ISSN 2961-5887

VETERINARY RESEARCH NEWS

2023 JULY

VOLUME 02 : ISSUE 01

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FB: SLVRI at 2022

Website : www.vri.lk

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Editor's Note :

Minimizing zoonotic diseases risk, awareness on "mpox" or Monkey pox

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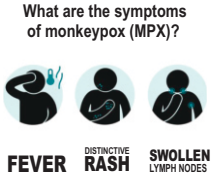
As we all know, only few cases of monkey pox were reported in Sri Lanka. A significant number of cases have been reported in North America, South America, and Europe. However, the number of cases are in increasing in trends in globally and also it is considered as a neglected disease. The first human case was reported in the Democratic Republic of Congo (DRC) in 1970. The disease was reported outside of Africa mostly in recent past due to people movement and migration in the USA, UK, Israel, and Singapore. Importantly, the disease can be transmitted from animal to human and human to human.

The transmission occurs through direct contact, contaminated body fluids, and contaminated respiratory droplets. Generally, human gets the infection through direct contact with the infected animal or contaminated materials. The face-to-face (such as talking or breathing close) or skin-to-skin (such as touching or vaginal/anal sex); mouth-to-mouth (kissing); or mouth-to-skin contact (such as oral sex or kissing the skin) are considered as major risk factors for dissemination of diseases in human population. During the global outbreak that began in 2022, the virus mostly spread through sexual contact.

Furthermore, human to human transmission of monkey pox has been reported through placental membranes, direct contact with skin and through fomite. The hospital acquired infections and sexual transmission have also been reported in humans. In addition, monkey pox virus persists for some time on clothing, bedding, towels, objects, electronics and surfaces. The virus spreads to feotus during pregnancy, during or after birth through skin-to-skin contact, or from a parent with mpox to an infant or child during close contact.

Although clinical signs and symptoms are varied from non-symptomatic to severe clinical diseases, pregnant, children and persons that are immunocompromised, including people with untreated and advanced HIV disease were identified as high risk group for mpox. The most common clinical signs is rashes which is lasted for 2-4 weeks followed by fever, headache, muscle aches, back pain, low energy and swollen lymph nodes. The rash looks like blisters or sores and commonly found in face, palms of the hands, soles of the feet, groin, genital and/or anal regions, mouth, throat, anus, rectum or vagina and in eyes. The first five days, fever, lymphadenopathy, back pain, extreme headache, myalgia (muscle ache), and severe asthenia (energy shortage) are reported in the infected humans. The macular-papular lesions appear in the first 1 - 3 days of fever and develop into to fluid filled blisters. The blisters rupture and crusts develop within 10 days.



Proctitis or inflammation of inside the rectum is considered as the most painful clinical sings of mpox. However, disease may lead to severe clinical infections such as brain (encephalitis), heart (myocarditis) or lungs (pneumonia), and eye infections. The no symptomatic disease has been reported with an unknown prevalence in humans.

Non-human primates and rodents had been suggested for harbouring the virus in the environment as rope squirrels, tree squirrels, Gambian pouched rats and dormice.

Inclusion body hepatitis – an emerging infectious disease of poultry in Sri Lanka

Inclusion body hepatitis (IBH) is an infectious disease in poultry caused by fowl adenoviruses. The disease has been noted to be emerging both globally and nationally during the last few years. Apart from IBH, fowl adenoviruses are also responsible in causing hepatitis-hydropericardium syndrome and gizzard erosion and ulceration in poultry as major disease entities. These conditions may occur together with IBH or in isolation. IBH is usually seen in broiler chicken aged between 3-7 weeks. However, the condition has been reported in birds as young as 7 days and old as 20 weeks and also in layer birds although rare. Mortality can range between 5-20% which may also reach up to 30%-40% when young broiler chickens are affected.

The disease has been first reported in chicken in 1963, where it was described as "acute hepatic catastrophe" due to its prominent pathological effects on liver. IBH suspected clinical cases were encountered in Sri Lanka from 2019. Districts where the disease has been mostly reported during 2019-2022 were Kurunegala, Puttalam, Gampaha, Colombo and Matale. The clinical signs observed were; pale comb and wattle, inappetence, depression, respiratory signs and mild degree of diarrhea. Mortality was commonly observed to be between 4-12%, but also detected to be low as 2% and as high as 50% in a few outbreaks encountered. Most commonly affected birds were the broiler chickens in between 2-4 weeks of age.

