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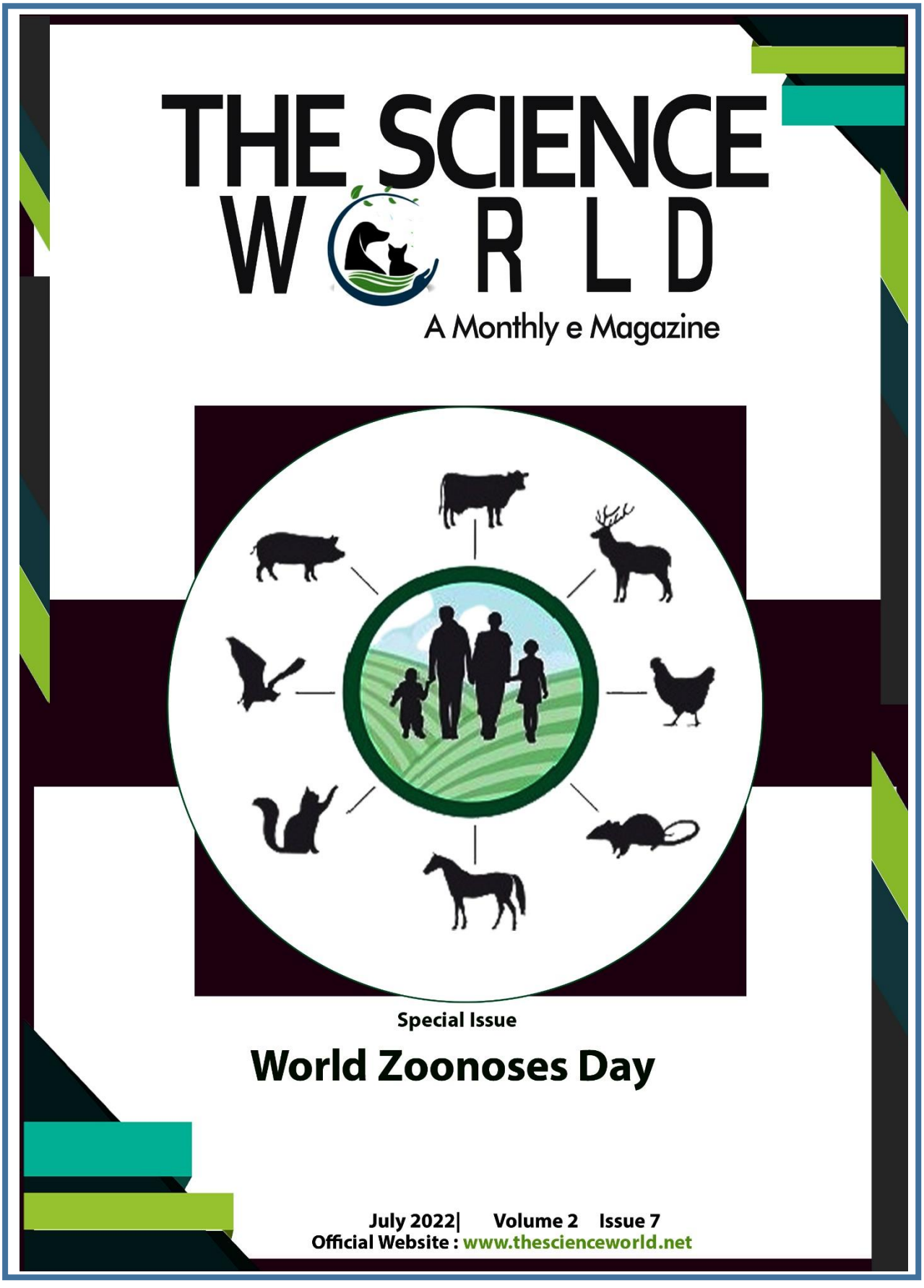

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Popular Article

Feline rabies: A re-emerging public health concern

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Abstract

Rabies is a uniformly fatal viral encephalitis that causes thousands of deaths worldwide each year. Prevention is the primary approach to the disease. In this discussion, we mainly focus upon feline rabies transmission and the use of active and passive vaccination for pre-exposure prophylaxis and post-exposure treatment of rabies. Human exposure to rabies will always be a possibility, but methods to prevent the disease both before and after exposure to the virus are safe and readily available.

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Introduction

The origin of term 'rabies' is from a Latin word 'rabere' that means 'to rage'. It is an important public health issue particularly in the developing countries which are evident from the fact that globally this devasting disease is responsible for more than 60,000 human deaths, while approximately 15 million people receive rabies post-exposure prophylaxis (PEP) annually (Wilde H. et al., 2013). Despite vast efforts made in monetary and epidemiological context, it is still highly prevalent in Asia and Africa continents. There are 20,000 human deaths annually that have been reported in India itself due to rabies (Sudarshan M K et al., 2006). The primary reservoir for rabies is carnivorous mammals throughout the world (Krebs et al., 2005). Below 10% of the documented rabies cases occur in domesticated animals including cats, cattle, and dogs predominantly (Ngobese CE et al., 2009). In India, canine rabies is enzootic with the dogs and jackals as primary reservoirs. Rabies affects more cats than dogs in the United States.

The virus can be passed on to other animals or humans and is fatal if not treated before symptoms appear. According to the American Veterinary Medical Association, 38.4% of households own dogs, making them the most common companion animal with nearly 77 million reported in the United States. Cats are a close second, with 25.4% of households reporting ownership (Burns K. Pet Ownership Stable, Veterinary Care Variable. Avma.org., accessed on 29 May 2022).

Etiology

It is caused by a bullet-shaped virion named rabies virion of the genus *Lyssavirus* of the family *Rhabdoviridae* and *Mononegavirale* order. It is an enveloped virus comprising of 12kb negatively sense single-stranded RNA virus of size around 180 nm x 75 nm in size. The virus affects the central nervous system of mammals. Based on sequence and phylogenetic studies, 7 distinct genotypes of RABV are known to occur in nature (Heaton *et al*., 1999). The classical RABV (RV-genotype 1) and its field strains are known the world over and cause rabies in a majority of the cases in humans and animals.

Epidemiology

Rabies is prevalent throughout the world except in the Islands. Many of the countries are endemic to rabies, except Australia and Antarctica. The countries free from rabies in the Asian subcontinent are Bahrain, Cyprus, Hong Kong, Japan, Malaysia, Maldives, Qatar, Singapore, Lakshadweep, Andaman and Nicobar Islands of India and Timor-Leste. Countries such as Antigua and Barmuda, Bahamas, Barbados, Belize, Falkland, Jamaica, Saint Kitts and Nevis, Trinidad and Tobago, Uruguay of America subcontinent and Albania, E.Y.R. of Macedona, Finland, Gibraltar, Greece, Iceland, Isle of Man, Malta, Portugal, Norway (except Svalbard), United Kingdom and Spain (except Melill + Ceuta) have also got rabies-free status.

In the Asian continent, the scenario of rabies is worse than in other continents with the fact that among rabies-induced mortality in humans, 15% of mortality occurred in children under 15 years of age with an overall burden of 3 billion cases of rabies annually, and 30,000 human deaths (Yousaf *et al*., 2012).

Pathogenesis

It's usually transmitted when an infected animal bites another animal or human. The virus starts at the location of the bite and moves through the body along the nerves until it

reaches the brain. Once rabies reaches the brain, the infected animal will begin to show symptoms and will usually die within 7 days.

How can a cat get rabies?

It's usually from the bite of an infected wild animal. Raccoons, skunks, bats, and foxes are common rabies carriers. The more contact a cat has with wild animals or rabid carnivorous mammals such as dogs, the higher the risk of their infection. The CDC reports that there were only 241 cases of rabies in cats in 2018.

How does zoonotic transmission occur?

The transmission of rabies from cats to humans takes place most commonly through bites. A human can get rabies from an animal scratch, but it's very rare.

Signs and symptoms of rabies

After a rabies exposure, the rabies virus has to travel to the brain before it can cause symptoms. This time between exposure and the appearance of symptoms is the incubation period. It may last for weeks to months. The incubation period may vary based upon;

- the location of exposure site,
- the type of rabies virus,
- any pre-existing immunity.

In cats

Behaviour change: Cats who are usually calm may become excitable or agitated. Extroverted cats may become less affectionate and may isolate themselves.

Aggression: Cats can become excitable, aggressive, and vicious towards humans or other animals.

Drooling: Rabies can affect muscles in a cat's mouth so they can't swallow. They may drool or foam at the mouth.

Loss of muscle control: The final stages of rabies cause paralysis and coma.

Fig.1 Aggressive form of rabies in cat (MSD Vet manual)

In humans:

During the initial stage of the disease;

- Symptoms are similar to flu such as weakness, discomfort, fever, or headache.
- There may be discomfort, prickling, or an itching sensation at the site of the bite.

During later stages;

- Cerebral dysfunction, anxiety, confusion, and agitation.
- A person may experience delirium, abnormal behaviour, hallucinations, hydrophobia (fear of water), and insomnia.

Once clinical signs of rabies appear, the disease is nearly always fatal, and treatment is typically supportive.

Diagnosis

In animals, rabies is diagnosed using the direct fluorescent antibody (DFA) test, which looks for the presence of rabies virus antigens in brain tissue.

In humans, it requires several tests before confirming it as rabies infection along with a history of the physical trauma and look after a period of the dog or cat.

Prevention

The prevention of rabies is the keystone behind the control of the disease. On the primary ground, vaccination of dogs and cats alongside eliminating stray animals and public health education, etc., are the components of animal rabies control as well as

In cats

Pre-exposure vaccination: Killed or inactivated adjuvanted vaccine with the potency of ≥2 I.U. should be used with primary vaccination at 90 days of age via subcutaneous route followed by annual vaccination in endemic areas such as India.

Post-exposure vaccination: It involves the vaccination with inactivated or killed adjuvanted vaccine with 5 shot protocol, i.e., starting with day 0 (day of exposure), day 3, day 7, day 14 and day 28.

In humans

Pre-exposure prophylaxis consists of one dose of intramuscular or intradermal injection of vaccine at one site in the deltoid region on days 0, 7 and 21 or 28.

Post-exposure prophylaxis consists of post-exposure prophylaxis (PEP) consists of wound treatment, the administration of rabies vaccines based on WHO recommendations, and if indicated, the administration of rabies immunoglobulin.

- For category I exposure (intact skin and no exposure to virus), only washing of the affected area is needed.

- For category II type exposure (nibbling of uncovered skin, minor scratches, or abrasions without bleeding), immediate vaccination is needed.
- For category III exposure (single or multiple transdermal bites or scratches, contamination of mucous membrane with saliva from licks, licks on broken skin, exposures to bats), immediate vaccination and administration of rabies immunoglobulin are recommended.

Conclusion

Rabies from a cat is a re-emerging disease in the context of modernization of the world. People started keeping cats as their pets which poses them at the risk of getting rabies. The rabies virus gets transmitted to the pet owners via a bite or salvia. Pet owners should vaccinate their pets at regular intervals and prevent the contact of their pets with feral carnivorous animals. If people get any physical injury from their pets, they should have to immediately take medical help.

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Success Story

Nutri Garden- A rich source of nutrition for rural women

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Nutri garden or Poshan Vatika means that small piece of land where the people of the house grow vegetables to make sure that all in the family specially children and women should not become victim of mal-nutrition. Nutri-garden is advanced form of kitchen garden in which vegetables are grown along with fruit, herbs, spices and other useful plants such as medicinal plants as a supplementary source of food and income. For small and marginal farmers, nutri-garden produce can make a critical contribution to the family diet and provide several other benefits, particularly for women.

Setting up of Nutri Garden

Usually a nutri-garden can be established in the backyard of house where there is enough water availability. A rectangular garden is preferred to a square plot. Nearly 200 m² land is sufficient to provide vegetables throughout year for a family consisting of five members. Layout and crop allotment in nutri-garden can be modified depending on climatic and seasonal changes. Perennial vegetables should be allotted to one side of the garden so that they may neither create shade for the remaining plot nor they interfere with intercultural operations. Shade loving vegetables may be planted in perennial plots. Compost pits can be provided on the corner of nutri-garden for effective utilization of kitchen waste. After allotting areas for perennial crops, remaining portions can be divided into 6-8 equal plots for growing annual vegetable crops. By following scientific practices and crop rotation, two to three annual crops can be raised in the same plot.

For effective utilization of plot accession cropping, inter cropping and mixed cropping can be followed. Walking path should be provided at the center as well as along four sides. Since fresh vegetables from garden are directly utilized for consumption, organic manure should be used which is abundant in villages. However, in order to harvest good crop free from pest and diseases, chemicals can be utilized in limited amount. It is important that preference should be given to long duration and steady yielding crop varieties than high yielding ones.

Women empowerment and improved health status in tribal region:

Like other farm families in the remote pocket village of BHASKI Panchayat, Jaridih Block of Bokaro District Jharkhand, Mrs. Meena Devi was earlier practicing traditional subsistence farming and produced food not enough to sustain the family. She had two daughters and a son. She is a member of "Lakshmi mahila mandal" and she belongs to "Mahli" community. This community main occupation is making basket from bamboo and the major source of earning is this only. As she also belongs to same community, so doing the same activities for surviving and as a source of income. She can't even afford proper essential diet as well as daily needs for all the family members. Once in Tondra village there was a Gram sabha organised by villagers. In that gram sabha Pradan staff and cadre were also participated. One major discussion of the Sabha regarding Nutrition and Health, and most of the farm women were unaware about this discussion as they don't know how balance diet is important for their health. After the discussion of nutrition and health as a gender perspective most of the women started discussion about their sacrifice in home for food. During discussion in gramn sabha she came to know about poshan vatika. She was very keen to learn about nutrition and other improved practices to enhance nutritional status. This poshan vatika can be set by any person even those who ever having no cultivation land on large scale although they are having small plots in backyard. Through government they will get 12 types of vegetable seed and one millet (among millet they will get finger millet as this is the major source of Iron and calcium). After getting seed they will train by cadre for organic Insect pest management so that they can produce their vegetables organically and control the insect pest and disease organically. Meena took a keen interest in the training of nutri-gardens in her back yard with a land area of 200 m^2 which is enough for meeting the daily nutrient requirement of her family. She has worked almost single-handedly on her land to achieve the nutrition farming and other allied activities. In the very first season she was able to obtain a good yield of vegetables more than sufficient for home consumption. She also sold vegetables in nearby local markets. Other farmers from nearby villages visited her farm for farmer-to-farmer exchange and learn from her efforts

towards food and nutritional security.

Conclusions

Nutri-gardening is one of the advantageous ways to improve nutrition level in women with minimum investment. Another benefit of this initiative has been the increased awareness of nutritious food among women and their families. Nutri-garden provides a continuous supply of nutritious vegetable for the table throughout the year and additional income to family.

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Popular Article

Foot-And-Mouth Disease: The Forgotten Zoonosis

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Abstract

Foot-and-mouth disease is considered to be a highly contagious disease among domesticated farm animals, especially ruminants. However, very little light has been shed on its zoonotic side and potential. The incidences are low, but can be of concern if the virus is given the chance to mutate. Hence, strict vigilance and measures must be taken even if a small outbreak occurs among the animal population to reduce the probability of the disease becoming a major threat to public health.

