulsifier and have the hydrodynamic diameter ranging from 50nm to 1000nm (Salvia-Trujillo *et al*., 2017). It consist of colloidal dispersion of droplets which are kinetically stable but thermodynamically unstable (Gupta *et al*., 2019). Nanoemulsion for canine cancer chemotherapy was synthesized (Lucas *et al*., 2015). Carmustine containing lipid nanoemulsion was used for canine lymphoma therapy using ultrasonication for reducing the size of the nanoparticles. Another study reported use of photodynamic therapy along with the aluminium-chloride-phthalo-cyanine nanoemulsion for the treatment of cutaneous hemangiosarcoma in dogs which lead to complete disappearance of tumor (Rocha *et al*., 2019). A study reported anesthetizing tilapia fish by using clove oil nanoemulsion having hydrodynamic diameter of 64 ± 1.0nm and it was observed that nanoemulsion enhanced the efficacy of clove oil as compared to eugenol ethanolic solution with respect to anesthesia of tilapia (Kheawfu *et al*., 2017).

Solid lipid nanoparticles (SLN)

Solid lipid nanoparticles have hydrodynamic diameter ranging from 50nm to 1000nm and are used as an alternative system to liposomes (Muller *et al*., 2011). SLN consist of solid lipids and surfactants are used as stabilizer. In contrast to nanoemulsion, the SLN have solid lipid replacing the liquid lipid used in nanoemulsion. This improves the stability and release profile of the SLN under severe environmental condition (Gordillo-galeano and Mora-huertas, 2018). For the treatment of leishmaniasis, oryzalin has proved to be a promising drug, but due to its less bioavailability and toxicity, it is not well tolerated in animals. To overcome this, a study reported development of SLN encapsulating oryzalin which consisted of mixture of soy lecithin, tween® 20 and sodium deoxycholate as surfactant and tripalmitin as solid lipid and the synthesized SLN had hydrodynamic diameter of less than 140 nm and zeta potential of -35mV with encapsulation efficiency of more than 75%. The cytotoxic effect of this SLN was analysed revealing that the nanoparticulate system allowed increased tolerability of the drug (Lopes *et al*., 2012).

An important Veterinary application of SLN is the delivery of antibiotic for the treatment of mastitis. Tilmicosin was encapsulated in SLN containing hydrogenated castor oil, which enhanced activity of tilmicosin with reduction in side effects related to tilmicosin (Wang, 2014; Ling, 2016). The SLN has proved to be cost effective as the tilmicosin encapsulated SLN were incorporated into a sodium alginate chitosan nanogel used for the treatment of the cow mastitis, such formulation required low concentration of the drug and had long post antibiotic effect (Zhou *et al*., 2019).

Nanostructured lipid carriers (NLC)

Nanostructured lipid carriers are similar to the SLN consisting of a structural solid lipid and stabilized by a surfactant which is amphiphilic in nature (Garcês *et al*., 2018). However, there is a minor difference between NLC and SLN, as NLC contains solid lipid which contains a small fraction liquid lipid which enhances more accommodation and encapsulation of the drug by the NLC and prevents the untimely release of the drug (Garcês *et al*., 2018). Nanotoxicological studies have shown that both SLN and NLC are biodegradable and have greater biocompatibility (Doktorovova *et al*., 2014). Buparvaquone was encapsulated in the NLC. The NLC were developed using Softisan® 154 and Miglyol® 812 as lipids and surfactants used were Kolliphor P188 as well as tween 80. High-pressure homogenization method was used for the synthesis of NLC, forming nanoparticles having hydrodynamic diameter around 350nm and encapsulation efficiency close to 100%. Another study involved synthesis of functionalised NLC, where the surface of NLC was modified with chitosan and dextran to co-deliver buparvaquone and polymixin B against *L. infantum*. The functionalisation and co-delivery enhance leishmanicidal activity in *in vitro* test up to 3-fold compared to free buparvaquone (Monteiro *et al*., 2019).