Necropsy examinations were conducted on the affected birds and the most remarkable post mortem lesions could be detected in the liver, where enlargement with mottling or patchy white to yellow discolouration could be observed with crumbly texture denoting necrosis. Multifocal haemorrhages were also spotted in liver and kidney of many cases, whereas pneumonic lesions with or without tracheitis could be noted in approximately half of the cases. Some cases were associated with hydropericardium and/or enteritis. Gizzard erosions were also detected in a few cases. Histopathological examination was conducted on tissue samples of affected chicken at the Pathology Laboratory of Veterinary Research Institute. The most prominent lesion observed was necrotizing hepatitis with presence of inflammatory cells (mainly lymphocytes) and intra-nuclear inclusion bodies either basophilic (pathognomonic) or eosinophilic or even both.

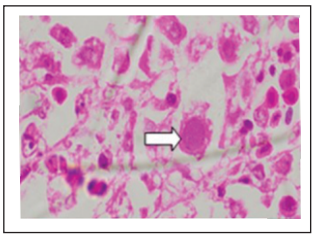


Figure 1. Large basophilic intra-nuclear inclusion body in a hepatocyte (arrow) associated with inflammatory reaction.
Liver, H&E, x1000

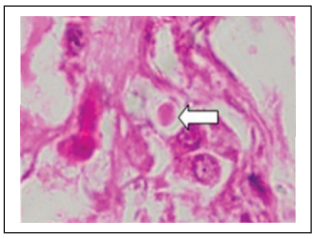


Figure 2. Intra-nuclear eosinophilic inclusion body (arrow) surrounded by a halo in a hepatocyte.
Liver, H&E, x1000

Apart from IBH, chickens of some farms showed concurrent infections since fowl adenoviruses can affect the immune competency of infected chicken. On the other hand, immunosuppressive diseases such as infectious bursal disease and chicken anaemia can also predispose birds to secondary IBH infection.

Since IBH can be transmitted both vertically and horizontally, best preventive option is vaccination of broiler breeding flocks, which should be serotype specific with the serotype/s circulating in the country to ensure effective protection. Therefore identification of fowl adenoviral serotype/s involved in causing IBH and /or hepatitis-hydropericardium syndrome in Sri Lanka is of utmost importance. According to a preliminary study conducted by Zoysa et al., 2022 (Faculty of Veterinary Medicine & Animal Science, University of Peradeniya) using samples collected from Western and Central provinces, serotypes 2 and 8b have been identified in Sri Lanka. A research study is currently underway at the Animal Virus Laboratory of Veterinary Research Institute for characterization of fowl adenoviruses associated with inclusion body hepatitis in Sri Lanka.

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Emergence of *Salmonella* Infantis : Food safety and hygienic practices to eliminate salmonellosis

Salmonellosis is an important foodborne gastrointestinal disorder that is linked to the consumption of *Salmonella*-contaminated food products. In Sri Lanka, many different sources of *Salmonella* contamination have been reported, including broiler chicken meat (11.6%), shrimp (25.5%), meat (17.7%) and fish (5.6%). Although there are more than 2500 serotypes of *Salmonella,* the vast majority of human illnesses are caused by serotypes from subspecies enterica. Centers for Disease Control and Prevention in the United States estimates that *Salmonella* bacteria cause about 1.35 million infections, 26,500 hospitalizations, and 420 deaths every year, and food has been identified as the source of most of the illnesses.

In Sri Lanka, the dominant motile *Salmonella* serovars transmitted through chicken meat previously were *Salmonella* Enteritidis and *Salmonella* Typhimurium. However, since 2016, *Salmonella* Infantis has emerged as one of the most commonly isolated serotypes of *Salmonella* from poultry sources in the United States. *Salmonella* Infantis is considered an emerging serovar in Europe and has been reported in broiler farms and poultry meat. Nevertheless, this is the first report of *Salmonella* Infantis found in chicken meat in Sri Lanka, with the reporting starting in 2023.

Furthermore, *Salmonella* Infantis is also known as poultry-adapted *Salmonella* enterica serovar, which could be attributed to its persistence despite cleaning protocols. The constant use of 2-3% NaOCl as biocide can trigger tolerance, adaptation and resistance to these reagents.

This brings attention to the importance of food safety and hygienic practices to ensure public health. Identifying the predominant *Salmonella* serotype is essential in implementing control measures.