Introduction

Foot-and-mouth disease (FMD) or more commonly known in the earlier days as 'epizootic vesicular stomatitis', 'aptha epizootica' or 'vesicular murrain' is essentially a highly infectious animal disease. Its susceptible hosts mainly consist of all cloven-footed animals. The disease is mainly characterized by fever and emergence of vesicular lesions on the epithelial surfaces. Although foot-and-mouth disease virus mainly infects animals, there have also been cases of human infections from the same virus, proved by isolation and typing. These cases are mostly from Europe, Africa and South America. The incidence is fairly low, but it can be ruled out that FMD is in fact, a zoonosis which can be of concern and should not be neglected.

About the etiology

FMD is caused by the Foot-and-Mouth Disease virus (FMDv) of the genus Apthovirus under the family Picornaviridae. Other pathogenic genera that come under this family are Enterovirus and Teschovirus causing poliomyelitis in humans and polioencephalomyelitis in pigs respectively.

The Picornaviridae family consists of viruses which are non-enveloped, of positive sense single stranded RNA genome encased in an icosahedral capsid of approximately 30 nm in diameter. Images from X-ray crystallography and electron micrographs suggest that the virion is smooth and round in appearance. Most of the virions of the family consists of 60 copies each of four major structural proteins namely VP1, VP2, VP3 and VP4.

Seven serotypes of the FMDv- O, A, C, SAT 1, SAT 2, SAT 3 and Asia 1 have been identified yet through rigorous serological and cross-protection testing. All the serotypes are antigenically distinct. The most common serotype to be isolated from the human cases is O (Pan Asia serotype), followed by C and A. However there have been many suspected cases of FMD which were confused as hand, foot and mouth disease which is relatively a mild disease caused mainly by Coxsackie A16 viruses. They were and are still confused sometimes with vesicular stomatitis (caused by a Rhabdovirus) and herpes simplex virus infections. The incubation period of the virus in most humans is found to be 2-6 days. The virus particles can stay viable for a long time in fresh, partially cooked meat and unpasteurized milk and its products.

A view from the historical standpoint

History has suggested many suspected and confirmed cases of FMD infections in humans. However, the reports of such cases before 1897, i.e., the year of discovery of FMDv were not confirmed by isolation or serological testing. The timeline goes as follows:

- 1695: The earliest recorded and suspected case of FMD in man was given by Valentini in Germany.
- 1834: Three veterinarians deliberately infected themselves with suspected FMD by drinking raw contaminated milk from infected cows.
- 1838: In Germany, there was an FMD epidemic amongst the cattle population in which many people were also suspected to be affected with the same.
- 1872: According to an account by William T. Briscoe in the British Medical Journal for October, a young woman was affected with FMD. She worked closely with infected cows and had consumed their milk.
- 1896: In Switzerland, two suspected FMD cases were recorded in children, aged fourteen and ten in which the clinical lesions were the same as that of FMD in animals.
- 1961: A human case of FMD was recorded in Chile.
- 1967: In the outbreak of FMD in the United Kingdom, a farm worker's tissue sample was found to be positive for FMD. He also had clinical manifestations

of the same.

- 1969: A report documented an asymptomatic case of FMD in man.

Since the first documented case, there have been more than 40 confirmed human cases with clinical manifestations of FMD till date. With respect to other zoonoses, though the cases are comparatively low, it has the potential to be a serious issue to global health. The 2001 outbreak of FMD in the United Kingdom was caused by a strain much virulent than the 1967 one, providing the possibility of occurrence of mutations that would enable the virus to jump the species barrier.

Transmission

FMD is a highly contagious disease and spread occurs by direct contact with infected animals. Such infected animals shed the virus in their nasal secretions, saliva, milk, faeces, urine and semen. Cattle are mainly the indicator hosts while infected pigs are the amplifier hosts. Pigs shed the virus 3000 times more than cattle. Sheep and goats are classified as maintenance hosts. Farm personnel can also spread the virus within and between farms. Contaminated feed and fomites also play a major role in the transmission. The confirmed cases of FMD in man are found to be mainly due to direct contact with infected animals. The virus can enter the person by abraded skin or oral and nasal mucosa. Person-to-person transmission has not been reported yet. Infection from animal to human mainly occurs by the consumption of contaminated raw milk, milk products and meat which is uncooked. Apart from the ones mentioned, rodents and flies can also act as vectors of the disease. Laboratory personnel can also get the infection if they are not careful while handling of the virus.

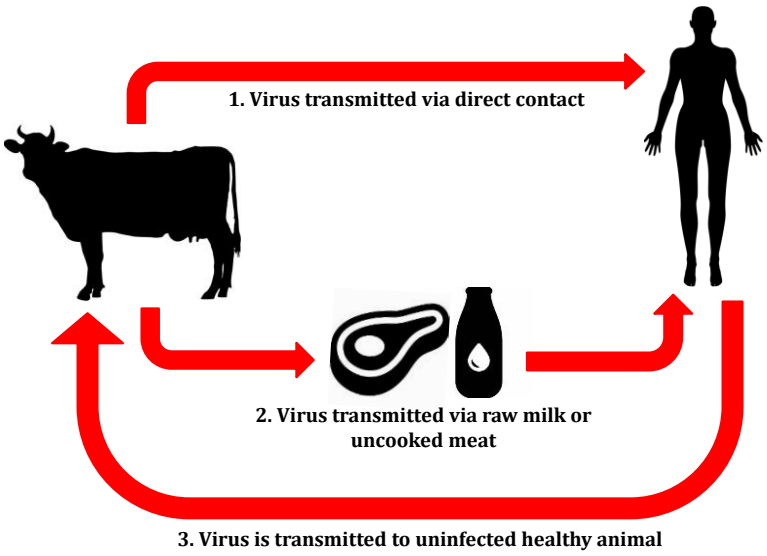

Fig 1: Transmission of Foot-and-Mouth disease from animal to man and vice-versa.

Studies show that the virus can survive in the nasal cavities of the human for 28 hours after direct exposure to infected animals. Another study demonstrated that the virus showed low rates of survival after 16-22 hours after direct contact with infected animals. However, there was the expected chance of a longer survival time if the ventilation was shut down. All the studies conducted and the information known suggests us that farm personnel, veterinarians, and farm attendants are at a high risk of contracting a possible FMDv infection.

Clinical signs and lesions

As the name of the disease suggests, the prominent clinical signs and lesions mainly involve the oral mucosa and feet. In domestic farm animals, vesicles are formed in the oral mucosa of tongue, lips, cheeks, gums; teats and cleft of the foot. These rupture later on leaving ulcers and sores very painful for the animal. High fever (104oF-106oF), depression and anorexia are also observed. The clinical signs and lesions found in the documented cases of FMD in human also correlate to the animal cases. The signs in the symptomatic cases which were reported are:

- High fever and anorexia
- Conjunctivitis
- Dry tongue
- Inflamed condition of the nasal and oral mucous membranes
- Pinkish papules on the face, neck, and anterior forearm regions
- Blisters and ulcers on the oral mucosa and tongue accompanied by severe pain of the mouth
- Excessive salivation
- Pharyngitis
- Tachycardia

The clinical signs and lesions listed above in humans are generally mild and recovery usually took within a week. No human who has contracted an FMDv infection and has died have been reported yet.

Diagnosis

There are many diagnostic methods that are used to diagnose FMD. All of those methods can be used to diagnose FMD both in animals and humans. Complement fixation test (CFT) and sandwich ELISA are used to detect the FMDv serotype specific antigen. Liquid phase blocking ELISA and virus neutralization test (VNT) are used to detect the FMDv serotype specific antibody. However, the antibodies produced by infected and vaccinated (by current vaccines against FMD) animals are almost similar to each other. Present methods rely on detection of

antibodies to non-structural proteins (NSPs) for differentiation between virus infected, carrier and vaccinated animals. Consecutively, the virus can also be isolated in cell lines like BHK-21 (baby hamster kidney), IBRS-2 (pig kidney) and in primary bovine (calf) thyroid cell monolayer. Isolation is also done in suckling mice and guinea pigs by intraperitoneal inoculation and intradermal inoculation of clinical material respectively. Molecular diagnostic methods include real time and reverse transcriptase polymerase chain reactions (PCR).

Prevention and control

Vaccines for animals are available but the currently available ones only provide temporary protection and vaccinated animals can still be carriers of the virus and shed it without showing any clinical signs.

The persons who are in direct contact with those animals should remain extremely cautious during an outbreak. The use of Biosafety level 2 (BSL-2) practices and equipment in laboratories should be promoted. Some of the measures that should be maintained to ensure that **FMD does not spread to humans are**

- Regular vaccination of the animals.
- Consumption of unpasteurized milk and milk products from infected animals should be avoided.
- Consumption of unprocessed and partially cooked meat should be avoided.
- During the examinations of FMD vesicles in animals, gloves should be used at all times.
- Disinfection of any equipment, clothing or vehicle that enters or exits the farm premises.
- Carcasses should be disposed off scientifically either by incineration or deep burial method.
- Avoiding visits to farms in areas affected with FMD.

Many FMD affected areas in the world are still underdeveloped. The farmers and farm attendants usually lack proper knowledge about biosafety measures and mitigation of animal diseases. Hence, apart from the measures mentioned above, education regarding animal and human health imparted to the people involved in the farm should be given the most primary measure.

Conclusion

There has not been a human case of FMD being reported for a few years now. But it should be taken into consideration that FMD is highly contagious and has spread to humans with clinical manifestations in some instances before, and therefore, it can be said that FMD is in fact, a zoonotic disease which has now been forgotten and neglected. Hence, all positive cases of FMD in animal should be taken seriously. Although the documented cases of FMD in humans are low, there is

still the risk of contracting the infection. The FMDv, being an RNA virus has the possibility and potential to rapidly mutate, jumping the species barrier to emerge as a major threat to public health. Concern has also been raised for the same. Proper biosafety measures and preparedness are the only keys to make sure that this economically catastrophic and potentially dangerous viral disease does not affect the human species again.

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Popular Article

Role of Microbiologists in controlling Covid-19 Pandemic

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Abstract

The Covid-19 pandemic is a global coronavirus disease pandemic that began in 2019 and is caused by the severe acute respiratory syndrome coronavirus 2. (SARS CoV-2). An epidemic in Wuhan, China, was the catalyst for the discovery of this new virus. It has caused significant financial hardship and death, making it one of the deadliest viruses in history. The structural and functional features of this virus must be identified in order to diagnose and treat it early. As a result, microbiologists play a critical role in preventing the spread of this disease.

Keywords: SARS CoV-2, Diagnostic kits, Antiviral therapy, Vaccines, Biomedical waste

Introduction

The first cases of SARS-CoV2 in India were reported on 30th January 2020 in Kerala. Since then, the destruction and devastation caused by this virus have resulted in monetary as well as loss of precious lives in various regions of our country. Because the virus is new, it must be identified and classified before strategic control strategies can be developed. As a result, microbiologists play a critical role.

Microbiologists are those scientists which study about the microscopic life forms and processes. Microbiologists have played a great role in identifying the SARS-CoV2 virus, developing a diagnostic toolkit for detection, generation of vaccines and in developing effective antiviral therapy for the disease. Microbiologists have been regarded as one of the crucial covid warriors fighting against the spread of the disease. Tests like RT-PCR, Rapid Antigen Test etc. have been proven to aid in the diagnosis of this disease. Furthermore, next generation sequencing techniques are also being used for genomic identification of this novel virus.

Role of Microbiologists:

Collection of specimens and its transportation

Only after following the case definition provided by the health authorities, Government of India, may the clinician decide on the need for clinical specimen collection for 2019-nCoV laboratory testing. In the presence of a clinician, a suitable clinical sample must be taken by laboratory personnel/healthcare workers who have been trained in specimen collection. Clinical samples must be sent to the approved laboratory such as (ICMR-NIV, Pune) using standard triple packing while adhering to all biosafety measures and wearing personal protective equipment (PPEs). Anyone who has Severe Acute Respiratory Illness (SARI) AND one or more of the following: a history of travel from Wuhan, China in the 14 days prior to onset of symptoms; disease in a healthcare worker who works in an environment with SARI patients; unusual or unexpected clinical course, especially sudden deterioration despite appropriate treatment; should be investigated immediately.

Laboratory diagnosis of Covid-19

SARS-CoV-2 genetic material or humoral responses are identified in tests for the etiological agent. Identifying viral genome targets in respiratory tract materials using real-time polymerase chain reaction (RT-PCR) within the first week of symptoms is the gold standard for diagnosis. Serological tests should be ordered starting the second week after the onset of symptoms. There are many different tests available, each with a distinct sensitivity and specificity, and the majority of them require validation. Complete blood count, C-reactive protein (CRP), D-dimer, clotting tests, lactic dehydrogenase (LDH), ferritin, and procalcitonin are examples of laboratory tests that can identify the risk of disease with greater severity, thromboembolic consequences, cardiac damage, and/or a poor prognosis. Imaging scans can help with diagnosis, especially if the clinical picture is consistent and other tests have come up negative or are unavailable (Goudouris E. S. *et al*., 2021).

Mass screening of suspected Covid-19 population by Rapid Antigen test

Early detection is still as important as it was in the early stages of the COVID-19 pandemic. Because RT-PCR is not always possible in developing countries or rural locations, doctors may utilise a rapid antigen test (RAT) to reduce the burden of diagnosis. The effectiveness of RAT, on the other hand, has yet to be properly examined. The total pooled specificity and sensitivity of RAT were found to be 99.4% (95 percent CI: 99.1–99.8; I2 = 90 percent) and 68.4% (95 percent CI: 60.8–75.9; I2 = 98 percent) in one study, respectively. Nasopharyngeal specimens and samples from symptomatic patients were shown to be more

sensitive in RAT, while cycle threshold (Ct) values were found to have an inverse connection with sensitivity in subgroup analysis. RAT performed better in both European and American populations. Although RAT's sensitivity needs to be enhanced, it could still be a viable option in places where laboratory facilities are lacking. However, to reduce false negative results, RAT negative samples can be re-tested using RT-PCR (Khandker, S. S. et al., 2021).

Development and Production of Covid-19 vaccines

Microbiologists have played an important role in development of vaccines. They have aided in identifying the SARS CoV2 structure, its potency, immunogenic properties etc and thus have opened a gateway for development of vaccines. COVID-19 vaccine candidates in development and clinical testing in India are among the most advanced products in the world. Apart from the COVID-19 vaccines developed in India, other local pharmaceutical and biotech companies have inked collaboration arrangements with vaccine developers from other countries. This cooperation vary from clinical trials through vaccine manufacture and distribution on a wide scale. Few covid vaccines developed in our country include Covishield, Covaxin, ZyCoV-D, Novavax, and others.

