THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
Sept, 2023; 3(09), 2397-2400

Popular Article

Drug Residues: Potential Threat to Public Health

Poonam Sharma[1], Chhavi Bharadwaj[1], Poonam Shakya[2*], Anju Nayak[3], Ajay Rai[4]
[1]MVSc Scholar, Veterinary Microbiology, College of Vety. Sci. & A.H., NDVSU Jabalpur
[2]Associate Professor, Veterinary Microbiology, NDVSU Jabalpur
[3]Professor & Head, Veterinary Microbiology, NDVSU Jabalpur
[4]Assistant Professor, Veterinary Microbiology, NDVSU Jabalpur
https://doi.org/10.5281/zenodo.8377544

Abstract

The public is always on threat of getting illness on consuming drug residues from animal food products. Number of drugs are used to treat many livestock and aquaculture diseases and hence endangering consumer health. Illegal and excessive use of veterinary drugs in animals and marine life cause a serious adverse effect to public and other organisms. There are some factors that can be considered for drug residue, such as pharmacokinetic characteristics, physicochemical or the biological process through which animal deals with the drug. The reason could be improper drug usage and failure to keep withdrawal period, these drug residues majorly lead to development of drug resistance, mutagenicity, carcinogenicity teratogenicity and disturbance to intestinal microflora in human being. These are not a sudden clinical finding; these develops with time. It is necessary to develop fast analytical methods to effectively detect drug residues in animal products and familiarize all animal health professionals with the pharmacokinetic, pharmacodynamics and toxicological effects of veterinary drug to make it least public health concern.

Keywords: Food animal products, public health significance, Residues, Detection Methods.

Introduction

Veterinary drugs are used for treatment and prevention purposes in animals. In a recent times drugs are becoming so important to meet the challenges of providing sufficient amount of food for the continuously growing population, as many drugs are used to improve weight gain, milk yield, to increase feed conversion ratio and all in all to fasten the growth rate of animal. However, this increase in productivity do not come with some lacunas, i.e. drug residues and posing a public health hazard. Hence this is the major worldwide issue concerning food contamination.

According to European Union and Food and Drug Administration (USA), residues are "pharmacologically active substances (whether active principle, recipients and degraded products) and their metabolites which remain in foodstuff obtained from animal to which the veterinary medicinal preparation in question has been administered. In process of aquaculture use of drugs can easily lead

to water pollution and drinking water. Usually, major part of the drug residue eliminates through urine and some from faeces but may also found in milk, eggs, meat and aquaculture bodies. According to protocol no animal product should be consumed before completion to withdrawal period mentioned on the drug label. So, by using high efficiency analytical methods, which shows that there is always presence of detectible residues, but these residues are at really low concentrations and nontoxic until gets accumulated in the body over a long period. This review put light on overview of the risk associated with the drug residues, global impact and consumer health and to provide a safety evaluation and control measures of drug residues in animal food products.

Risk Associated with Residues in Animal Food Product

Major contamination related to consumption of animal food product is drug residue contamination. On a normal basis an animal food product should not contain any residues. But as not following dosage instructions, not giving heed to withdrawal period, administering a single large dose on one site, use of drug contaminated equipment's, improper dosing, extending antibiotic dose without prescription, letting animals to feed on drug spilled feed and excessive use of pesticides.

Liver and kidney are two major detoxification sites in body. Drug residues accumulation is mainly related with human mismanagement such as use of banned drugs, giving antibiotics for periods longer than required. There is also, animal to animal drug transfer. Risk factor responsible for the development of residue are:

Age of animal

Weaning status and with little impact of age of the animal affect drug deposition. There were several studies conducted on different drug comparison between weaned and unweaned calves, between young and old age adults. For instance, norfloxacin nicotinate has longer clearance time in weaned calves; reason could be increase in weight due to ruminal fluid. Similarly, Sulfamethazine has shorter clearance time for grain fed calves than weaned ones. In the same way tindazole have shorter clearance time in unweaned calves than adults and apramycin have longer clearance time in calves. Reason could be immature drug clearance system.

Feeding

Bioavailability of drug can depend on diet. For instance, study conducted to check the effect of diet on orally administered fenbendazole bioavailability on cattle and buffalo, shows animal receiving feed containing green fresh herbage had lowered bioavailability of drug. As fenbendazole remains in rumen, released progressively with digesta, the presence of fresh herbage increases gut motility and flow of ingesta, this depletes the bioavailability of drug. With feed gut content can also affect drug uptake.