Micelles

Micelles are particulate system which consist of the polymers which are amphiphilic in nature. Micelles having anti-leishmanial activity were developed in which amphotericin B was encapsulated in the pluronic F127 micelles coated with chitosan. The hydrodynamic diameter of the synthesized micelle was 102.23 ± 11.14nm with encapsulation efficiency around 60%. The micelles were 21.97 times more internalized by macrophage as compared to the free drug in flow cytometric studies (Singh *et al*., 2017). Pluronic F127 encapsulated bilirubin nanoparticles were synthesized to enhance the wound healing activity in Wistar rats (Kamothi *et al*., 2022). The synthesized bilirubin nanoparticles had hydrodynamic diameter ranging from 100-150 nm and showed greater wound healing activity than the free drug by stimulating the expression of VEGF, TGF-β and IL-10 levels.

Polymeric nanoparticles

Polymeric nanoparticles can be prepared using number of polymers which are either natural, semi-synthetic or synthetic in nature (Sur *et al*., 2019), having hydrodynamic diameter ranging from 1 to 100nm and the polymeric nanoparticles are further divided into two types i.e. Nanocapsules and nanospheres (Ferreira *et al*., 2018). Natural polymers consist of chitosan, alginate, hyaluronic acid, dextran, carboxymethyl cellulose and pectin (Ferreira *et al*., 2018) and are biodegradable, biocompatible and non-toxic in nature (Jin *et al*., 2019). A study reported the synthesis of platin-M encapsulated polymeric nanoparticles for the treatment of canine brain tumors (Feldhaeusser *et al*., 2015). The nanoparticles exhibited a good anti-cancerous effect by disrupting mitochondrial energy production in glioblastoma and canine glioma cell lines.

To treat and prevent the diseases related to poultry breeding, sodium alginate-polyvinyl alcohol was used to encapsulate amoxicillin having hydrodynamic diameter of 513nm and surface charge of -45mV encapsulating around 43% of the drug. The amoxicillin encapsulated sodium alginate-polyvinyl alcohol nanoparticles exhibited increased bioavailability and plasma half-life as compared to the free drug, thus increasing the mean residence time in the intestinal and circulatory system (Güncüm *et al*., 2018).

Another study reported a cream prepared by synthesis of nano composite consisting of chlorhexidine, calcium phosphate nanoparticles mixed with polyethylene glycol polymer for wound healing (Viswanathan *et al*., 2016).

Metallic nanoparticle

Metallic nanoparticles are mainly used in biosensing, bioimaging, drug delivery, gene delivery and cellular labelling (McNamara and Tofail, 2017). Metal nanoparticles mainly include silver, iron oxide, gold, zinc and copper nanoparticles. These are mainly used as antimicrobial and antiviral agents in veterinary. In a study, silver nanoparticles were synthesized to evaluate its antimicrobial effect against drug-resistant strains of *Pseudomonas aeruginosa* and *Staphylococcus aureus* isolated from mastitis-infected goats (Yuan *et al*., 2017). The synthesized nanoparticles had hydrodynamic diameter of 10-50nm and surface charge of 37.7mV and exhibited anti-bacterial effect by generating ROS against bacterial cells.

Dendrimers

Dendrimers are branched structure consisting of number of functional groups allowing the delivery of hydrophilic or hydrophobic therapeutic agents, internalized or attached to the surface. Dendrimer based classical swine fever vaccine was developed and it was observed that the vaccine elicited better immune response against the virus due to the inclusion of dendrimer (Tarradas *et al*., 2012).

In a study, generation six dendrimer cyanine 5 conjugates were prepared targeting hypothermic circulatory arrest (HCA) induced brain injury in a canine model (Grimm *et al*., 2016). It was found that the administration of dendrimer cyanine 5 conjugates systemically leads to penetration of blood brain barrier by the conjugates and its accumulation in areas of the brain most affected with HCA.

Conclusion

In the present era, there is a need for the development of novel pharmaceutical products for Veterinary medicine. The field of nanotechnology holds great potential for the synthesis of novel formulations which can enhance animal health and productivity. Nanomedicine can be used along with

the conventional treatments available in order to enhance the efficacy of the therapy and decrease the time required for recovery of the animals, thus improving animal health and livestock production.

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THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
August, 2022; 2(8), 1521-1525

Popular Article

Invitro Fertilization- an Art and Science conglomeration

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https://doi.org/10.5281/zenodo.7038663

Abstract

In the domain of reproductive biotechnology, In Vitro fertilization has revolutionized various aspects of reproductive processes. It has re-defined evolution in getting back fertilization from internal to external. This technology is becoming an inevitable solution to major problems of human and animal reproduction. This expounding technology has huge potential in the fields of genomics, transgenics, and embryo physiology. Nevertheless, the cost of embryo production and the outcome is still an area of concern. Henceforth, to avoid exploitation of this technology concerning human and animal welfare, regulations and surveillance are to be incorporated to enhance the efficiency of Invitro fertilization.