Development of high sensitivity and specificity-based tests

Several new high sensitivity and specificity tests have been developed to accurately diagnose the SARS-CoV-2. These tests include rRT-PCR, LAMP, Lateral Flow, ELISA etc. These tests use specimens like nasopharyngeal swab samples and blood for diagnosis. The time for production of results can vary from 20 min- 4 hours (Younes, N. *et al*., 2020).

Development of antiviral therapy

For those who are awaiting vaccination as well as those who do not respond well to vaccination, the discovery of effective antiviral medication for COVID-19 is crucial. The sole medicine licenced by the Food and Drug Administration (FDA) for the treatment of COVID-19 is Remdesivir. The FDA has granted Emergency Use Authorizations for ritonavir-boosted nirmatrelvir (Paxlovid), molnupiravir, and some anti-SARS-CoV-2 monoclonal antibodies (mAbs) for the treatment of COVID-19.

Biomedical waste management

All waste generated during diagnostic testing of suspected covid-19 patients is referred to as Covid-19 biomedical waste. This includes patient samples (nasopharyngeal swabs, blood, sputum), laboratory reagents and consumables (disposable syringes, needles, and cotton swabs), and laboratory worker protective gear (coverall suits, gloves, N95 masks, face shield, and so on). Color-coded bins/bags/containers should be used for proper waste disposal. Double-layered bags

must be used to collect waste from the sample collection room as a precaution. Before being delivered to a local biomedical waste facility, all microbiology laboratory waste should be autoclaved at a waste management complex.

Conclusion

SARS CoV2 is a novel virus which is mutating rapidly with time and resulting in emergence of new variants. Thus, thorough studying, identification and classification of such variants is necessary. Microbiologists all over the world have been conducting research regarding the properties, infectivity, potency etc of this virus. These research aid in developing diagnostic kits, production of vaccines and generation of effective antiviral therapy against this disease. As a result, microbiologists play a critical role in today's world. It is also critical to establish new research and diagnostic laboratory facilities in order to diagnose the virus effectively and quickly.

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Popular Article

Functional Anatomy of Hoof in Horses

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Abstract

The quote "no hoof, no horse is entirely true. Without solid, sound feet, you have no horse, so understanding hoof anatomy is extremely important. The hoof of horse is anatomically complex designed and highly specialized digital end organ. Compare the size and weight of a horse relative to the size of a hoof, and how fast horses can run or how high they can jump; it's amazing how so much is supported by so little. Knowledge of functional anatomy of the hoof and all its internal structures is of paramount importance in being able to assess the condition of the horse health and performance. The different parts of hoof serving a different purpose, yet working in symmetry to keep the horse sound and healthy. Numerous factors can affect hoof structure and health, including genetics, hoof conformation, environmental influences, and athletic performance of the animal.

Introduction

The interaction of human and horse is well known for sport competitions and non-competitive recreational pursuits, agriculture, police work and entertainment. Horses were historically used in warfare, from which a wide variety of riding and driving techniques developed. Humans provide domesticated horses with food, water, and shelter, as well as attention from specialists such as veterinarians and farriers. A hoof plays a major role in its ability to survive and function. Hooves perform many functions, including supporting the weight of animal, dissipating the energy impact as the hooves strike the ground, protecting the tissues and bone within the hoof, and providing traction for the animal. Horse's hooves not only require daily cleaning, but some horses benefit from shoeing as well. Horse's hooves are subjected to many insults either out in the pasture or while they are being ridden or driven. Stone bruises, punctures, and abscesses are all common problems in equine hooves. Horses also suffer from diseases similar to those in cattle, sheep, and goats. Understanding the functional anatomy of the horse hoof is essential in order to further investigate the structures involvement in the pathogenesis of lameness and in order to help understand disorders such as lameness and laminitis.

All four hooves of a horse are structurally designed the same. The Hoof is the horny covering of the distal end of the digit. For description it is divided into external structures such as wall, sole and frog, and internal structures as digital cushion and bones.

(A) Wall of Hoof

The hoof wall can either be black or white. While there is some belief that black hooves are stronger than white hooves, that's just a myth. Farriers confirmed that the quality of the hoof is not affected by its colour**.** The wall is hard, horny outer covering that house and protects the more delicate structures within, supports the weight of the horse and absorbs shock as the horse moves (Fig.1). It covers the front and sides of the foot, and is reflected posteriorly at an acute angle to form the bars (Fig.2). Hoof wall does not have blood vessels and nerves. It is a continually growing, keratinous material that needs to be trimmed or naturally worn off. A healthy hoof wall grows about 3/8 of an inch per month; 5/16 of an inch (8 mm) every month. Hoof wall can either be black or white. The primary purpose of the outer wall is store and release energy during the different phases of the stride to help propel the horse. It also provides protection from the structures within, regulating ingress and egress of moisture. Healthy wall should not have any cracks or rings. Cracks can make the internal structures vulnerable to potentially damaging substances, like gravel or germs. Rings on wall can indicate that the horse may have some additional health problems that are affecting his hooves.

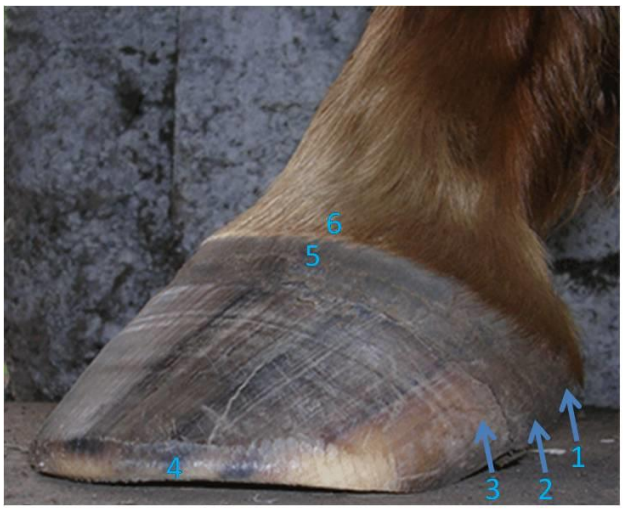

Fig.1 Hoof wall showing 1. Heel bulb, 2. Heel, 3. Quarter 4. Toe 5. Periople 6. Coronary border

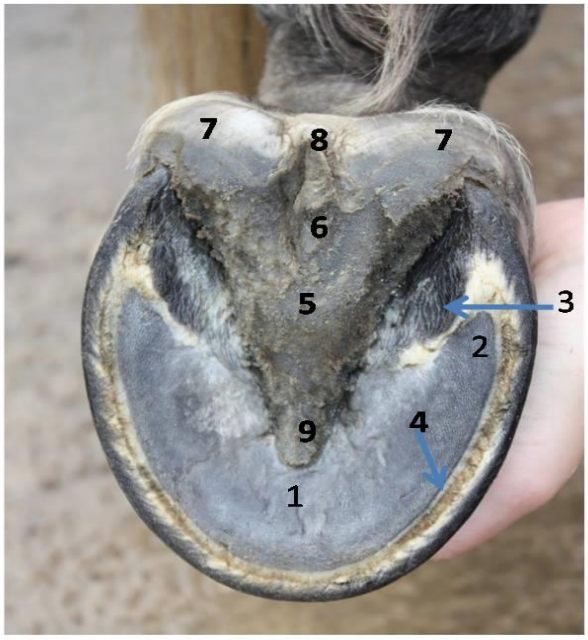

Fig.2 Hoof (ground surface) showing 1. ole, 2. crura 3. bar ,4. white line, 5. frog 6. central sulcus 7. bulb 8. base of frog and 9. apex of frog.

The different parts of wall are following

1. Toe: Most anterior part of the wall (Fig.1).
2. Quarter: Medial and lateral parts of the wall (Fig.1)
3. Heel: Angles of the wall (Fig.1).

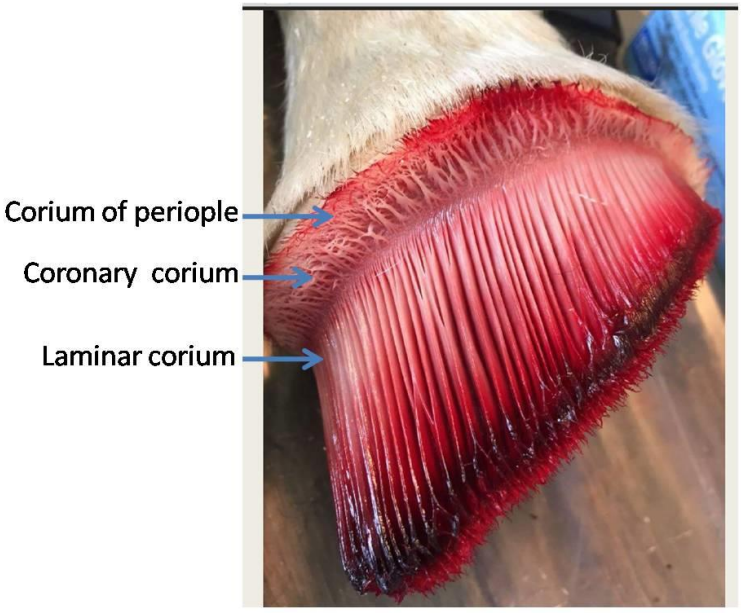

Fig.3 Internal view of hoof after removal of hoof wall and part of skin showing

The thickness of wall at the toe, quarter and heel is about in the ratio of 4:3:2 for the fore foot and about 3: $2^{1/2}$:2 for the hind foot. For description the wall has 2 surfaces and 2 borders:

a. **External surface**: it is convex from side to side and slopes obliquely from edge to edge. Angle of inclination to the ground on the front of the hoof. In forelimb- 50 degree, in hind limb is 55-degree angle of inclination to the ground on the heel is 100 degrees.

b. Internal surface: it is concave from side to side and bears about six hundred thin primary laminae which extends from coronary groove to the basal border of the wall (Fig.4). Each primary laminae bears a more than hundred secondary laminae, so that the arrangement is pinnate on cross scetion. Laminae are continued on the inner surface of the bars and dovetail with corresponding laminae of the corium (Fig.3).

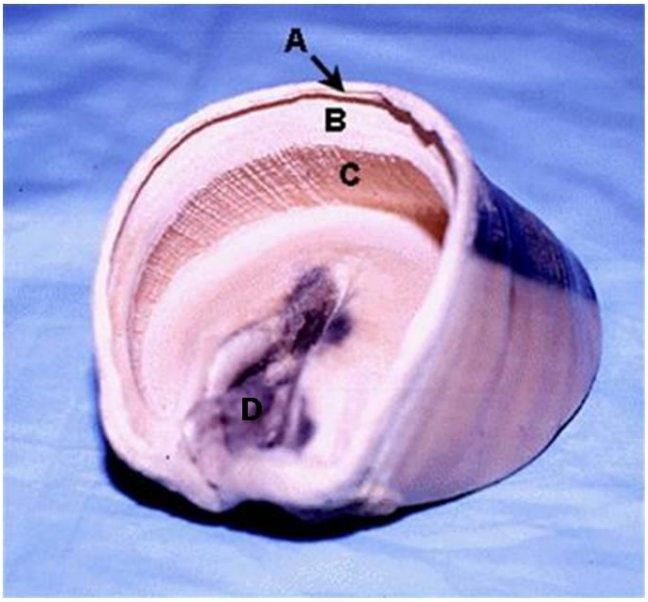

Fig.4 Showing (internal surface) A. coronary groove, B.perioplic groove ,C. laminae of wall and D. frog stay

Borders

a. Coronary border: it is thin and covered by a layer of soft, light-colored horn known as the periople; this appears as a ring like prominence above and gradually fades out below; at the angle it forms a wide cap or bulb and blends centrally with the frog (Fig.1). The inner aspect of

the border is excavated to form the coronary groove, which contains the thick coronary corium (Fig.4). The groove narrows on the sides and merges at the angles with perioplic groove (Fig.4).

Periople: The outer aspect of cornary border covered by a layer of soft, light-colored horn (Fig.1). This is known as periople of the hoof. The soft area is made up of newly formed hoof wall tissue, and the periople helps give it time to harden.

b. Basal border/ Ground border: It comes in contact with the ground. Its thickness is greatest in front and decreases considerably with on before backward on either sides but there is slight increase at the angles. Its inner surface is united with the periphery of the sole by horn of lighter color and softer texture, which appears on the ground surface of the hoof called white line or white zone (Fig.2). White line is distinct line of demarcation between wall of hoof and sole and should take care of it when shoeing is done in horses.

(B) Sole

Sole forms the greater part of ground surface of the hoof (Fig.2). It is somewhat crescentic in outline and for description presents two surfaces and two borders.

Surfaces

a. External surface or ground surface: it is concave, curved more strongly in the hind than the fore foot. The curvature is more in lighter breeds than in heavy draft horses. The surface is usually rough, since the horn exfoliate here in irregular flakes.

b. Internal surface: it is convex and slopes obliquely downward to the convex border. It presents numerous small funnel like openings which contain numerous papillae of the sole corium in the natural state.

Borders

a. **Convex border:** it is joined to the wall by relatively soft horn called white line on the ground surface of hoof (Fig.2). The white line is somewhat yellow in color as discussed previously. White line is the junction between the hoof wall and the sole. Tissues of the white line area contribute to sole protection and help attach the sole to the inner wall of the hoof. When the white line area becomes impaired, it allows germs to enter and separate the layers of the hoof wall. Once this happens, it can spread throughout the hoof and make the horse lame.

b. **Concave border:** it is in the form of deep angle, which is occupied by the bars and the apex of frog (Fig.2). It concurs in part with these in forming two pronounced ridges in the interior of the

foot. The parts of the sole between the wall and bars are called crura (Fig.2). The palmer or planter extremity of crus is called angle of the sole.

(C) Frog

It is wedge shaped mass which occupies the angle bounded by bars and sole and extends below the ground surface of the foot (Fig.2). It protects the digital cushion beneath it, aids in traction and circulation in the hoof, and partly acts as a shock absorber when the horse moves. For description it has two surfaces, a base and an apex.

Surfaces

1. External surface or ground surface: it presents central sulcus, bounded by paired ridge like called crura. The medial and lateral surfaces are united at the upper part with the bars and sole
2. Internal surface: it bears central ridge called frog stay, which is high posteriorly but dorsally subsides abruptly in front (Fig.4). On either side of this there is depression, bounded outwardly by the rounded ridge formed by the junction of the frog with the bar and sole. The surface presents fine stria and openings for the papillae of corium.

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Base: It is depressed centrally and prominent at the sides where it unites with angles of the wall; the junction here is covered by the expanded periople and constitutes the bulb of the hoof (Fig.2).
Apex: it occupies the central angle of the concave border of the sole and form blunt rounded prominence a little dorsal to the middle of the ground surface of the hoof (Fig.2).

Corium of the foot or Pododerm

It is specially modified and highly vascular part of the corium of the common integument which furnishes nutrition to the hoof (Fig.3). It is divided into five parts which nourish corresponding parts of the hoof.

1. **Perioplic corium:** it gives nutrition to periople**.**
2. **Coronary corium:** it gives nutrition to bulk of wall of hoof.
3. **Laminar Corium:** it gives nutrition to horney lamellae and interlaminar horn of the white zone.
4. **Corium of sole:** it gives nutrition to horny sole.
5. **Corium of frog:** it gives nutrition to frog.