Control measures should be focused on:

- Health and biosecurity at breeder farms: Healthy breeder hens lead to healthy eggs and eventually, healthy chicks.
- At the hatchery where the chicks are hatched, strict sanitation measures and appropriate vaccinations ensure that the chicks are off to a healthy start.
- At the feed mill, heat- or chemical-treated corn and soybean meal that the chickens eat ensures the killing of any bacteria that may be present.
- On the farm, veterinarians and strict biosecurity measures ensure chickens are safe and healthy.
- At the processing facility, chicken processors should ensure that every single chicken product is safe and wholesome and abide by the monitoring programme of the Department of Animal Production and Health.
- Consumers also play a pivotal role in food safety: Remember to follow the clean, separate, cook and chill guidelines to help keep you and your family safe from *Salmonella.*

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Bovine abortions due to infectious organisms

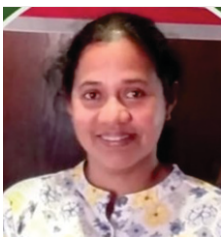
The dairy industry becomes profitable only when a post-pubertal heifer or cow produces a healthy calf each year. Abortions are a major cause for decreased profits of a dairy enterprise as it detrimentally affects the health of the dam, increases inter-calving interval, reduces milk production, reduces the number of calves born, and increases culling of animals.

Abortions occur due to infectious pathogens and non-infectious causes. Infectious causes for abortions can be bacteria, viruses, protozoa and fungi. Non-infectious causes include physical trauma, nutritional deficiencies, genetic abnormalities and exposure to toxic chemicals.

In many countries the most important diseases causing abortions in cattle and buffaloes are bovine viral diarrhoea, leptospirosis, neosporosis & brucellosis. The following table shows some common abortifacient organisms, particular time of the gestation period in which they generally cause abortion and the type of samples that should be collected and sent for laboratory diagnosis.

Pathogen type	Organism	Time of abortion occurrence during gestation	Required samples
Bacteria	*Brucella abortus*	3rd trimester	fetus (stomach content, spleen, and lung), fetal membranes, vaginal secretions, colostrum, milk
	Leptospira	3rd trimester	Dam sera, Fetus, placenta
	Salmonella Dublin	3rd trimester	Fetal fluids, fresh tissue
	Campylobacter fetus subsp. *venerealis* *C. fetus* subsp. *fetus*	Early embryonic death 2nd - 3rd trimester	Placenta, fetal tissue & stomach content
	Listeria monocytogenes	3rd trimester	Placenta, fetal tissues
	Bacillus cereus	3rd trimester	Placenta, fetal tissues & fetal fluids
	Mycoplasma bovis	3rd trimester	Placenta, fetal tissues & fetal fluids
Viruses	Bovine viral diarrhoea virus	All trimesters	Dam sera, fetal fluids & fresh tissues
	Blue tongue virus	2nd – 3rd trimesters	Fetal tissue, fetal brain
Protozoa	*Neospora caninum*	3-8 months (usually 5 months)	Dam sera, fetal fluids, placenta, fetal brain, heart, liver
	Tritrichomonas fetus	Early embryonic death	Uterine discharges, placenta, fetus
	Babesia bovis & *B. bi- gemina*	All trimesters	Dam whole blood, serum
Fungi	*Aspergillus fumigatus*	4 months to term	Placenta, fetus including (fetal stomach contents)

Many Sri Lankan farmers do not realize the economic loss and the detrimental effects of sporadic abortions to their livestock enterprise, as the dam does not die in most cases. Successful diagnosis depends on rapid submission of correct samples appropriately. Therefore, farmers should be made aware of the importance of preventing abortions and asked to report abortions in their farms to the veterinary surgeon as soon as possible because some of these diseases are notifiable and/or zoonotic. In order to control abortions of infectious origin and improve the dairy industry of the country, collaborative and collective effort of farmers, veterinary surgeons and field staff, laboratory personnel and policy makers is essential.



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Rejection of Raw Milk Based on Ethanol Stability - Is it fair?

The Ethanol Stability (ES) or alcohol test was established in the 1930s to identify milk with acidic pH, milk mixed with colostrum, or milk from a cow with mastitis. Initially, this simple and Inexpensive test determined casein precipitation in relation to milk pH. Milk that remained stable at 68% ethanol was considered to have acceptable microbiological quality. However, with the discovery of an indirect relationship between ES and the stability of milk at high temperatures (heat stability - HS), the test began to be used as a measure of HS instead of microbiological quality.