Introduction

One of the aspects of biology that fascinated at the same time challenged human intellectual ability is the idea of "ARTIFICAL CREATION" which was thought to be impossible in the past until the birth of "LOUIS BROWN" the world's first baby born out of In vitro fertilization in 1978. IVF technology is a third-generation reproductive technology with immense scope in humans, domestic and wild animals. Though the methodology remains similar there exists a diversified purpose. In humans, it is to address the potential problems of Infertility, while in production animals the prime intention is to propagate elite animals and attain rapid genetic gain. However, in wild animals, it is urgency to conserve and preserve unique endangered species. The first successful birth of IVF in Rabbit was reported by Chang in 1959. Further, it has taken another 23 years not until 1982 for this technology to be successful in domestic animals with the first calf "Virgil" was been born out of IVF technology using In vivo matured oocytes. Followed by the birth of IVF animals was also reported in various species in due course of time.

Annual statistics from the International Embryo Transfer Society Denver, Colorado reported that more than **4lakh** bovine embryos were transferred worldwide in **2020**. In India, IVF technology is still in the budding stage. Department of animal husbandry and dairying, Government of India has taken massive initiation on conservation and propagation of Indigenous breeds under Rashtriya Gokul Mission with special emphasis on establishing IVF labs by **100%**central funding basis. These labs across India are now fully functional and being monitored intensively under the surveillance of the central committee. The prime intention of this **herculean task** is to establish a high-potential genetic herd of various unique breeds within the Indian subcontinent.

Mammalian ovaries are provided with a non-replenishable follicular pool approximately 2,00,000 primordial follicles per ovary constituting ovarian reserve. Nevertheless, a single such follicle finally reaches the preovulatory stage to release oocyte at each estrous cycle remaining undergoing atresia which is the most dominant event occurring all the time. Otherwise, undergo development on gonadotrophin stimulation. This principle is being utilized in IVF technology.

In conventional breeding/AI, a Cow can produce an average of 6-8 calves per lifetime. In contrast through IVF technology, 2-3 calves can be made to born from an opu session which can be done conveniently and frequently without detrimental effect on the animal. Hence 48-72 calves can be made to be born per animal each year. Such is the potential of this technology once the procedure is standardized.

Methodology

IVF is a long and continuous process every step is important and interdependent. The outline of the procedure is as follows.

❖ Oocyte Collection

Oocytes are the starting and crucial material of the whole IVF process. The Source of oocytes can be from slaughter or live animals. Oocytes from slaughterhouses contribute largely to the IVF industry worldwide. Ovaries are procured and cumulus-oocyte complexes are collected by aspiration technique which is often used or by slicing or follicular dissection. Follicles greater than 2mm in diameter are aspirated as these follicles host the developmentally competent oocytes. In our country, a major source of oocytes from the bovine species is donor aspiration. Transvaginal oocyte aspiration is most often used others include surgical flank incision through Laparoscopic procedures via Para lumbar Fossa. No. of oocytes collected depends on Vacuum pressure, gauge needle, length of the bevel, age, frequency, season, and efficiency of collection. An important aspect is aspiration time should coincide with follicular wave emergence. Donors are aspirated with or without stimulation. Porcine follicle stimulating hormone comes under two trades names Follitropin/ Stimufol is used for ovarian stimulation in either single or multiple doses. A coasting period / FSH fasting of 44–68 hours is usually recommended between the last FSH injection and OPU session. Intact cumulus-oocyte complexes are important for further maturation and fertilization. Advantages of stimulation include an increase in no of oocytes, blastocysts, grade 1 oocytes, and conception rate (Oliveira 2016). The cost of hormones is a major setback in stimulation protocols.

❖ *In Vitro* Maturation

Oocytes in follicles are growth arrested at the dictyate stage in prophase- I of meiosis under inhibitory forces of granulosa cells which is resumed upon gonadotrophin surge at ovulation. The cytoplasmic and nuclear changes between diplotene nuclear arrest and metaphase II at ovulation are termed maturation (Pan et al. 2019). The follicles that are in different stages of development at collection have to undergo similar phases of development in *In vitro* maturation step that enables the oocyte to fertilize the male gamete. Oocytes procured are graded those with a greater number of cumulus layers with even cytoplasm are ideal candidates to incubate in the media containing hormones, growth factors, energy resources, etc for a 20-24hour period in IVM media (Fig: 1). The expansion of the cumulus with the release of the polar body is the external sign of maturation.