Vessels and nerves of hoof

The corium is richly supplied by digital arteries. The veins are valvless and form extensive plexuses which communicate with each other and are drained by the digital veins. The

lymph vessels form subpapillary plexuses in corium of sole and frog. The nerves are branches of the digital nerves.

Internal Structures

1. Digital cushion

It is wedge shaped mass which overlies the frog (Fig.). For description it presents four surfaces, a base and an apex. The superficial surface covered by corium of frog. The sides are related chiefly to the cartilages of the distal phalanx or coffine bone. The deep surface of cushion is connected with the distal fibrous sheath of the deep digital flexor tendon. The base is situated caudally and presents two prominences termed bulb of cushion. The apex is adherent to the terminal part of deep digital flexor tendon (Fig.5)**.** The digital cushion is poorly supplies with vessels. It consists of white and elastic fibres, in meshes of which are masses of fat and some islands of cartilage. The bulbs are soft and contain more fat. The coiled glands occur chiefly in the part which overlies central ridge of frog and their secretion contains fat. Horses with a long toe, low-heel conformation may have a compromised digital cushion, as the heels are load-bearing more weight than normal and it slowly compresses the cushion's thickness. Once the digital cushion is "crushed," it will not regenerate.

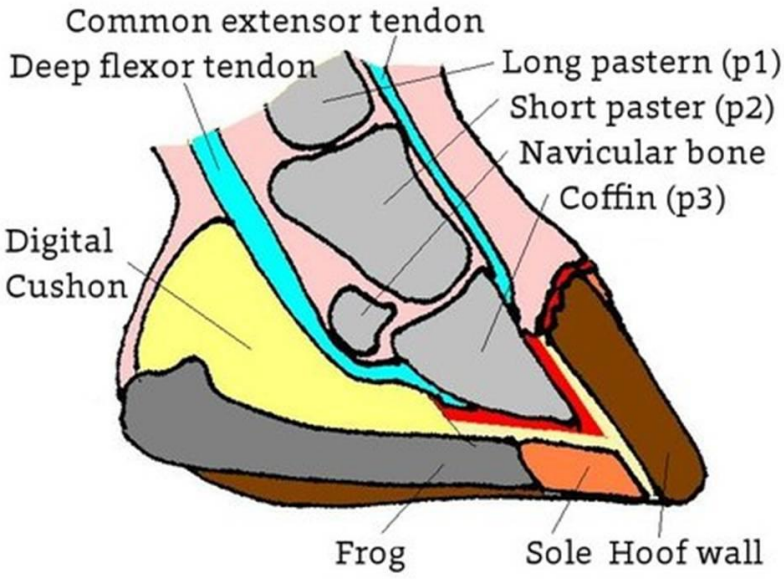

Fig.5 Showing different parts of hoof (lateral view)

2. Coffin Bone/ Pedal bone/IIIrd Phalanx

The coffin bone is encapsulated in the hoof (Fig.5). It is the largest bone in the hoof and helps to shape the hoof wall. It is surrounded by special tissues that make-up the laminae of the hoof wall, as well as, the tissues of the sole. Anything that upsets the working relationship between the coffin bone and the hoof capsule, such as major shoeing changes, sole puncture and rotation of the coffin bone, can result in lameness.

3. Navicular Bone/ Distal sesamoid bone

The navicular bone is the small bone that is tucked behind the coffin bone and the short pastern bone (Fig.5). The navicular bone helps to stabilize the coffin bone and allows for some

tilt over uneven ground. There are two major tendons that help support and move the bones the extensor tendon and the deep digital flexor tendon. The extensor tendon attaches to the front of the coffin bone and straightens the leg; whereas, the deep digital flexor tendon runs down the back of the leg and wraps around the navicular bone, bending and flexing the leg.

Hoof care and its management

Hoof care is an important issue for all horse owners. While a horse may be able to sustain injury or illness in many parts of its body, the hoof bears weight and so adds hundreds of pounds of stress to any ailment. Maintaining a healthy hoof is the best way to give horses a good shot at long, healthy lives. Regularly pick out your horse's hooves. The goal of picking out the hoof is to keep out rocks and thrush. A horse hoof grows continuously over time and need to be trimmed every six to eight weeks to keep them in proper shape. The hooves must also be balanced to the horse's natural way. Some common horse hoof problems as cracks, canker, bruished sole, thrush, abcess and overgrown hoof, that can be happen (Figs.6-11). So it is important to know what to

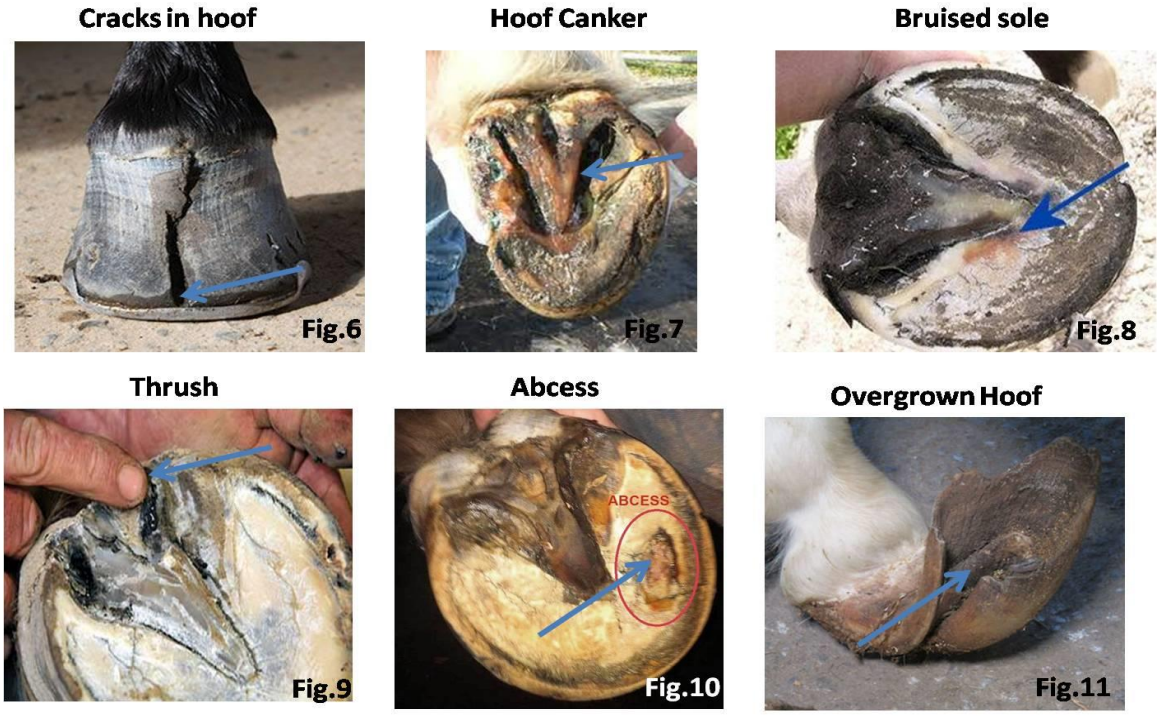

Fig.6–11 showing some common horse hoof problems

watch out for, and what to do in case a problem arises. This is why it is important to check your horse's hooves regularly. A horse is only as strong as the feet it stands on. Without a healthy hoof, a horse could be in trouble.

Horse Shoeing

Not every horse will require shoeing, but if your horses are doing a lot of hard work or working on hard surfaces, the horse will need to be shod. If a hoof is not maintained properly, it can cause problems such as cankers, bruised sole, abscesses, and cracks in the hoof wall. Horse shoe prevent the feet of horses from being worn down excessively. It also prevents hoof wall from proximally to the end of the horny wall at the coronary splitting. Horse shoe prevent slipping of feet. Shoe protects the foot from bruising. Shoeing achieves a balanced foot with normal axis. Horse shoeing keep the pastern and hoof axis unbroken. Shoeing reduces uneven concussion to the foot. Horse shoeing give better traction in unfavourable for shoeing & terrain. It also helps to cure hoof diseases & weight and hoof defects. Physiological horseshoeing could be defined as that which promotes a healthy functional foot, biomechanical efficiency and prevents lameness.

Conclusion

Functional anatomy of the hoof is helpful to understand how certain lamenesses occur, how to prevent them. In order to understand how to properly care for the hoof, it is important that understand the basic structure and anatomy of the hoof. The hoof is a complex structure that plays a key role in many aspects of the animal's overall health and productivity. Healthy hooves lead to healthy animals, which raises productivity and income. When hooves are kept in good condition, it reduces the losses that stem from treating lame animals and the production losses that result from their discomfort. A lame animal is not only in pain, but it is an extra expense that most producers cannot afford. By maintaining a sound hoof management routine, animal owners can reduce their economic losses and increase their chances for profit in the future.

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Popular Article

Quantitative Genetics: A better tool to understand animal population

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Abstract

Quantitative genetics or population genetics is a subfield of genetics that deals with genetic differences within and between populations, and is a part of evolutionary biology. Studies in this branch of biology examine such phenomena as adaptation, speciation, and population structure. The average effect and average excess of a gene substitution are formulated in terms of gene frequencies and inbreeding coefficient. The role of population mean, average gene effect and variances plays an important role in population study.

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Introduction

Genetics can no longer be regarded as a very young science. To be sure, no part of the genetic theory is established firmly enough and elaborated completely enough to be respectfully embalmed for all time to come in textbooks and manuals. (Meglitsch, 1954). Nevertheless, some basic rules of the transmission of heredity from parents to offspring are so well known that the ignorance of a Lysenko is needed to deny them. Chromosomes and their parts can be, in well studied organisms, juggled almost at will. The genetic consequences of this juggling are predictable with sufficient accuracy to be used as safe problems for doctoral dissertations. In contrast to the rules of the transmission of heredity, population genetics is quite young. Quantitative genetics deals with phenotypes that vary continuously (in characters such as height or mass)—as opposed to discreetly identifiable phenotypes and gene-products (such as eye-color etc.) Due to the continuous distribution of phenotypic values, quantitative genetics must employ many other statistical methods (such as the effect size, the mean and the variance) to link phenotypes (attributes) to genotypes. (Álvarez-Castro and Carlborg, 2007)

What is the Gene Effect?

Sir Ronald Fischer (1930) defined the gene effects as deviations from a central value—enabling the use of statistical concepts such as mean and variance, which use this idea. The central value he chose for the gene was the midpoint between the two opposing homozygotes at the one locus. The deviation from there to the "greater" homozygous genotype can be named "+*a*"; and therefore, it is "-*a*" from that same midpoint to the "lesser" homozygous genotype.

This is the "allele" effect mentioned above. The heterozygote deviation from the same midpoint can be named "*d*", this being the "dominance" effect referred to above. The diagram depicts the idea. However, in reality we measure phenotypes, and the figure also shows how observed phenotypes relate to the gene effects. (Zeng et al., 2005)
Suppose take the value of locus A, with alleles **A** and **a**.
So, the Individuals with genotype will be **AA, Aa and aa**.

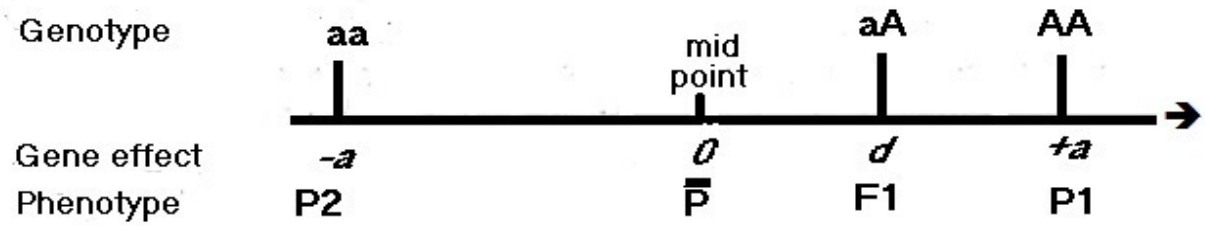

fig.1: Genotypic and gene value of Phenotype (source: Wikipedia)

Here, **A** allele is increasing the value and **a** is decreasing and **d** is the degree of dominance.

- d=0, when there is no dominance.
- If A is dominant than a, then d is positive and *vis a versa*. (Partial dominance).
- If A is completely dominant, then Aa will be same as AA. and d= a
- If a is completely dominant, then Aa will be same as aa, and d= -a.
- In case of over dominance, then d>a or d<-a.

Population mean:

Let the Frequency of A gene= p, i.e., f(A) = p and f(a) =q

Genotypes	Frequency	Value	f x v
AA	p^2	+a	ap^2
Aa	2pq	d	2pqd
aa	q^2	-a	$-aq^2$

Total = $ap^2+2pqd-aq^2$

$= a(p^2 - q^2) + 2pqd$

$=a(p-q) + 2pqd$ ---------- (1)

So, Mean phenotypic value in a population= Mean genotypic value in a population=

M=a (p-q) +2pqd

In a random breeding population, where f x v and sum of it gives the mean value of the whole population.

Here, **a (p-q) is attributed to homozygous.**

2pqd is attributed to heterozygous.

1. If d=0 (Where there is no dominance)

=> **M = a (p-q)** ---------- (2)

population mean ∝ gene frequency

2. If d = +a (complete dominance,

Then, M = a(p-q)+ 2pqa

= a (p-q+ 2pq)

$=a [1-q-q+2q-2q^2]$

$M = a(1-2q^2)$ ---------- (3)

3. If A is fixed, p=1 and q=0 (a won't occur at all)

=> **M =a** ---------- (4)

And if a is fixed then **M= -a** ---------- (5)

4. If a character contains several allele then the equation will be

$$M= \sum a(p-q) + 2\sum pqd \quad \text{---------- (6)}$$

Average Effect

- Parents pass on their genes but not the genotype as it is formed freshly within. Therefore a new value is required referring to Genes.

- So breeding value is associated with the value of genes that are transmitted to The Offspring. This is the average effect in crude or rough sense.
- By definition, **the average effect of a gene is the mean deviation from population. Mean of individuals which receives that Gene from one parent. The other gene from other parents comes at random from the population.** Another way of explaining the average effect is, if we could change A2 Gene into A1 at random in the population, the resulting change of the value is the average effect of the gene substituted**.** (Falconer and MacKay, 1996).

Average Effect of Gene Substitution

- If we could change say, A2 gene <--------->A1 gene at random in the population and could note the resulting change of value. Then this is called the average effect of the gene's substitution. It is equal to the difference between the average effect of A1 and A2.