Due to the expensive and unavailable nature of HS testing methods at milk collecting centers, many developing countries, including Sri Lanka, rely on ES as an indirect measure of HS.

The interest in HS has increased in recent years, especially with the production of ultra-high temperature milk (UHT), which

subjects milk to high temperatures during processing. As a result, raw milk is now tested for its stability at higher ethanol percentages (>74%), rendering the use of 68% ethanol obsolete in most places. Processors are highly concerned about ES due to the significant economic loss caused by milk coagulation in processing plants. This has led to the use of very high ethanol percentages (84-86%) to test ES. Consequently, a considerable amount of milk stable at low ethanol percentages (>68%) and suitable for low heat treatments, such as pasteurization, is unfairly being rejected.

Recent research has discovered that the presence of higher levels of ionized calcium (Cai) in milk has been associated with decreased heat stability, making the milk more prone to coagulation or precipitation. Milk contains calcium in two forms: Cai, present in the aqueous phase, and non-ionized calcium (Ca), found in the colloidal phase as calcium phosphate. Normally, these two forms are in an equilibrium, preventing the aggregation of casein micelles. However, environmental changes that alter hydrophobic interactions and calcium phosphate solubility, such as increased acidity (H+), changes in salt balance, and elevated temperatures, have been identified as factors that raise milk Cai or reduce milk HS.

A study conducted at the Veterinary Research Institute aimed to understand the relationship between milk Cai and ES. It found no significant relationship between Cai and ES beyond 74% ethanol.

Therefore, rejecting milk stable at 68% - 74% ethanol solely based on ES is a waste. There is potential for utilizing such milk in processing that requires low heat treatments.

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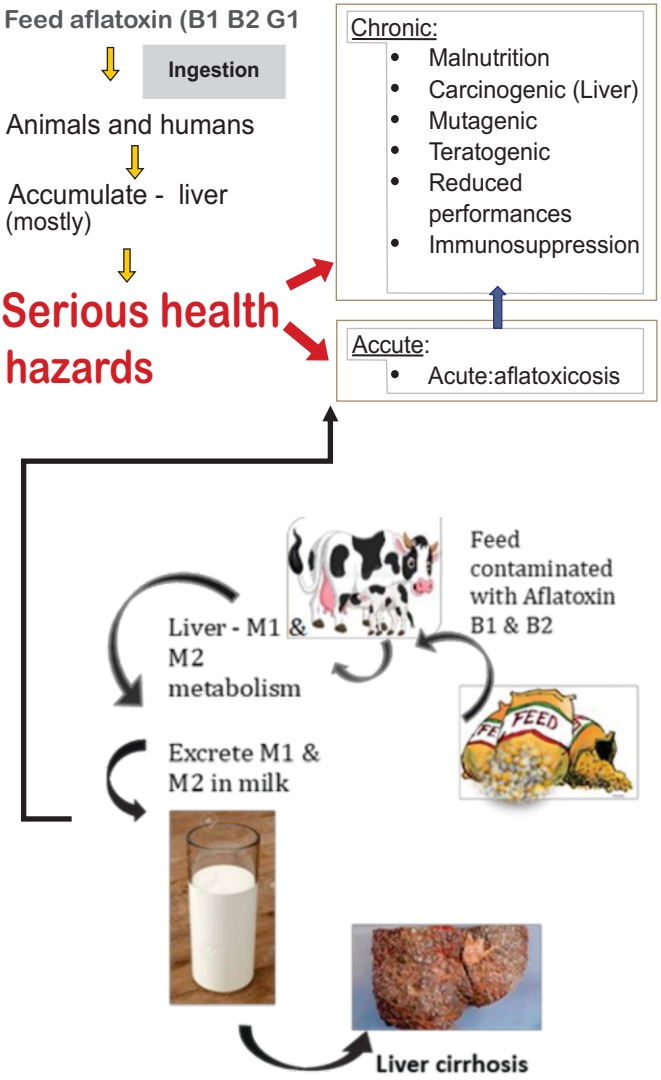
Total aflatoxin occurrence in suspected animal feed samples

Introduction

Aflatoxins - mycotoxins produced - by naturally occurring, ubiquitous Aspergillus species - in grains and crops stored at warm, humid and dark environments.