❖ ***In Vitro* Fertilization**

Involves co-incubation of spermatozoa with matured oocytes in IVF media for 16-18hours to yield embryo. Capacitation changes are the obligatory maturational changes that spermatozoa have to undergo before they could fertilize the oocyte. These are characterized by elevated intracellular calcium and cholesterol efflux. The process of capacitation usually happens in the female reproductive tract to be specific in the isthmus region of the oviduct. The primary capacitating agent added to IVF media is heparin. Others are caffeine, adenosine, etc.

***In Vitro* CULTURE**

Newly fertilized eggs are transferred to an IVC medium and require six days of incubation under favorable conditions to transform into an embryo. There is significant evidence that bovine embryos develop under5% CO2, 5% O2, and 90% N2 gaseous mixture. These embryos are cultured in a CO2 / benchtop incubator. Embryo handling for longer times outside media leads to contamination and decreased blastocyst rate. All that comes in contact with the embryo must be tested and maintained at 37 ° c including glassware and media to minimize stress on the developing embryo.

❖ **Embryo Transfer**

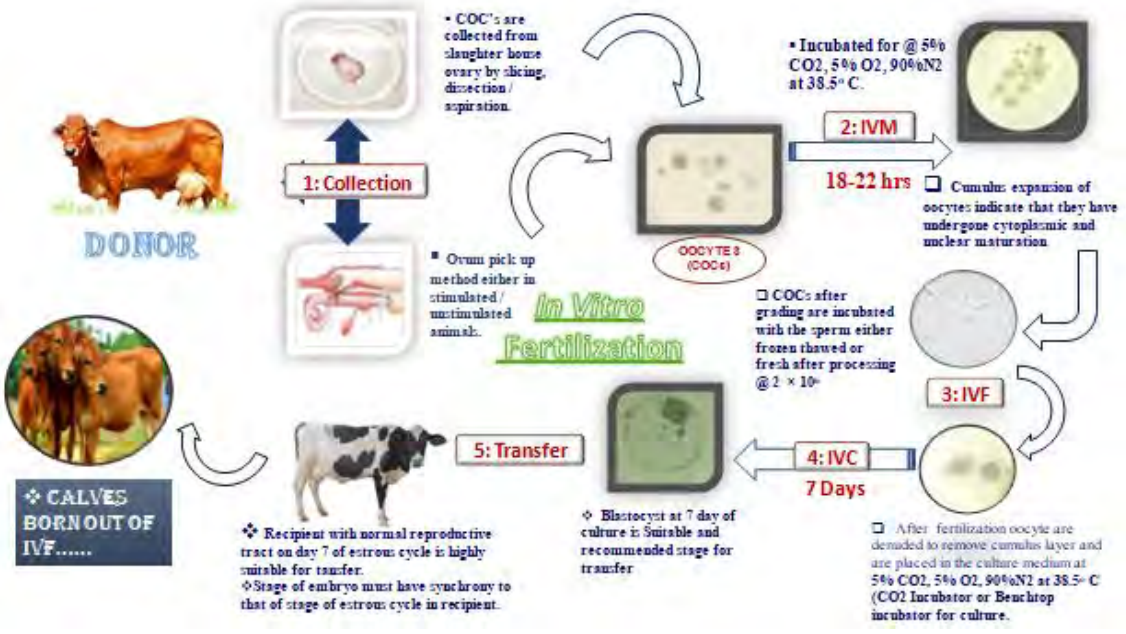

Fig 1: Illustrates outline of the methodology of *In Vitro* Fertilization.

On day 7 of culture, blastocysts are graded to segregate. This is very crucial as it not only enables us to evaluate the quality of an embryo that increases the likelihood of Positive Pregnancy but also an indirect indication reflecting the operating skills of the IVF lab. The diameter of the bovine embryo measures 170 to 190µm and it is a 3D structure hence stereomicroscope is required to evaluate its quality. IETS Standardized coding system to describe the stage and grade of an embryo. Grade A and B are selected for transfer while Grade A is reserved for cryopreservation. Recipient animals with regular reproductive cycles and free from anatomical abnormalities are estrous synchronized naturally or through hormones. The day of the estrous cycle on the day of transfer should be similar to that of the embryo developmental stage. In bovine species transfer is done on day 7 under epidural anesthesia (Fig: 1). Precautions have to be taken for utmost hygienic maintenance.