Average Effect w.r.t. a and d*a* and *d:*

- Let the Average Effect of A1 gene = α_1
- If gametes carrying A1 unite at random with other gametes from the population, now the genotype produced from A1A1 will be **p** proportion of **f(A1A1)** of previous population and **q** proportion of **f (A1A2).** [As, A2 is converted to A1 so, A2A2 is A1A2]
  i.e. A1A1 individuals produced are of p proportion and A1A2 in q proportion.
  So the mean value of gene A1 = pa + qd , resulting change i.e.,

$$\alpha_1 = [pa + qd] - [a(p-q) + 2pqd]$$

$$= pa + qd - pa + qa - 2pqd$$

$$= q(d+a) - 2pqd$$

$$\therefore \alpha_1 = q[a + d(q-p)]$$

Similarly, Average effect of A2 gene $(\alpha_2) = -p[a+d(q-p)]$

Dominance Deviation

- We know that,

$$G = A + D$$

$$\Rightarrow D = G - A$$

Genotypic Value of A1A1 = +a

Population Mean = a (p-q) + 2pqd

∴ Genotypic value as a deviation from population mean (As Breeding value are always expressed as deviation from population)

Genotypic value = a- [a (p-q) + 2pqd]

= [a - ap +aq-2pqd]

= [a - a(1-q)+ aq- 2pqd]

= [a-a +aq+aq-2pqd]

= 2q [a-dp]

∴ **A1A1 = 2q(a-dp)**
A2A2 = -2p (a+ qd)
A1A2 = d-a + 2q (a-dp)

Interactive Deviation

P = G+ E
= A+ D+ I+ E

Inter allelic Interaction or epistasis is due to interaction among more than one locus i.e., when more than 1 locus is involved then there is epistasis (I).

$G = G_A + G_B + I_{AB}$

G_A is genotypic value at locus A

$G_{B\ is}$ genotypic value at locus B.

Variance

In probability theory and statistics, variance is the expectation of the squared deviation of a random variable from its population mean or sample mean. Variance is a measure of dispersion, meaning it is a measure of how far a set of numbers is spread out from their average value. Variance has a central role in statistics, where some ideas that use it include descriptive statistics, statistical inference, hypothesis testing, goodness of fit, and Monte Carlo sampling. Variance is an important tool in the sciences, where statistical analysis of data is common. The variance is the square of the standard deviation, the second central moment of a distribution, and the covariance of the random variable with itself, and it is often represented by V_A or σ_A^2.

Variance components:

Components	**Symbol**	**Value**
Phenotypic	V_P	Phenotypic Value
Genotypic	V_G	Genotypic Value
Additive	V_A	Breeding Value
Dominance	V_D	Dominant Deviation
Interaction	V_I	Interaction deviation
Environmental	V_E	Environment Deviation

Conclusion

Fisher's concepts of average effects and average excesses are at the core of the quantitative genetics' theory. Their meaning and relationship have regularly been discussed and clarified. Here we develop a generalized set of one locus two-allele orthogonal contrasts for average excesses and average effects, based on the concept of the effective gene content of alleles. The article helps understand the average excesses of alleles for the biallelic case. It has been discussed how average excesses relate to the average effects and to the decomposition of the genetic variance.

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Popular Article

Amoebiasis: A long lasting Zoonotic threat to mankind

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Introduction

Amoebiasis is caused by the parasite Entamoeba histolytica that is a pathogenic intestinal protozoan transmitted through water and food. This parasite is the only species of its genus that can cause mild irritation, injury, inflammation in the walls of the colon and cecum. Although it is more common in people who live in tropical areas with poor sanitary conditions still it can affect anyone. Few cases around 4-10% showed parasites invading other organs, especially the liver, lungs, kidneys, and brain. Based on the location of the infection, amoebiasis is divided into two types namely intestinal amoebiasis and extraintestinal amoebiasis.

Taxonomy (Junaidi et al; 2020)

Entamoeba histolytica originate from the Sarcomastigophora phylum, the Lobosea class, the Endamoebidae family, the Amoebida order and the genus Entamoeba

Causal Agent

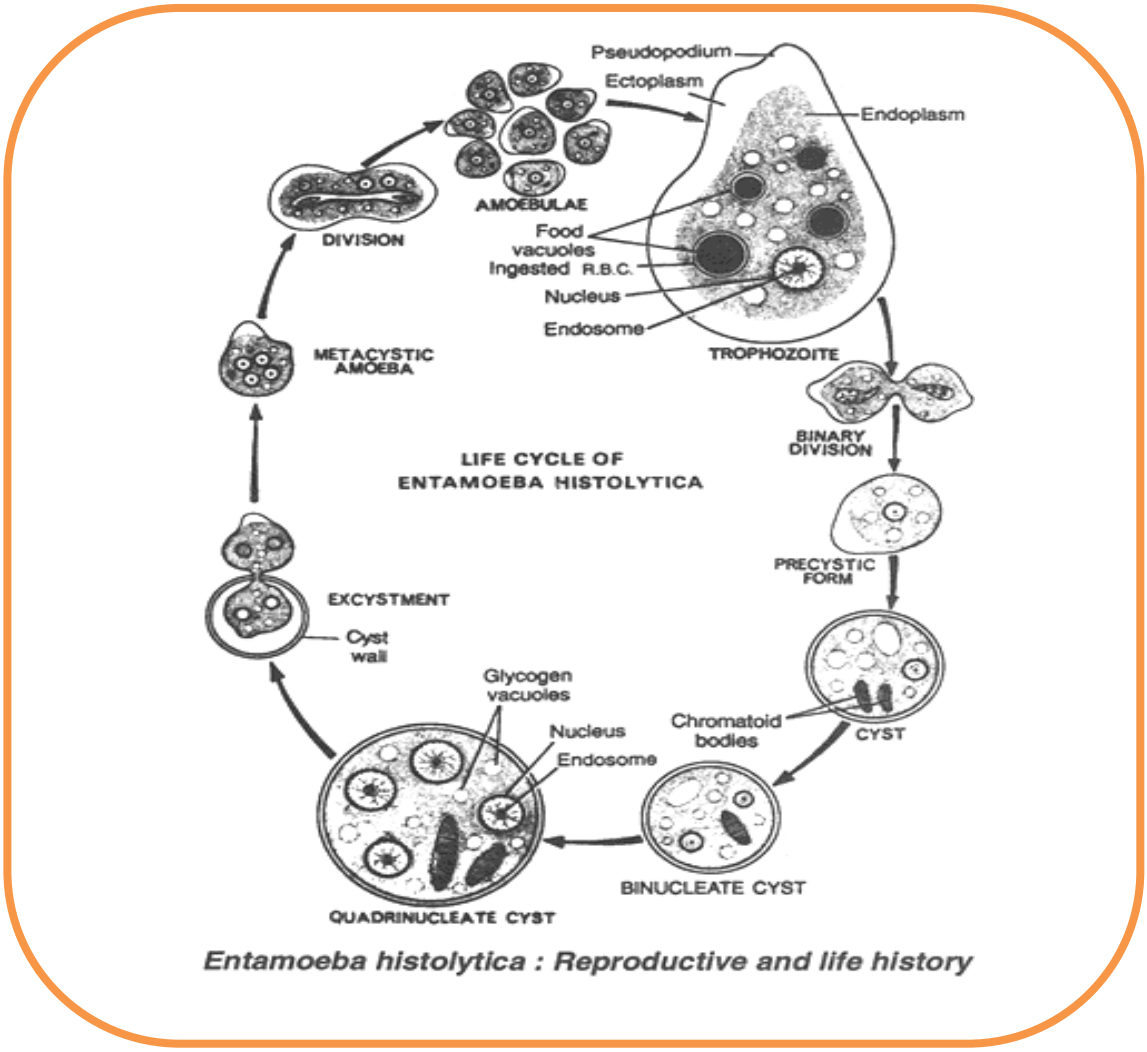
Several protozoan species in the genus Entamoeba colonize humans, but not all of them are associated with disease. Entamoeba histolytica is well recognized as a pathogenic amoeba, associated with intestinal and extraintestinal infections.

Epidemiology (Cope & Ali, 2019)

Amoebiasis is distributed worldwide, particularly in the tropics, most commonly in areas of poor sanitation. Long-term travelers (duration >6 months) are significantly more likely to be affected by E. histolytica infection than short-term travelers (duration <1 month). Recent immigrants and refugees from endemic areas are also at risk. Outbreaks among men who have sex with men have been reported. People at higher risk for severe disease are those who are pregnant, immunocompromised, or receiving corticosteroids; associations with diabetes and alcohol use have also been reported.

Life Cycle (Junaidi *et al;* 2020)

The life cycle of E. histolytica includes trophozoite stages, precystes, cysts, metacysts, and metacystic tropoozoites (Figure 1). Stage E. histolytica transition is strongly influenced by factors of food availability and environmental stress. 1) Cyst with 4 nuclei (metacyst) from contaminated food or drinking water (A-C). 2-4) once in the small intestine, the cytoplasm and nucleus are divided into 8 small amoebulae (metacystic to trophozoites). 5, 6) adult trophozoites (minuta form) reproduce by binary fission 7) non-nucleated cysts (precursors) containing large chromatoid objects and glycogen vacuoles. 8) Cyst with 2 nuclei and body chromatoid. 9) Metacyst is excreted with the patient's stool and transmits another host. 10- 11) Some forms of minuta can grow into histolytic (magna) forms, penetrate the intestinal wall and through the bloodstream, to other organs such as the liver, lungs, and brain (11 ac), parasites cause abscesses (amoebomae). Live amoebas are only found at the edge of this ameboma.



Entamoeba histolytica : Reproductive and life history

Transmission (Junaidi *et al;* 2020)

Three important pathways that contribute to the spread and spread of E. histolytica are 1) person to person transmission; 2) water and foodborne transmission and 3) borne transmission vector. Other factors that can also increase the risk of disease transmission are malnutrition, poverty, low education, population density, inadequate water supply, and poor sanitation. Risk factors that are associated with increased disease severity and mortality include young age, pregnancy, malignancy, malnutrition, alcoholism, and corticosteroid use. Fruits and vegetables that are eaten raw and are not peeled, washed properly also act as medium for entry of various parasites into the digestive system. Parasitic cysts do not die by water chlorination and detergents. However, washing with detergent and running water can dissolve attached parasites. Cysts can also be damaged with 5% acetic acid or low heating for 15 minutes.

Immune Response

Various host immune mechanisms educed in response to amoebiasis to clear or prevent infection. Interferon gamma (IFN-Ɣ) provides protection from amoebiasis. It has been seen those children with higher IFN-Ɣ had a significantly lower incidence of future *E. histolytica* diarrhea and protection from amoebiasis by acquired immunity from antibodies against the amebic antigens like Gal/GalNAc lectin and *Eh*MIF. Another cytokine produced during infection is interleukin-8 (IL-8), a potent neutrophil chemoattractant, which increases the neutrophils infiltration in the intestinal tract as the first cells of an innate immune response against amoebic invasion. Even though the immune response is normally protective sometimes it may produce undesirable effects if the amount of immune response is excessive.

Pathology (Harries, 1982)

If the intestinal environment is favorable and the variety of E. *histolytica* is pathogenic, invasion of the mucosa occurs. The amoebae having lysosomal enzymes shows cytopathogenic effect in addition with their active pseudopodic movement which helps them to penetrate intact mucosa. At the submucosa, lateral spread takes place by a process of lysis and necrosis of cells. There is no inflammatory reaction around these initial lesions, which produce **flask-shaped ulcers** and are seen on the mucosal surface as slightly raised areas with central yellow pits often surrounded by petechial hemorrhages. This mode of invasion causes the edges of these ulcers to be undermined, which becomes more obvious as they enlarge. The ulcers tend to be diamond-shaped. In the majority of cases the intervening mucosa is unaffected and the visible lesions are distinct, unlike the convergent changes in bacillary dysentery and ulcerative colitis. Repeated

invasion of the colon by *E. histolytica* followed by secondary infection may leads to formation of granuloma formation called as the ameboma

Clinical Manifestations (Kantor *et al.;* 2018)

Intestinal Amoebiasis

Approximately 19% of *Entamoeba* infections are asymptomatic. Amoebic colitis generally has a subacute onset, with symptoms ranging from mild diarrhea to severe dysentery, abdominal pain and watery or bloody diarrhea. Rare but serious complications such as toxic megacolon, fulminant necrotizing colitis, and fistulizing perianal ulcerations can also occur, particularly when diagnosis and treatment is not done timely. Patients shows signs of toxemia, with fever, bloody diarrhea and peritoneal irritation.

Ameboma formation is another uncommon manifestation that is seen in amebic colitis. It causes pain and swelling in the right iliac fossa with symptoms of bowel obstruction. Macroscopically, amebomas look like a mass (or multiple masses) typically localized in the cecum or ascending colon and consist of localized hyperplastic granulation tissue. Ameboma formation is generally associated with untreated or partially treated amoebic colitis. Its appearance sometimes may resemble lymphoma, neoplasm, tuberculosis, abscess, or inflammatory bowel disease. Thus, colonoscopy and histopathological examination of the biopsied material helps in differentially diagnosing the actual lesions and excluding the others.

Extra Intestinal Invasive Amoebiasis

Liver

Amebic liver abscess (ALA) is the most common extra intestinal manifestation of amoebiasis. Patients show chronic symptoms like diarrhea, weight loss and abdominal pain. Dysentery is most common symptom seen in 40% of affected patients. Leukocytosis, transaminitis and elevated alkaline phosphatase on laboratory evaluation are usually recorded and imaging shows abscess, mainly on the right hepatic lobe. Amoebic abscesses are usually solitary but sometimes multiple abscesses can also occur (described in previous literature). Anemia and hypoalbuminemia is commonly recorded in ALA in comparison to pyogenic abscesses.

Lungs

Lungs are the second most common extra intestinal organ affected. Pulmonary amoebiasis usually occurs by direct extension of an ALA but can also occur by direct

hematogenous spread from intestinal lesions or by lymphatic spread. The right lower or middle lobe of the lung is most commonly affected. Patients present with fever, hemoptysis, right upper quadrant pain, and referred pain to the right shoulder or intrascapular region. **Patients characteristically present with "anchovy sauce-like" like pus or sputum.** The presence of bile in these secretions indicates liver origin.