Objective

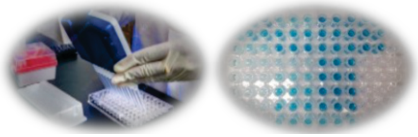
To get an overall understanding on aflatoxin contamination in suspected animal feeds submitted for testing (2017-2020).

Methodology

Feed received from the industry

- Suspect of poor animal performances
- Sales need
- Manufacture's self-quality

Compound feed (Cattle feed, Poultry feed etc.)	**Feed Ingredients** (Maize, Coconut poonac etc.)



Enzyme Linked Immuno-Sorbent Assay (ELISA)

Results

2017-2020	Compound feed	Feed Ingredients
Total = 177	67 (38%)	110 (62%)
Positive for total aflatoxins	40 (22%)	33 (19%)
Exceeds the FDA regulatory limits of 20ppb (Total 18)	**6 (Cattle feed 33%)** 6 (Other feed)	**4 (Maize 22%)** 2 (Other)

Discussion

Out of all 177 samples ⟹ 41% (73) ⟹ positive for total aflatoxin

25% (18/73) exceeded accepted limit 20ppb (Sec.683.100 Action Levels for Aflatoxins in Feed)

75% (55/73) ⟹ within accepted limit (Possible to use as animal feeds - leave no residues

Conclusion

From total samples, 10% had hazardous level of aflatoxin contamination, could result in aflatoxin in animal products causing public health hazards.

Suggestion

To assure animal and public, health it is essential to monitor animal feeds routinely.

Current situation

This analysis was based on samples received to Animal Nutrition division/VRI, during 2017 to 2020 and tested with ELISA. At present, aflatoxin B1, B2, G1 & G2 analysis and confirmation is done by LCMSMS and the current reported incidence is higher than the previous years.

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Introduction of Hybrid Napier CO-5 to Sri Lanka as a potential fodder variety

To address the lack of enhanced fodder varieties in the country, the Cumbu Napier hybrid CO (BN)-5: (Pennisetum glaucum × P. purpureum Schumach) was introduced to Sri Lanka from India in early 2020. Initial experiments conducted in India revealed its superiority in terms of yield, protein content, and energy content compared to other forage crops.

One of the key advantages of CO-5 is its ability to produce a higher number of tillers, featuring soft stems with high sugar content. This characteristic not only makes the fodder more palatable for livestock but also enhances its productivity. In order to distribute this hybrid among farmers, an experimental study was conducted in the mid-country wet zone of Sri Lanka.

The experiment was conducted at the Veterinary Research Farm in Gannoruwa, using a spacing of 1m x 1m between rows and plants, which is consistent with the spacing used for other Napier hybrids like CO-3, CO-4, and Pakchong. The crops were harvested at different intervals of 4, 6, 8, 10, and 12 weeks.

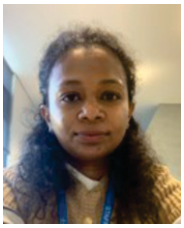
This study was conducted under rain-fed conditions without irrigation, during both the Yala and Maha seasons.

The growth characteristics yield, and nutritional values were analyzed at each harvesting interval to determine the optimal time for harvest based on performance and nutritive value.

Laboratory analysis of samples revealed that the highest dry matter yield (Yala: 12.54 mt/ha and Maha: 5.13 Mt/ha) was obtained at the 12th week of maturity during both seasons. However, from a nutritional standpoint, harvesting during the 6th week of maturity in the Yala season (Crude Protein: 11.90%, Metabolizable Energy: 8.63 MJ/KgDM, Acid Detergent Fiber (ADF): 37.75%, Neutral Detergent Fiber (NDF): 67.70%) and the 8th week of maturity in the Maha season (Crude Protein: 15.46%, Metabolizable Energy: 9.46 MJ/KgDM, Crude Fiber: 28.97%) would be more beneficial for farmers in the mid-country wet zone.

It should be noted that yield and nutritive values may vary depending on agro-climatic zone, soil conditions, climate, irrigation, and fertilizer application. Therefore, it is recommended to conduct a prior soil analysis in order to establish Hybrid Napier CO-5 successfully in Sri Lanka. Additionally, fertilization should be carried out based on the soil condition to obtain superior yield and nutritive values.

In conclusion, the introduction of Hybrid Napier CO-5 holds significant promise for Sri Lankan farmers as a potential fodder variety. Its exceptional yield, protein content, and palatability make it a valuable addition to the ruminant feeding in Sri Lanka. By conducting further research and adopting appropriate cultivation practices, we can optimize the benefits of this hybrid in different regions of the country.