❖ **Applications Of IVF**

- IVF and Embryo transfer together revolutionized genetic improvement protocols that enable us to carry out conservation programs most efficiently to propagate and preserve endangered and rare species.
- Production of progeny is possible in dead animals and animals with reproductive tract abnormalities.
- Production of progeny from pregnant animals till the first trimester.
- IVF with sexed semen yielded double-fold results.
- Genomics, facilitating blastocyst testing to interpret bioinformatic analysis made it possible to determine the breeding value which is widely in practice.
- Transport of valuable genoplasm in the form of oocytes and embryos across continents.
- Interdisciplinary research for deeper understanding is possible with the studies on bovine species as they match in similarity with human physiology.

❖ **Challenges of IVF**

- The cost of production in terms of hormones, media, equipment, embryo transportation, and herd maintenance are high.
- Need for skilled personnel
- The lower blastocyst development rate is around 35-40% and conception rate of 25-35% is still an area of concern.
- Availability of recipient animals.
- Lack of enthusiasm from the farmers.

Apart from the challenges the IVF industry is rapidly developing in India with improved results across the country.

Conclusion

In vitro fertilization has the potential to establish a high genetic merit herd of indigenous bovine species such as Sahiwal, Gir, Red Sindhi, Tharparker, Ongole, Punganur, etc. IVF demands herculean efforts where Inter-institutional collaboration between universities, state livestock boards, national institutes, and most importantly farmers are very crucial for this technology to flourish and get established in India.

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THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
August, 2022; 2(8), 1526-1529

Popular Article

Monkeypox in animals

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https://doi.org/10.5281/zenodo.7038721

Abstract

With more than 31,000 confirmed cases of monkeypox worldwide, health authorities are warning that it's not just people who are at risk from the disease even pets can get monkeypox, too. With monkeypox spreading in humans throughout the world, veterinarians have begun to worry about the increased risk of monkeypox spreading from humans to animals. If monkeypox spreads to wildlife species, the virus could become endemic in the places, where it has historically been absent, resulting in more frequent outbreaks. The recent report of a greyhound in Paris which was infected with monkeypox from its owner, has underscored the possibility of a viral reservoir in animals. This article provides a general overview of the disease in animals especially dogs, along with information on how to diagnose and treat them.

A species-jumping virus

Monkeypox virus is an enveloped double-stranded DNA virus that belongs to the Orthopoxvirus genus of the Poxviridae family. Monkeypox is a Poxvirus in the same family as variola, the virus that causes smallpox and cowpox viruses and likely evolved in animals before jumping to humans. Monkeypox is a zoonotic disease, which means that it can spread between animals and people. But just because an animal can get infected with monkeypox doesn't mean they can pass it on. There is a difference between accidental hosts and a reservoir. Accidental hosts are often dead ends for the virus. A true reservoir species must be able to pass the virus from animal to animal, and then sometimes to humans they encounter.

There are two distinct genetic clades of the monkeypox virus: the central African (Congo Basin) clade and the west African clade. The Congo Basin clade has historically caused more severe disease and was thought to be more transmissible.

Natural host of monkeypox virus

Various animal species have been identified as susceptible to monkeypox virus. This includes rope squirrels, tree squirrels, Gambian pouched rats, dormice, non-human primates and other species.

Monkeypox in pets and other animals

About 80 percent of the potential new hosts for monkeypox are rodents or primates, the researchers predict. But domestic animals like dogs and cats were also predicted to be susceptible to infection. Red foxes and brown rats are two potential monkeypox hosts. Monkeypox virus can infect a wide range of mammal species, including monkeys, anteaters, hedgehogs, prairie dogs, squirrels, shrews and dogs. There has been a single report of sick people transmitting Monkeypox virus to animals (a dog).