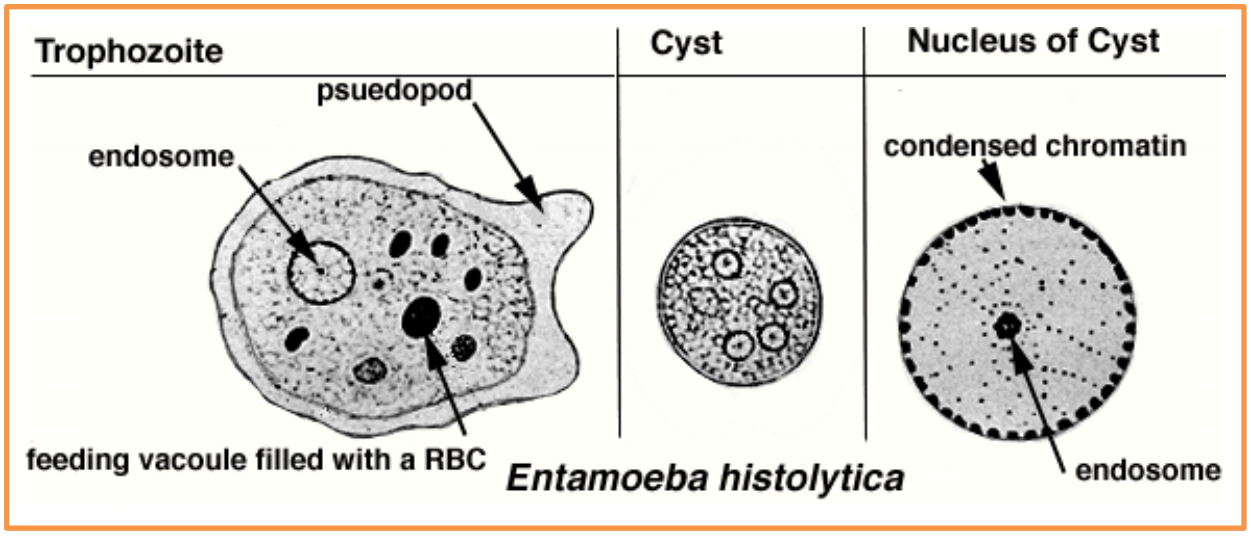
Differential Diagnosis

Symptoms are mainly nonspecific and the differential diagnosis is broad. Infectious causes that need to be excluded include shigella, salmonella, campylobacter, and enteroinvasive and enterohemorrhagic *Escherichia coli* . Noninfectious causes include inflammatory bowel disease, intestinal tuberculosis, diverticulitis, and ischemic colitis (Kantor *et al.;* 2018).

Diagnosis

Various diagnostic tools exist for the diagnosis of *E. histolytica* including microscopy, serology, antigen detection, molecular techniques, and colonoscopy with histological examination. Identification of cysts or trophozoites in stool cannot accurately identify the disease caused by *E. histolytica*, because it is morphologically indistinguishable from *E. dispar* and *E. moshkovskii* which are considered nonpathological species.

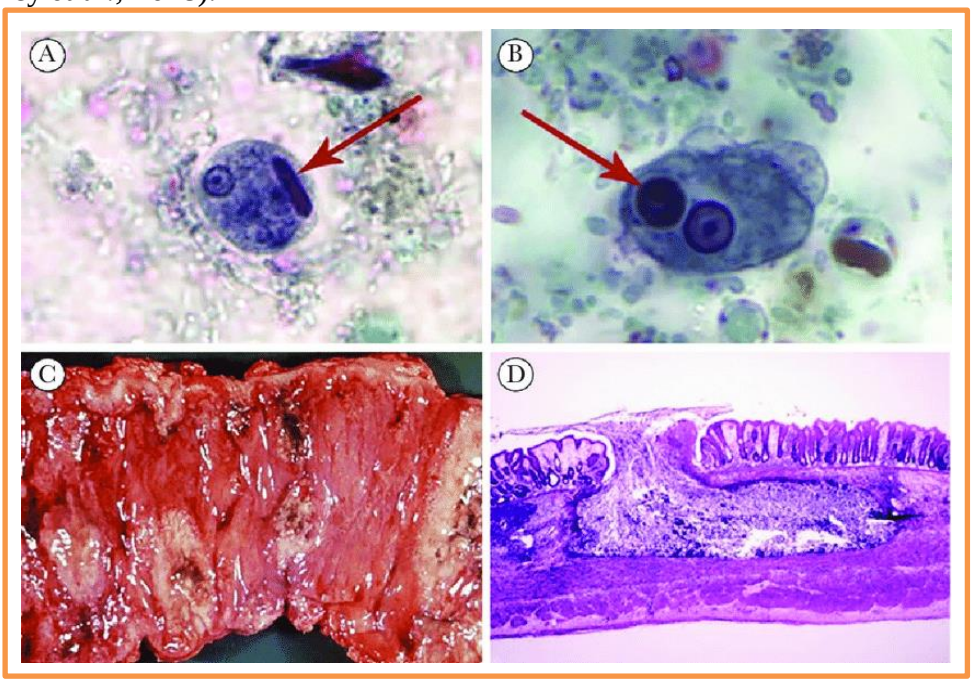
Stool Microscopy Cysts and trophozoites can be visualized with evidence of hemophagocytosis. Fresh stools increase the recovery of both trophozoites and cysts and can be prepared as either wet mounts or stained preparations. **Mature cysts have 4 nuclei measuring about 12–15 µm in diameter. Trophozoites have a single nucleus and are slightly larger, measuring about 15–20 µm.**



The identification of *E. histolytica*-specific nucleic acids **by PCR** is fast, precise and efficient in diagnosing both intestinal and extra intestinal disease. It has high sensitivity and specificity but due to lack of standardization and high cost, it is not available widely for diagnostic testing. **Stool and serum antigen detection assays** are sensitive, specific (differentiating between strains), and easy to perform and can possibly diagnose early infection. Antigen detection can also be done using **radioimmunoassay, ELISA or immunofluorescence.**

To diagnose amoebiasis, direct visualization of the colon can be done by colonoscopy specially when nonspecific gastrointestinal symptoms are present and diagnosis becomes difficult. It also helps in excluding other disease, mainly neoplasms. **The most common findings are "flask-like" ulcerations or erosions typically present in the cecum,** followed by the rectum, ascending colon, sigmoid colon and, rarely, the transverse and descending colon.

Currently the best diagnostic approach for diagnosis is combination of serological testing with PCR or antigen detection. Combined technique usage increases the specificity and sensitivity for the diagnosis of *E. histolytica* infection. Further, these method allows clinicians to distinguish acute infection from chronic or previously treated infection (Kantor *et al.;* 2018 & Shirley *et al.;* 2018).



Treatment & Prevention

The amoebicidal agents include metronidazole and tinidazole, which are both nitroimidazole agents. There is no vaccine to prevent amoebiasis. Therefore, focus of primary

preventative efforts remains attention to hand hygiene, food and water safety and avoidance of fecal–oral exposure, including sexual practices. Before travel to endemic areas such as Asia, Mexico, South America, and sub-Saharan Africa, patients should be advised about food safety to prevent enteric illness. Patients, should also be advised to avoid sexual practices that may lead to fecal–oral transmission.

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Popular Article

Climate Change Impact on Livestock

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Abstract

Livestock has a two-way impact on climate change in general. firstly, the livestock's contribution to climate change, and second is how climate change affects livestock. As a result, boosting livestock productivity in a changing climate scenario requires reducing both livestock greenhouse gas emissions and the impact of climate change on livestock output. Under the changing climate scenario, these activities will optimize cattle output. By 2050, global demand for animal products is predicted to quadruple, owing primarily to rising global living standards. Meanwhile, the influence of climate change on feed crop and forage quality, water availability, animal and milk production, livestock illnesses, animal reproduction, and biodiversity poses a threat to livestock production.

Introduction (Junaidi et al; 2020)

By 2050, the world's population is predicted to grow from 7.2 billion to 9.6 billion people (UN, 2013). This is a 33% increase in population, but as the global quality of living rises, demand for agricultural products will rise by almost 70% in the same time span (FAO, 2009). In the meantime, total global cultivated land area has remained constant since 1991, indicating greater productivity and intensification initiatives. Climate change, competition for land and water, and food security at a time when it is most required are all expected to have a negative impact on livestock output.

Consequences of climate change

Climate change has direct consequences for livestock in terms of growth, milk production, reproduction, metabolic activity, and illness occurrence. Climate change has indirect effects on livestock through diminishing the availability of water, pasture, and other feed resources. Mitigating the effects of environmental stress on cattle necessitates multidisciplinary approaches that prioritize animal nutrition, housing, and health. It is critical to comprehend and assess livestock responses to the environment in order to make nutritional and environmental management changes that will improve animal comfort and performance. Alcohol use have also been reported.

Most key aspects of livestock production, such as water availability, animal production, reproduction, and health, are affected by temperature. Temperature, CO2 levels, and precipitation variations all have an impact on forage quantity and quality. Temperature and precipitation variations have a major impact on livestock illnesses.

A thermal comfort zone exists in all animals, which is a range of ambient environmental temperatures that are helpful to physiological activities. Temperature, humidity, species, genetic potential, life stage, and nutritional state all influence heat stress in livestock. Because livestock in lower latitudes are normally better acclimated to high temperatures and droughts, livestock in higher latitudes will be more affected by rising temperatures than livestock in lower latitudes. Heat stress reduces forage intake, milk output, feed conversion efficiency, and performance.

Heat stress can decrease the reproductive efficiency of both sexes of livestock. It has an effect on oocyte growth and quality, embryo development, and pregnancy rate in cows and pigs. Increased energy shortfalls and heat stress may jeopardize cow reproduction. In bulls, pigs, and poultry, stress has been linked to reduced sperm concentration and quality.

Climate change's impact on cattle diseases is determined by geographical location, land use type, disease characteristics, and animal susceptibility. Climate change, particularly rising temperatures, can have a direct or indirect impact on animal health. The direct impacts are linked to rising temperatures, which raise the risk of sickness and death. Climate change's indirect consequences include changes in microbial populations (pathogens or parasites), the spread of vector-borne diseases, food-borne diseases, host resistance, and feed and water availability.

Conclusion

To protect cattle production, climate change adaptation, mitigation measures, and policy frameworks are essential. Diversification of livestock animals, the use of multiple crop varieties, and the transition to mixed crop-livestock systems appear to be the most promising adaptation measures among the studies examined. If we wish to address climate change and livestock production with effective adaptation and mitigation methods, we need to scale them up through legislation.

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Popular Article

Parasitic Vaccines

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Introduction

Protective immunity can be induced by either active or passive immunization. Passive immunization provides immediate immunity by administering preformed antibodies to an individual. Passive immunity is short lived since transferred antibodies are metabolized. Active immunization involves administration of antigen in the form of vaccine. By this way immunity provoked takes several weeks to develop but may persist for a longer time.

Following types of antiparasitic vaccines are used-

1) **Live vaccine**- Live vaccines are based on live organisms that stimulate an immune reaction in the hosts, mimicking natural infections.

A) **Lung worm vaccine-** Dictyocaulus Viviparus infection in calves can be successfully prevented by using X irradiated third stage larvae which irradiated at 40 Kr. This vaccine contains two dose of 1000 irradiated larvae given at an interval of one month. First dose given when calves are of 8 weeks of age. It is suggested that calves should be confined indoors at least for 2 weeks after 2nd vaccination. Vaccination is claimed to be 89% effective in preventing clinical lung worm disease in average condition.

B) **Hookworm vaccination**- Larvae of Ancylostoma caninum irraadired at 40 Kr and 1000 larvae administered S/C, protected pups against the severe challenges. Vaccination may be started 72 hours after birth and maternal antibody and prenatal colostrum infection do not interfere with efficacy of the vaccine. Duration of immunity at least 7 months. An unexpected bonus of the vaccine was that it induced protection against A. Braziliense and Uncinaria stenocephala. Since this vaccine dose not induce sterile immunity allowing the single worm to become mature and produce egg, together with high cost of production led to withdrawal of vaccine in 1975.

A) Poultry coccidiosis- Coccivac and Immunocox are two commercial vaccines against poultry coccidiosis. This vaccine consists of viable oocyst from 8 different fully virulent *Emeria* spp. combined with a weak coccidiosis. Vaccine can be administered with drinking water at the age of 4-10 days. The primary exposure starts the process of immunization but the substantial immunity depends upon re-infection of birds with excreted oocysts.

B) Rakshavac T- This is a commercial vaccine against *Theileria annulata*. This vaccine based on the principle that schizontal stages of the organism can be cultivated in lymphocyte culture. If the serial passaging is done, over a long period of time, the virulence of the parasite is attenuated. The vaccination is done with such attenuated cultured schizonts, distributed in frozen form. Age of vaccination is 2 months or above and repeat yearly in endemic areas.

2) Dead vaccines -

I. Killed vaccines/ cultured supernatant

A) Neoguard- This vaccine comprising of a killed Neospora tachyzoite preparation formulated with ab adjuvant [SPUR(R)]. This vaccine has about 50% protectivity against abortions occurring at 5-6 months of gestation in cattle due to *N. caninum*.

B) Cultured supernatant like Piridog- This is a commercial vaccine against *B. canis*. This vaccine contains exoantigen obtained from micro aerophiles stationary phase culture (MASP culture) supernatant. The first dose of vaccine is given from 5 months of age and second dose is given 3-4 weeks later.

II. Recombinant/ sub-unit Vaccine-

A) Taenia ovis- This is a recombinant vaccine against *T. ovis* cysticercosis in sheep contains a cloned onchosphere antigen (TO 45w). The vaccine stimulates a response that prevents penetration of parasite into intestinal wall. This vaccine provide immunity for 12 months in 98% cases.

B) Tickguard- This is a commercial vaccine against *Boophilus microplus*. This vaccine containing mid gut antigen of *B. microplus* named Bm 86. The protective immunity interfering with engorgement phase of tick *B. microplus*. The immune components produced against these antigens get delivered to the tick gut during blood sucking process, cause damage to tick gut and lead to its elimination.

Cite as

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Popular Article

Present scenario of Sheep Farming Sector in the country

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Introduction

Livestock systems have both positive and negative effects on the natural resource base, public health, social equity and economic growth (World Bank 2009 report). Currently, livestock is one of the fastest growing agricultural subsectors in developing countries. The livestock sector currently contributes 25.6 percent to the Agricultural GDP and 4.11 percent to the National GDP.

Dairy small ruminants are mainly located in subtropical-temperate areas of Asia, Africa and Europe and they account approximately for 29% of all sheep and goats in the world, producing around 3.4% of the world's milk (FAOSTAT 2021).

Sheep with its multi-facet utility for wool, meat, milk, skins and manure, form an important component of rural economy particularly in the arid, semi-arid and mountainous areas of the country. It provides a dependable source of income to the shepherds through sale of wool and animals. They play an important role in the livelihood of a large percentage of small and marginal farmers and landless laborers engaged in sheep rearing.

Advantages of sheep farming

1. Sheep are utilized for transportation and offer meat, wool, skin, manure, and to some extent milk.
2. Wool, meat, and manure production provide three separate kinds of income each year.
3. Lambs can be sold from the age of 5-6 months (ideally before one year) and yield a quick profit.
4. Mutton is preferred by all types of community in India.
5. Generates self-employment particularly in wool and leather industry.

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6. Most suitable of the small ruminants to utilize the sparse vegetation in dry land areas through rangeland management and developed pasture.
7. Unlike goats, sheep hardly damage any tree.
8. Better adapted to arid and semi-arid tropics with marginal and sub-marginal lands which are unfit for crops.
9. Since sheep eat more different type of plants than any other kind of livestock, they can turn waste into profit and are excellent weed destroyer.
10. Sheep dung is a valuable fertilizer or premium quality.
11. **Karakul** breed of sheep is used for **pelt** production.

Grazing management and Migratory patterns

In spite of a number of sheep development activities in operation in various parts of the country, sheep rearing remains to be a nomadic/backward proposition and thus mostly affects impoverished and landless people. For scanty suitable grazing lands in most of the states, the shepherds keep on migrating their flocks across large areas within or even in the neighboring states. Sheep farming is thus done in a variety of ways, depending on the region and the location.