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Immature Paramphistomiasis: A Growing Concern in Sri Lanka

Introduction:

In this edition of VRN, we shine a spotlight on a rising animal health concern in Sri Lanka - immature paramphistomiasis of cattle. This neglected tropical disease, caused by immature *paramphistome* flukes, poses significant challenges to both human and animal health in the country. Join us as we delve into the intricacies of this parasitic infection, its impact on Sri Lanka, and the efforts being made to combat it.

Understanding Immature Paramphistomiasis:

Immature paramphistomiasis, also known as immature rumen fluke infection, is caused by a trematode parasite called Paramphistomum spp. These parasites primarily infect the rumen and reticulum of ruminant animals, including cattle, buffalo, goats, and sheep. The infection occurs when animals ingest water or vegetation contaminated with the larvae of the parasite.

In Sri Lanka, where agriculture and animal husbandry play significant roles in the economy, immature paramphistomiasis has emerged as a major concern. The country's favorable climate and abundant water sources create an ideal environment for the parasite's life cycle, contributing to its prevalence in livestock populations.

Health Impact on Livestock:

Immature paramphistomiasis poses several health challenges to livestock. The immature flukes attach themselves to the lining of the upper one-third of the small intestine, burrow into the epithelium and feed on the animal's blood, leading to diarrhoea, anemia, and decreased nutrient absorption. Gradually as they mature, they migrate into the rumen along the wall of the small intestine, reticulum, and rumen. Finally, the mature flukes get attached to the mucosa of the rumen as the final predilection site.

Affected animals often display symptoms such as diarrhoea, anaemia, sub mandibular oedema, weight loss, decreased milk production, and general weakness. In severe cases, it can even result in death.

The economic impact of this disease is substantial, as it significantly reduces the productivity and profitability of the livestock industry. Farmers face financial losses due to decreased milk yield, poor reproductive performance, and the cost of treatment and control measures. Moreover, the chronic nature of the disease can result in long-term damage to the animals' organs, further exacerbating the economic burden.

Life Cycle of *Paramphistomum* spp:

The life cycle of Paramphistomum spp., the trematode parasite responsible for immature paramphistomiasis, involves both definitive and intermediate hosts. The adult flukes reside in the rumen of the definitive hosts such as cattle and buffalos. They shed eggs through their feces, contaminating water bodies or vegetation.

The eggs require water for the miracidium (larval stage) to hatch. Upon hatching, the miracidium infects a suitable intermediate host, usually a snail, where it undergoes several developmental stages. Inside the snail, the miracidium transforms into cercariae (free-swimming larvae).

These cercariae are released into the water, where they encyst on vegetation or form free-floating metacercariae. When livestock graze on these contaminated water plants or drink water containing metacercariae, they become the definitive host for the immature flukes, which mature in the rumen and reticulum.

Clinical Signs and Pathogenesis:

Common clinical signs observed in animals suffering from immature Paramphistomiasis include listlessness, loss of appetite, weight loss, decreased milk production, fetid diarrhoea (watery or bloody), weakness, sub mandibular oedema and anemia. Severe cases can lead to emaciation, debilitation, and even death.

Pathologically, the presence of immature flukes causes damage to the small intestine leading to diarrhea and decreased absorption of nutrients. It may cause several biological and biochemical changes in the animal.

1. Anemia: Paramphistomiasis can cause anemia in infected animals due to blood loss from the attachment and feeding of the parasites. The loss of red blood cells can result in decreased levels of hemoglobin and hematocrit, leading to anemia.

2. Hypoalbuminemia: Damage caused by immature larvae into the small intestinal epithelium can affect the absorption and utilization of nutrients, including proteins. This can result in decreased albumin levels in the blood, leading to hypoalbuminemia.

3. Increased Liver Enzymes: Paramphistomiasis can cause liver damage due to the migration of the parasites and their attachment to the bile ducts. This can lead to increased levels of liver enzymes, such as alanine aminotransferase (ALT), Alkaline phosphatase (ALP), and aspartate aminotransferase (AST), indicating liver dysfunction.

4. Electrolyte Imbalance: Paramphistomiasis can disrupt the electrolyte balance in affected animals. This may include alterations in levels of sodium, potassium, calcium, and phosphorus, which can impact overall metabolic functions.