- Now for the first time, a case of a pet dog getting monkeypox has been documented.
- The evidence shows the virus caused real canine disease and highlights the need for infected people to isolate themselves from their pets.
- A dog in Paris has caught monkeypox from one of its owners, both of whom were infected with the virus, according to a scientific paper published on Aug. 10, 2022. The dog was an Italian greyhound. This is the first case of a dog contracting the monkeypox virus through direct contact with skin lesions on a human.
- These examples show which animals can be infected with Monkeypox virus. It also indicates that not all animals of this type are susceptible, this may vary by species, and variety or strain of the animal.

Here is a list of animals likely to get affected:

- Prairie dogs
- Squirrels
- Marmots and groundhogs
- Chinchillas
- Giant-pouched rats
- Dogs
- Monkeys
- Apes

Modes of transmission

WHO, has added: It's the first time, so it means that dogs can be infected, but it doesn't mean that the dog can transmit the disease and infect other dogs, nor does it mean that the dog can re-infect human if it is infected.

i. Infected animals can spread Monkeypox virus to people, and it is possible that people who are infected can spread Monkeypox virus to animals through close contact, including petting, cuddling, hugging, kissing, licking, sharing sleeping areas, and sharing food.

ii. Monkeypox virus can be found in the rash caused by monkeypox (scabs, crusts, fluids) and infected bodily fluids, including respiratory secretions, and potentially in urine and faces.

iii. The monkeypox virus is also present in saliva.

iv. The Centres for Disease Control and Prevention says Monkeypox can spread by touching fabrics like bedding.

Signs, symptoms of monkeypox in pets

The CDC said potential signs of illness among pets include

- Fatigue, lack of appetite, coughing, nasal secretions or crust, bloating, fever and conjunctivitis (aka pink eye)
- Monkeypox's distinctive lesions, which may appear as a pimple- or blister-like rash
- If a rash or two other clinical symptoms appear on a pet within 21 days of exposure, the CDC urges people to notify their veterinarian to get a professional assessment.
- Signs of monkeypox in dogs include development of a new rash, which to date has been located on the abdomen and anus.

However, it's important to keep in mind those are common symptoms of a lot of respiratory diseases or viral infections.

What to do if a pet shows signs of monkeypox

i. Do not surrender, euthanize, or abandon pets just because of a potential exposure or Monkeypox virus

ii. Do not wipe or bathe your pet with chemical disinfectants, alcohol, hydrogen peroxide, or other products, such as hand sanitizer, counter-cleaning wipes, or other industrial or surface cleaners.

iii. Get your pet tested if they have had close contact with a person with probable or confirmed monkeypox and they have a new rash or two other clinical signs. Call your veterinarian if you notice an animal appears sick within 21 days of having contact with a person who has probable or confirmed monkeypox.

iv. Separate the sick pet or animal from other animals and minimize direct contact with people for at least 21 days after becoming ill or until fully recovered.

v. Wash your hands often and use personal protective equipment (PPE) when caring for and cleaning up after sick animals. PPE includes wearing gloves, using eye protection (safety glasses, goggles, or face shield), wearing a well-fitting mask

or respirator (ideally a disposable NIOSH-approved N95 filtering facepiece respirator), and wearing a disposable gown.

vi. Bedding, enclosures, food dishes, and any other items in direct contact with infected animals must be properly disinfected

vii. Frequent hand washing is also recommended when handling the pet.

Treatment

Precautions: If you have monkeypox, isolate at home in a separate room from family and pets until your rash and scabs heal. There is no specific treatment approved for monkeypox. Health care providers may treat monkeypox with some antiviral drugs used to treat smallpox, such as tecovirimat (TPOXX) or brincidofovir (Tembexa).

Vaccines: The effectiveness of the Imvanex® smallpox vaccine in preventing monkeypox has only been studied in animals.

THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
August, 2022; 2(8), 1530-1532

Popular Article

'Red Bag' Delivery or Placenta Previa: An Emergency in Mares

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https://doi.org/10.5281/zenodo.7042446

Abstract

Mares have an active and fast labor process where the foal is born within 30 minutes from the start of active labor. Any complications during foaling can result in loss of foal, if timely assistance is not provided. One such foaling emergency condition is 'red bag' delivery or placenta previa in which premature placental separation of chorioallantois results in protrusion of intact fluid-filled red velvety-looking chorioallantois through vulva of mare (the characteristic dark red color of placenta gives the condition its name). Failure of chorioallantois to rupture and its subsequent separation from uterus results in hypoxia to fetus leading to a life-threatening emergency. The condition, though rare can be managed through timely intervention during foaling.