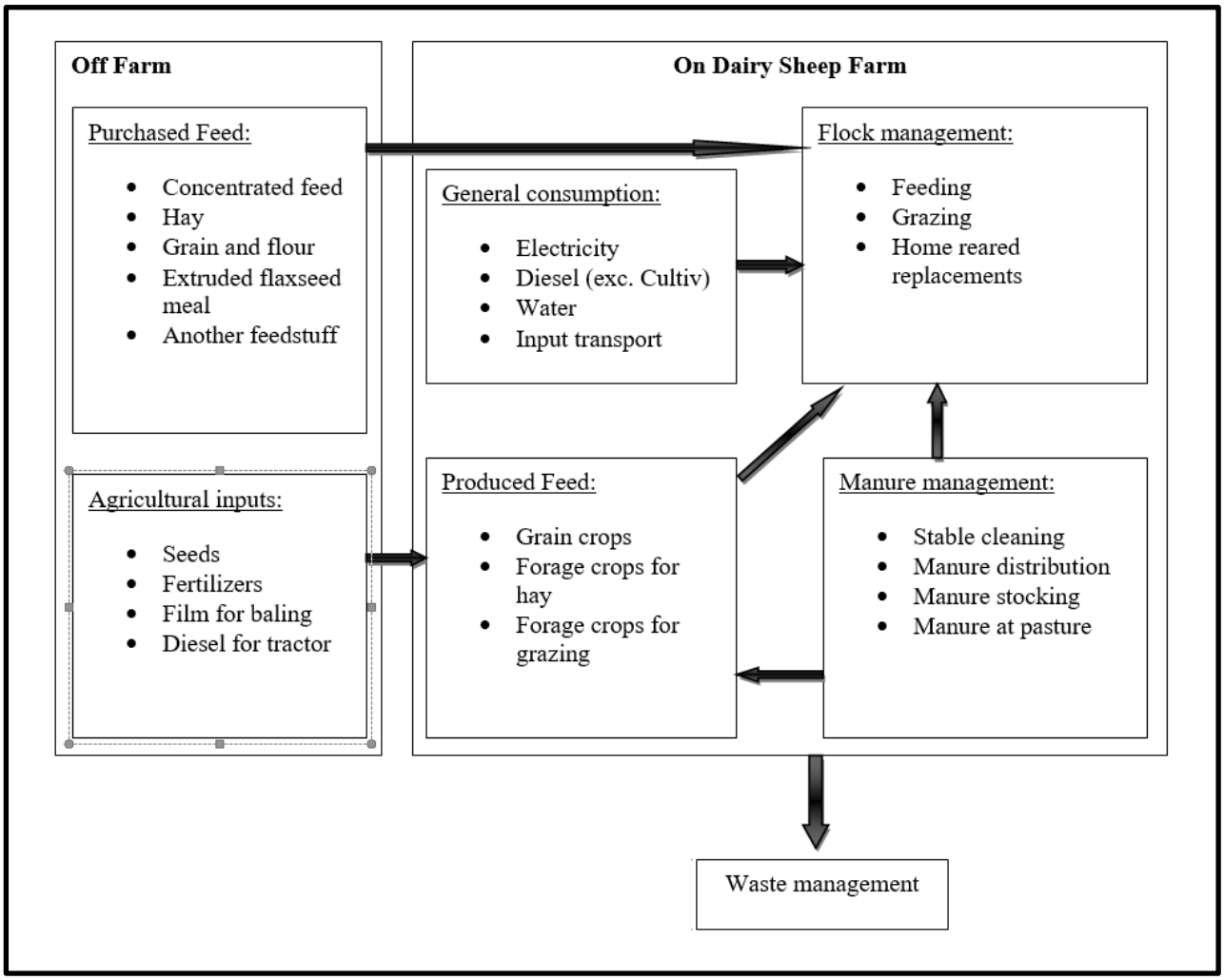
Generally, there are two types of migratory flocks: -

a) Truly nomadic flocks with no fixed centers but following seasonal migratory routes to grazing areas; they are largely governed by the availability of foraging and drinking water resources.

b) Flocks on the fallow land, but following definite migratory routes to the season pastures and returning to their permanent homes during other seasons.

- Sheep are grazed on fallow lands during monsoon and after the Kharif crops are harvested on stubbles in the harvested fields.
- During the later part of the year starting from Sep-Oct, they are mostly grazed on uncultivated areas where the flocks are non-migratory.
- In the case of migratory flocks, the animals are grazed on the harvested fields and the reserve forests in their migratory tracts on nominal fees from Nov-Feb.

- Shepherds also book harvested fields where the cost of grazing on stubbles and gram husk in minimal.
- In both the migratory and non-migratory flocks, top feeding by lopping tree branches and shaking of pods is also common.
- During extreme summer months of the year, flocks are grazed in the cooler hours of the day. Animals are rested during the hotter part of the day between noon to around 4-5 PM.



Products and Co- Products

- Milk
- Lamb Meat
- Ewe Meat
- Wool

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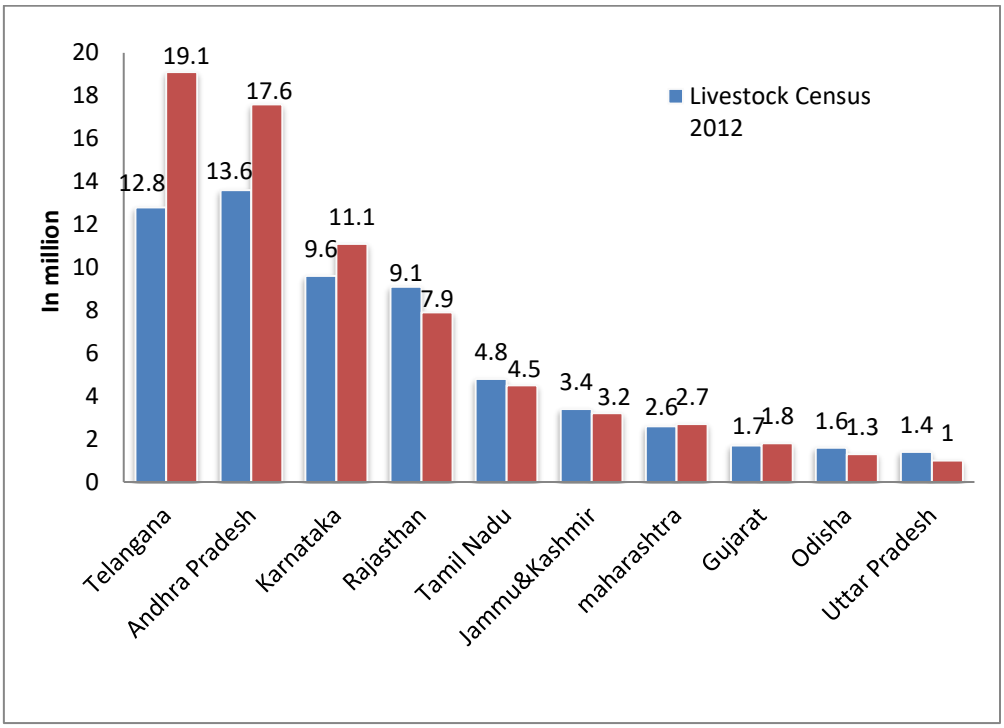
Population Statistics of Sheep as per the 20th Livestock Census 2019.

Sheep population- Major states



Sheep Population- Exotic/Crossbred and Indigenous/Non-Descript

Catagory	Population (In million) 2012	Population (In million) 2019	% Change
Total-Sheep	65.07	74.26	14.13
Exotic/Crossbred	3.78	4.09	8.12
Exotic/Crossbred Male	1.21	0.83	-31.32
Exotic/Crossbred Female	2.57	3.26	26.85
Indigenous/Non-Descript	61.29	70.17	14.50
Indigenous/Non-Descript Male	13.92	12.53	-9.94
Indigenous/Non-Descript Female	47.37	57.64	21.67

Importance of sheep production in national economy

Sheep population in India was **65.07 million** as per 19th livestock census (2012 census) and 74.26 **million** as per 20th livestock census (2019 census). The sheep population increased by 14.1% over previous Census. India rank **3rd position** in sheep population in the world. **Telangana** ranks **first** (19.1 million share) in sheep population, followed by **Andhra Pradesh** ranks **2nd position** (17.6 million), Karnataka ranks 3rd position (11.1 million) and Rajasthan ranks 4th position (7.9 million) in India. Wool production in India during 2017-18, 2018-19 and 2019-20 was 41.46, 40.42 and 36.74 million kg. The wool production has shown negative growth (*i.e.* -9.1%) during 2019-20. India ranks 9th position in wool production in the world. Highest wool producing state is Rajasthan (34.59% share of total wool production). Second largest wool producing state is Jammu & Kashmir (20.34% share of total wool production).

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Popular Article

Success Story Of Bangla Krishi Sech Yojana (Bksy) Of Bishnupur Block, Bankura

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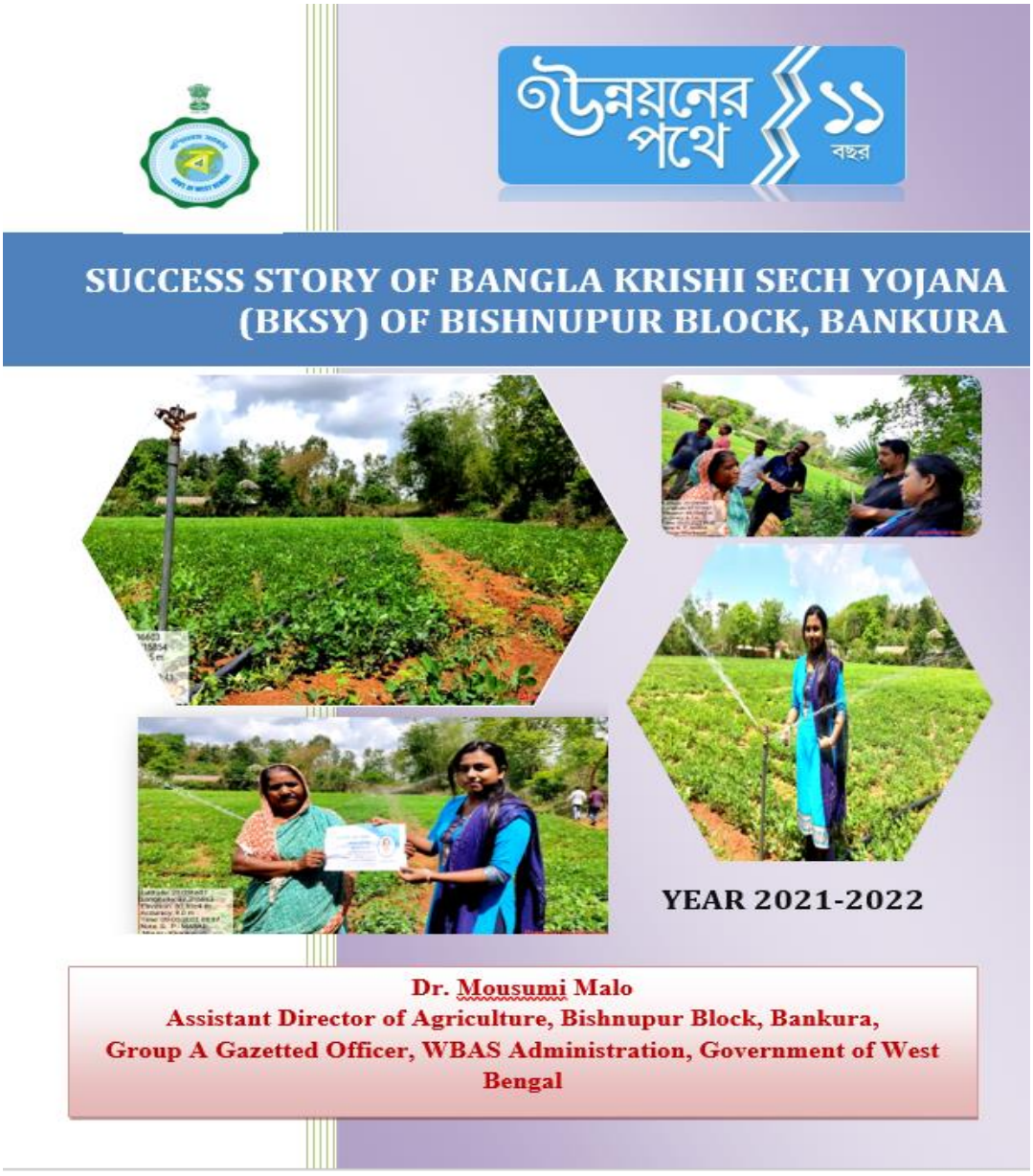
DOI



Introduction

Bishnupur (also spelled as Vishnupur) is a community development block (CD block) that forms an administrative division in Bishnupur subdivision of Bankura district in West Bengal, India. Bishnupur CD block is located at 23°05′00″N 87°19′00″E in the north-eastern part of the district and belongs to the fertile low lying alluvial plains, similar to the predominating rice lands in adjacent districts of West Bengal. Here, the eye constantly rests on wide expanses of rice fields, green in the rains but parched and dry in summer. This block is surrounded by Sonamukhi CD block on the north; Indas, Patrasayer and Joypur on the east; Garhbeta I CD block in Paschim Medinipur district on the south and Taldangra and Onda CD blocks on the west. Bishnupur block has an area of 365.73 km^2. It has 1 panchayat samity, 9 gram panchayats, 113 gram sansads (village councils), 161 mouzas and 147 inhabited villages. Gram panchayats of Bishnupur block/panchayat samiti are: Ajodhya, Bankadha, Belsulia, Bhora, Dwarika Gosainpur, Layekbandh, Marar, Radhanagar and Uliara.

The annual average rainfall is 1067 mm. The soil type varies from sandy to lateritic and gravelly soils as well as heavy clay soils. Use of fertilizer, improved seeds, organic manure and pesticides are increasing day by day. Farmers have now been habituated to use agricultural implements like tractor, power tiller, thresher, pump set, sprayer etc. in the field of agriculture. Paddy transplanter, paddy reaper, drum seeder etc. has recently been introduced.

Rice is the main crop of the district as well as Bishnupur block. Besides rice, the major crops are potato, wheat, vegetables, mustard, summer sesame etc. Though the block is prone to drought, it can raise surplus food production in years of good rainfall.

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Water scarcity due to climate change like increase in temperature and decrease in rainfall is an increasingly important issue in many parts of the world. Restricted supply of good quality water is the most important factor limiting the crop production. On the other hand, owing to over exploitation, the ground water in many parts of the country is fast depleting. Thus, efficient management of water resources through increased irrigation efficiency is essential to meet the increasing competition for water between agricultural and non-agricultural sectors. During last few decades, emphasis has been given on alternative water application method such as micro irrigation which may contribute substantially to attain the twin objectives of higher productivity and optimum use of water. The trend in recent years has been towards conversion of surface to micro irrigation because cost of installation has relatively decreased with the easy access to subsidized micro irrigation equipment's. We therefore are trying to give special emphasis on sprinkler irrigation technique through Bangla Krishi Sech Yojana (BKSY) in different crops cultivated throughout Bishnupur block.