5. Inflammatory Markers: In response to the presence of the parasites the immune system of the infected animals may mount an inflammatory response. This can be reflected by increased levels of acute-phase proteins, such as C-reactive protein (CRP) and serum amyloid A (SAA).

It's important to note that the specific biochemical changes observed in paramphistomiasis may vary depending on factors such as the severity of the infection, host response, and individual variations. Additionally, concurrent infections or complications can influence the biochemistry profile.

Diagnosis of Immature Paramphistomiasis:

Accurate diagnosis of immature paramphistomiasis is crucial for effective control and treatment. Veterinary professionals employ various diagnostic techniques, including clinical examination, fecal analysis, and post-mortem examination.

Clinical examination involves evaluating the animal's overall condition, observing clinical signs, and conducting blood tests to assess anemia and other potential abnormalities. Fecal analysis helps identify the presence of *paramphistome* eggs or immature flukes in diarrhoea. Immature pinkish-white flukes can be demonstrated when diarrheic feces is sieved through 50 µm filters and the residue is examined.

Post-mortem examination, in cases of death, allows for a detailed assessment of the extent of the infection. The carcass is thin and hind quarters may be soiled with feces. During necropsy, sub-cutaneous oedema, ascites, hydrothorax, hydro pericardium, lung oedema can be seen. Erosions and petechial lesions in pyloric portion of abomasum and upper 2/3 of the small intestine can be seen. Abomasal folds are enlarged and oedematous. The presence of immature and mature flukes can be observed in the small intestine, rumen and reticulum.

Definitive diagnosis can be made by finding immature flukes in pyloric portion of abomasum or upper 2/3 of the small intestine.

Sending samples to the laboratory

Fresh post mortem samples for Parasitology should be sent in ice and should be delivered to the laboratory within 12 hrs of death.

If unable to send the fresh samples, frozen samples can be sent in ice.

For species identification of the flukes, samples have to be sent in 70% Alcohol.

For Pathology, samples (small intestine parts containing lesions) should be sent in 10% Formalin.

Treatment and Control Measures:

Treatment and control of immature paramphistomiasis involve a combination of management practices, anthelmintic treatments, and preventive measures. The following strategies are commonly employed:

1. Improved Livestock Management: Proper grazing management, rotational grazing to avoid the contaminated pasture , and avoiding the use of contaminated water sources can reduce the risk of infection. Providing clean drinking water and minimizing exposure to snail habitats are essential preventive measures. Pasture and fodder cut and feeding, rather grazing, is an important method to control the disease.

2. Anthelmintic Treatment: Various anthelmintic drugs are available for the treatment of immature paramphistomiasis. Effective drugs include Closantel, and Oxyclozanide, among others. Treatment protocols should be followed as per veterinary recommendations.

3. Strategic Deworming: Implementing strategic deworming programs, based on the epidemiology and seasonal patterns of infection, helps reduce the parasite burden and prevent the development of drug resistance.

a. One prophylactic treatment of ruminants towards the end of dry season.

b. One curative treatment one or two months after the onset of the rainy season.

c. Additional treatment of one or two months later in high risk areas such as Southern Province, NCP, NWP, North and Eastern Provinces.

4. Biological control of snails can be done by planting trees that have molluscidal effect such as "Kubuk" and having natural predators of snails such as ducks in and around the water bodies where cattle go for drinking.

5. Public Awareness and Education: Raising awareness among farmers, veterinary professionals, and the general public about the importance of proper livestock management, preventive measures, and timely treatment is crucial. Education campaigns can significantly contribute to disease control and prevention.

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Chemical decontamination strategies of chicken meat to reduce the bacterial level in the poultry processing line

Food quality and safety are the most important public health concerns in the world. Under Good Management Practices (GMP) and Hazard Analysis Critical Control Points (HACCP) poultry processing plants have established many protocols to reduce the contamination of foodborne pathogens. However, these standardized protocols are not evenly practiced throughout the country. Chemical decontamination (washing of the carcasses using chemically treated water) has been considered the most effective strategy to reduce bacterial load.

Chlorine is the most commonly used disinfectant for chemical decontamination of chicken meat in Sri Lanka. It is an oxidizing agent, which disrupts the bacterial cell membrane permeability. Although the SLS standards for chlorination of potable water have been established, there is no standard guideline for chlorine usage in poultry processing plants.