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published: 24.09.2023

Condition of animal

Animal condition can affect pharmacokinetics of drug administered, which can lead to potential residues. This can depend on whether animal having condition related to metabolism or infection and inflammation causing the drug to accumulate in affected tissues or organ. For instance, cattle with acute mastitis, apramycin penetrate the affected areas and drug residues have been found 10 times more than to not affected cow. It is also observed that level of ketoprofen increases during clinical mastitis. Calves with experimentally infected with faciolosis cause increase in elimination half-life of antipyrine but decrease in oxytetracycline. The mechanism given behind is the changes in the liver function.

Pharmacokinetics

Term refers to the movement of drug into, through and out of the body including its absorption, bioavailability, distribution, metabolism and excretion.

a) ***Absorption***- Process by which drug/compound passes from site of administration into bloodstream. Absorption is influenced by many factors such as drug properties, route and physio pathological state of animal.

b) ***Distribution***- process by which drug or absorb compound is distributed to all tissues and organs and then site of action. Only a part (fraction) of drug is delivered to exert activity at site of action. Parameter defining distribution is volume.

c) ***Metabolism***- it is the principal mechanism of elimination for transformation of drug or xenobiotic into metabolites. Liver plays very important role in metabolism of drugs. Elimination is mainly done by kidneys. All though some drugs are eliminated and unchanged, mostly undergo metabolism by liver.

d) ***Excretion***- it is the process of elimination of drug are the metabolites. Elimination is mostly done through release in body fluids, so here kidney place very important role in the elimination of drug. Renal insufficiency generally affects rate of elimination of drug/metabolite. It is also noted that general ability to excrete drug largely varies with species variation, for example birds are good biliary excreters compared to sheep and rabbit.

Disturbed Withdrawal

It is the time period during which the drug residues, reaches safe concentration where there is no harm in consuming animal food products when people do not follow protocols according to withdrawal period, chances of retention of drug residue in animal product become high.

Public health concern

Generally low-level residues do not generate adverse effects of residues. But when present in higher level can cause antibiotic resistance and hypersensitivity reaction.

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published: 24.09.2023

Detection of residues

Usually, detection of veterinary drug residues in animal products require sample preprocessing, instrumentation, method establishment and data analysis to evaluate stability, precision and sensitivity of the method. Animal obtain food usually have complex matrix and many endogenous interfering substances, making it difficult to directly detect drug residue. Some pretreatment steps are required such as extraction, purification, evaporation, concentration and reconstitution.

Control and prevention from residues

Self-monitoring and control of residue are based on standardized analytical methods. Regulatory framework on force in EU (European Union) based on Directive 96/23/EC, which structures the networks of laboratory approved for residues control, laying down requirements in terms of quality and performance of analytical methods (Decision 2002/657).

There is two-way approach (1) Detection of residues using tests (2) followed by confirmation, requiring quantification against mean residual limit and identification with low rate of false positives. There are some prevention steps which can be taken to avoid drug residues (1) proper herd health management, maintaining clean healthy environment (2) use of licensed drug with proper drug dosage (3) making proper conversation between veterinarian client patient (4) maintenance of treatment records (5) following proper withdraw time period (6) creating awareness.

Conclusion and Recommendation

The use of veterinary drugs in food producing animals has the potential to generate residues in animal derived products and possess a health hazard to the consumer. Veterinarians are facing a dramatic change in attitude and behavior concerning drug residues because of the therapeutic and prophylactic use of drugs. Until recently, veterinarians did not pay sufficient attention to ensuring that the producers adhered strictly to the withdrawal period of milk, meat and egg and aquaculture product from animals treated with variety of drugs. The most likely reason for dug residues may result from human management, such as improper usage, including extra label or illegal drug applications. However, the most obvious reason for unacceptable residues might be due to failure to keep to the withdrawal period, including using over dose and long-acting drugs. There is also limited information on the magnitude of veterinary drug residue worldwide. Hence, an extensive work has to be carried out to prevent the occurrence of veterinary medicinal preparation residues and to familiarize all animal health professionals with pharmacokinetic, pharmacodynamics, and toxicological effects of drugs and their control.

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published: **24.09.2023**