Introduction

Mares have diffused type placenta; the entire surface of the outer placental membrane (allanto-chorion) is covered with villi and microvilli that penetrate into the crypts of endometrium and the inner placental membrane (amnion) which surrounds the foal. The entire endometrium and chorion take part in the placentation via micro-cotyledons except at the region of the internal os of the cervix. As a result, the surface of outer chorion having micro-cotyledons has a 'red velvety' appearance but the placental surface appears 'smooth white' at the cervix internal os region. The latter is known as cervical star. This diffused placental bed helps in exchange of nutrients and gases between the dam and fetus.

Equine births are accomplished in shortest labor duration when compared with other domestic species. Normally, the first stage of labor lasts 1-4 hour in which the cervix begins to relax and the uterine contractions increase in frequency and intensity. It is characterized by signs of abdominal discomfort and restlessness. Patches of sweat appear behind the elbows and on flank. The fetus rotates from a dorsopubic to a dorsosacral position inside the birth canal before expulsion. Increasing contractions of the uterus causes protrusion of the chorioallantois through internal-os of cervix.

In eutocia, chorioallantois ruptures at the cervical star leading to release of large amount of allantoic fluid (tea-colored) that lubricates the birth canal to facilitate birth. This is followed by second stage of labor which lasts 15–30 minutes. The amnion (white fluid filled membrane) containing the fetus protrudes from the vulva and strong contractions (uterine and abdominal) result in the expulsion of fetus. The third stage involves expulsion of fetal membranes (within 3 hours of foaling).

Occasionally, an emergency situation arises during foaling due to change in the series of events occurring during labor process. One such condition that occurs (though rarely) is 'red-bag' delivery or placenta previa in which premature separation of outer placental membrane from the uterine wall (chorioallantois) leads to protrusion of intact fluid-filled red velvety-looking chorioallantois through vulva while fetus lies within the amnion. This characteristic dark red color of the outer surface of chorioallantois gives rise to this common term for premature placental separation – "red bag".

"Red-bag delivery": why an emergency?

It is uncommon and accounts for 5-10% of all causes of abortion, perinatal death or stillbirth in equine. In this condition, the outer placental membranes (chorioallantois) fail to rupture during labor and there is subsequent separation of attachments between uterus and placenta leading to rapid hypoxia (decrease in oxygen transport) to the fetus as the placenta is foal's only life support in-utero. As a result, the fetus may die of asphyxiation if immediate intervention is delayed.

a) Normal foaling with amnion containing the fetus

b) 'Red bag' delivery (appearance of cervical star)
Red Bag Delivery - Olive Grove Equine Clinic (ogec.com.au)

that influence abnormal detachment of placenta include: a) Placentitis due to bacterial or viral infections; b) Extended labor duration with dystocia and dead foal; c) Fescue toxicity resulting from digestion of grass infested with an endophytic fungus, *Acremonium coenophialu* (Cross, 2011); d) stress

Diagnosis: Premature placental separation can be possibly diagnosed by ultrasound examination of gravid uterus. In case of chronic condition, mild blood loss or cervical discharge may be noticed from vulva. Confirmation of this condition during foaling can be made by observing the cervical star

located on the chorionic surface.

Management: Vigilance during foaling is necessary. If a mare is in second stage of labor and there is protrusion of red-velvety placenta instead of the greyish-white amnion, this should be considered as an emergency (red-bag delivery). Recognition of condition and timely intervention are the key factors to manage this condition. Veterinary assistance should be called with immediate delivery of foal. The procedure involves immediate opening of chorioallantois (red-bag) with knife or scissors which results in release of large quantity of allantoic fluid. The foal in the amnion should be located and delivery by necessary obstetrical procedures. Foal should be administered oxygen, if available as this condition results in hypoxia.

In conclusion, 'red-bag' delivery should be treated as an extreme emergency with vigilance and immediate intervention to save the life of foal. Necessary care of the pregnant mare should be taken during gestation to avoid this complication by keeping the causes in check.

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THE SCIENCE WORLD

A Monthly e Magazine

Pets & Vets

Vol 2 Issue 9

September, 2022

Visit official Website
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ISSN:2583-2212

THE SCIENCE WORLD

A Monthly e Magazine

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August, 2022
Vol 2 Issue 8

Visit official Website
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