A survey was conducted in ten large-scale poultry processing plants, which have a production capacity of over 24000 birds/day and representing collectively, 80% chicken meat production in Sri Lanka.

The evisceration of poultry carcasses is a main critical control point (CCP) in processing. The main food-borne pathogens; such as *Salmonella* and *Campylobacter* are colonized in the intestine, preventing the piercing of the intestine is very important to reduce cross-contamination. According to the study, 75% of the processing plants have semi-automated evisceration, and the rest of the plants have fully automated evisceration techniques. In a semi-automated system having well-trained personnel is very important in forking out the intestines. After the evisceration, the carcasses go through inside and outside bird washes. There, 87.5% of the plants used chlorinated water in the bird washes.

Inside outside bird washer

Spin chill tank

The carcass washing removes the debris on the carcass the included chlorine inactivates the existing pathogens. It is very important to reduce the organic matter content on the carcass to reduce the organic matter content in the chill tank. Because several studies have shown that, the higher organic matter content reduces the effectiveness of chlorine. Chilling and chemical decontamination in the spin chill tank is one of the most important critical control points in poultry processing to reduce bacterial contamination. All the processing plants (100%) have maintained the temperature in the chill tank at 4°C following the ISO guidelines for chill chicken. The reduced temperature and the chlorination would reduce the bacterial load on the chicken and increase the food quality and safety.

According to the survey, poultry processing plants in Sri Lanka used either liquid chlorine (25%) or liquid Sodium Hypochlorite (75%) in the chill tank. Studies have shown that a lower concentration of chlorine causes sublethal injury to the cell, which can be resuscitated in favorable conditions.

Therefore the correct concentration and the contact time are very important to undergo lethal injury in the bacteria. In most of the processing plants, 20-50ppm chlorine was used in the chill tank while the exposure time was varied between 20min to 55min. But in some processing plants, the chlorine level was low as 2-5ppm. Notably, 25% of plants used two chill tanks; the first tank with high chlorine concentration (20 -50ppm) and the second tank with a lower chlorine concentration (2-5ppm). This might be to reduce the chlorine smell on the meat caused by high chlorine concentration. But importantly this practice may lead to develop chlorine resistance in food-borne pathogens and they may persist throughout the food chain.

Especially *Campylobacter* has an adaptive response mechanism, which adapts to sudden environmental stresses. Although the bacterial load would be reduced in the chill tank, contaminated cutting boards and knives can increase the bacterial load, In some developed countries post-spin chill chemical decontamination is used to minimize the bacterial load, which is not practice in Sri Lanka.

It is very important to conduct a national surveillance program to understand the food borne pathogen contamination on the chicken meat at the end of processing. According to the present study, the unavailability of standard chlorination methods in poultry processing is identified and it might increase the risk of persistent foodborne pathogens in the poultry processing chain in Sri Lanka.

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PVS pathway follow up evaluation and JEE in animal health system in Sri Lanka

Performance of Veterinary Services (PVS) is for monitoring sustainable development of veterinary services and aquatic animal health service is carried out in more than 140 countries in the world. The expert team from World Organization for Animal Health (WOAH), evaluates the strength and weakness of the veterinary services or aquatic animal health service in a country. Usually the team is focused on WOHA international standards on animal health and welfare based on globally consistent methodologies. The International funding and donor agencies examine these identified gaps for their proposal evaluation process for funding.

In Sri Lanka, PVS evaluation was carried out in June 2023 by a team from WOAH. They visited many places including provincial director Office, veterinary hospitals, VICs, Field, Slaughter houses, Poultry processing facilities, VS ranges, dairy farms, poultry farms, quarantine stations, Sri Lanka customs, wild life hospital, veterinary pharmaceutical industry, municipal councils, Farm school, VRI , Faculty of Veterinary Medicine and Animal Science and ministry of health. The final report will be released soon online.

In addition, DAPH is also monitored by Joint External Evaluation (JEE) from World Health Organization (WHO). The strength of zoonotic disease diagnostic at DAPH is evaluated as primary function of DAPH under this programme. With that 19 areas are monitored and evaluated by WHO. DAPH holds key roles in some of the main areas such as Antimicrobial resistance, National laboratory services, Biosafety and biosecurity under this evaluation. In addition, DAPH is also considered in the section of development of Human resource, surveillance and under the 19 categories examined.

Published by ;

Research Management Committee

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Tel : +94812388312 , +94812388376 , FB: SLVRI at 2022