Bksy In Brief

The Government of West Bengal has launched Bangla Krishi Sech Yojana to provide necessary assistance to small and marginal farmers to promote micro irrigation facilities which will ensure that the farmers can cultivate their land using less amount of water mainly in areas receiving less rainfall. It is important to note that small and marginal farmers can't afford the cost of drip and sprinkle irrigation techniques as they cost around Rs. 70,000 and Rs. 20,000 per acre of land respectively. But in this scheme farmers will get these facilities absolutely free of

cost excluding GST. Bankura district in the state of West Bengal has been doing consistently sterling work in the execution of Bangla Krishi Sech Yojana (BKSY) for quite some time as discovered during interaction with the local farmers, inspection of actual works in the field and a random inspection of the records as readily available. In this regard, Bishnupur block of Bankura district is not an exception. The block has moved in a very methodical and planned manner to execute this type of certain very good scheme with respect to the identified focus areas.

During the financial year of 2021-2022, total 46 installations of sprinkler irrigation system were done successfully in Dwarika-Gossainpur (33) and Morar (13) gram panchayats almost covering 13 hectares of land. Registration, joint inspection, work order as well as installation were accordingly planned, made and executed with a very strong system of monitoring and supervision backed by block, sub-division and also district level which added to the overall quality of the scheme.

Achievement Story

Smt. Shyamali Singha (58) is a well-known progressive farmer from Kharikasuli mouza (Plot No. 44, JL. No. 119 and Khatian No. 212), Morar gram panchayat of Bishnupur block, Bankura district. She has been involved in farming since the age of 20. From the beginning itself, she was keen to learn and adopt new production techniques. This passion led her to adopt sprinkler irrigation system when it was introduced in agriculture in our state through BKSY. Previously she was using conventional surface irrigation method for cultivating crops. But after she gained knowledge about micro irrigation techniques from television and newspaper, she became quite interested about adoption of this new method in her field. She got an automated sprinkler irrigation system on 20/04/2022 from Government of West Bengal, installed for cultivation in her farm. Presently, she is cultivating groundnut on 0.08 hectares of land using micro irrigation.

Officials from the office of Assistant Director of Agriculture, Bishnupur block visited her field recently and when she was asked about the advantages of this improved irrigation method she is getting over previously used surface method, she replied enthusiastically that one of the greatest irrigation methods that have been invented for taking care of plants in a proper way is sprinkler irrigation. She also added that when you witness rainfalls you must have seen how droplets of water get distributed equally among all the crops that have been planted in an individual field. The plants seem to come back to life because of gaining a sufficient amount of water after each rainfall occurrence. The most appreciable regions, which have witnessed a critical change, have been noticed in saving of the most precious input i.e. 'water'; equal distribution and controlled application of water depending on the actual necessity and requirements of plants.

Not only Smt. Shyamali Singha but also many other farmers of that mouza including Shri Panchanan Ghosh, Shri Sudhamadhab Goswami, Shri Mahabbat Mandal, Shri Banshi Singha, Shri Anarul Mondal have applied for getting sprinkler irrigation system. According to

Shri Banshi Singha they have always watched on television the success of micro irrigation in crop fields only in Punjab, Haryana, Uttar Pradesh etc. but they are now capable of adopting this technique easily like other states by the extreme co-operation from our government. Besides, it was added by him that there is no requirement of using many areas of our field for setting up the sprinkler irrigation; the interference with cultivation for setting up this system is very less and frequent application of water can be supplied to the plants which you will not need to do it yourself.

Shri Anarul Mondal said that the sprinkler irrigation is suitable for setting up in all types of soil and this system can be used for other purposes as well such as cooling during high temperature, protection from insect pests etc. They are highly determined to use micro irrigation in their fields for cultivating various types of crops in future.

The disadvantage of this system i.e. the investment cost required for purchasing the equipment of sprinkler irrigation system is high which can be overcome by the marked assistance of full subsidy from the government and only minimum amount of GST has to be paid by the farmers.

Just like how rainfall distributes water, sprinkler irrigation is a system that allows water distribution through the pipes by pumping and with the help of sprinklers the water is sprinkled into the air. The water is then converted into small droplets like rain which then falls on the crops in a field. This water saving method seems to be a mind-blowing technology that will ease farming and also increase the yield of the crop. Their plan for the future is to expand the area of cultivation for crops that witness good yields.

The overall outcomes of the various works executed, as mentioned above, are really very encouraging and prove as to how a committed and determined effort can bring about positive changes by way of efficient and effective implementation of a government scheme.

Groundnut is an important oilseed crop in India as well as our state. Surface irrigation is the prevalent irrigation method followed in this crop. Micro irrigation viz. sprinkler irrigation in groundnut is a relatively new innovative technology which has convincingly shown that the technique results in high water use efficiency, conserves water and energy, reduces fertilizer requirement, provides better quality crop and higher pod yield and moreover increases profits. However, if not installed properly, it may result in wastage of water, time and yield. Application of micro irrigation requires careful study of all the relevant factors like land topography, soil, water, crop and agro-climatic conditions, and suitability of micro irrigation system and its components. The subsidy and technical support to the farmers may be an incentive to adopt this method on a large scale. Adoption of sprinkler irrigation system in

groundnut cultivation is technically feasible and economically viable and needs to be vigorously followed.

The entire team for documenting and skilfully depicting the success stories of different farmers of Bishnupur Block by visiting their fields where sprinkler irrigation systems has been successfully installed during 2021-2022 is being complimented and congratulated by the office of ***Assistant Director of Agriculture, Bishnupur Block, Bankura****. Further, these success stories would go a long way to encourage other farmers to adopt this improved methodology and enhance their income and moreover these are truly the stories of innovators in farming who are making a difference in this agricultural industry, starting with their own operations.*

Cite as

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Popular Article

Nematode Problems Under Protected Cultivation and Their Management

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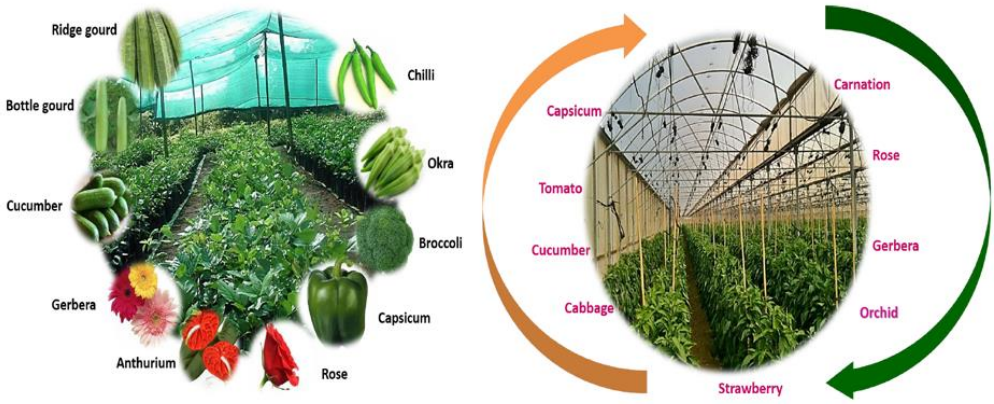
Introduction

Protected cultivation is the cultivation of diverse horticultural crops under controlled circumstances, resulting in a significant increase in yield per unit area. It is gaining popularity for cultivating high-value crops due to the demand for high-quality, export-oriented horticultural products and the need for horticultural crop produce availability throughout the year, particularly during the off-season. Poly houses, green houses, and shade net houses can all be used to raise ornamental flowers and vegetables. Under Indian conditions, these horticultural crops are seriously infested with nematodes such as root-knot nematodes (Meloidogyne incognita, M. javanica and M. hapla) along with other nematodes like lesion nematode (Pratylenchus spp.), reniform nematode (Rotylenchulus reniformis), foliar nematode (Aphelenchoides fragariae), burrowing nematode (Radopholus similis) and bulb and stem nematode (Ditylenchus dipsaci) which may develop on crops grown under polyhouses. Under protected conditions, nematode issues on all of these crops have reached alarming proportions, resulting in massive crop losses of up to 80% in some crops. In rare situations, nematode infestations are followed by secondary pathogen infections such as fungus and bacterium, resulting in full crop losses.

Crops covered under protected cultivation:



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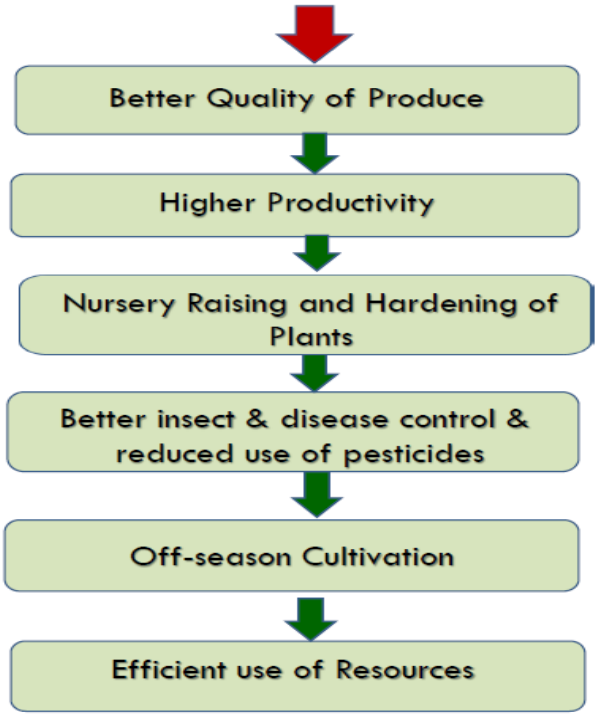
The main reasons to adopt protected cultivation:



Various sources of contamination in poly-houses?

1. Soil and potting media
2. Irrigation water
3. Seed and planting materials
4. Improper sanitation in and outside the polyhouses *i.e.*, tools and machinery

Farmers are more conscious of the nematode problem in their fields for a variety of reasons, including the high value of crops, where each plant is valuable and farmers cannot afford to lose them, and greater literacy rates among poly-house growers. Most farmers rely on pesticide sellers for nematode remedies, just as they do for other pests and diseases, and rarely seek expert assistance. The majority of nematode control is preventative or based on cultural and biological techniques. These must be started prior to planting/sowing; however, managing nematodes in standing crops is extremely impossible.

Some general practices to be followed in poly-houses for nematodes management:

- Use of healthy nursery and planting materials;
- Soil should be examined for nematode infestations before starting poly-houses.
- Crops should be grown on pasteurized media with disease-fighting additives.
- The poly-houses should be kept clean, and the tools employed should be dedicated to the task.
- Proper plant spacing for improved aeration
- After the crop is harvested and any residual roots have been removed, the field should be ploughed properly, levelled, and lightly watered to moisten the soil every year in May-June (peak summer). A thin (25 m) transparent polythene sheet should be laid over the soil surface. The edges should be neatly overlapped and sealed.
- Seal the entire poly-house by draping polythene drapes on all sides for at least 2-3 weeks.
- While the polyhouse is being closed, the nursery can be prepared as well as the multiplication of bio-agents outdoors.
- Because soil solarization is so successful, it may be possible to avoid the need of chemical pesticides.
- Bio-agents such as *Trichoderma* and *Pseudomonas* not only boost plant health but also have broad spectrum activity, including anti-nematode activity.

Recommendations in the CCS HAU, Hisar package of practices:

- Soil solarization by 2-3 deep summer ploughings in the month of May-June at 15 days interval followed by light irrigation and covering of soil with 25-micron transparent polythene sheet for 30 days during June-July for the management of root-knot nematodes (*Meloidogyne* spp.) in polyhouses.
- Soil application of *Trichoderma viride* @ 20 g/m^2, mixed with neem cake/FYM/vermicompost @ 100 g/m^2 in the beds for the management of root-knot nematodes (*Meloidogyne* spp.) in tomato grown under polyhouse conditions.

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Popular Article

Sustainable Development in The Indian Agriculture Sector

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Introduction

Sustainable agriculture refers to farming practices that meet society's current food and textile needs without jeopardizing current or future generations' ability to meet those needs. It is a type of farming that produces enough food to suit the demands of the current generation without depleting the ecological assets and productivity of future generations' life-supporting systems. Ecological farming, eco-farming, organic farming, natural farming, and permaculture are all terms used to describe this type of farming.

According to National Agricultural Research, Extension and Teaching Policy Act of 1977.

"Sustainable agriculture" is defined as an integrated system of plant and animal production practices having a site-specific application that will, over the long term:

- ✓ Satisfy human food and fiber needs
- ✓ Enhance environmental quality and the natural resource base upon which the agriculture economy depends
- ✓ Make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls
- ✓ Sustain the economic viability of farm operations
- ✓ Enhance the quality of life for farmers and society as a whole

The notion of sustainable agriculture came as a result of a plateau in modern farming yields and an environmental crisis caused by excessive use of chemicals and fertilizers, as well as pesticide residue in the food chain. Many farming practices are employed to help agriculture become more sustainable. Growing plants that produce their own nutrients to reduce fertilizer use and rotating crops in fields to reduce pesticide use since the crops change regularly are two of the most prominent strategies. Mixing crops is another frequent practice that decreases the danger of a disease killing an entire crop while also reducing the demand for pesticides and herbicides.

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It also makes use of water management techniques such as drip irrigation, which wastes less water. There are a variety of approaches that can be used to improve agriculture's long-term viability. It is critical to build flexible business processes and farming methods while developing agriculture within sustainable food systems. Agriculture contributes significantly to climate change (one-third of anthropogenic GHG emissions are attributed to food systems), water scarcity, water pollution, land degradation, deforestation, and other processes. It is causing and being impacted by environmental changes at the same time. It consists of agricultural methods that are favorable to the environment and allow for the production of crops or livestock without causing harm to human or natural systems. It entails avoiding negative consequences for soil, water, biodiversity, nearby or downstream resources, as well as those who work or live on the farm or in the surrounding area. Permaculture, agroforestry, mixed farming, multiple cropping, and crop rotation are all examples of sustainable agriculture.

Method of sustainable agriculture

Crop rotation- It is one of the most significant methods for achieving long-term agricultural sustainability. Sustainable agriculture aims to avoid the negative impacts of planting the same crops in the same soil year after year. It aids in the prevention of pest problems because many pests favour specific crops. If the pest has a consistent food supply, it can rapidly expand its population.

Permaculture- Itis a food production system with intention, design and smart farming to reduce waste of resources and create increased production efficiency. Permaculture design techniques include growing grain without tillage, herb and plant spirals, sheet mulching, each plant serving multiplepurposes.

Cover Crops- Many farmers prefer to have crops planted in a field at all times and never leave it barren; this can cause unintended consequences. The farmer can fulfil his aims of minimizing soil erosion, controlling weed development, and improving soil quality by planting cover crops like clover or oats. Cover crops also cut down on the use of chemicals like fertilizer.

Soil Enrichment- Soil is a central component of agricultural ecosystems. Healthy soil is full of life, which can regularly be killed by the overuse of pesticides. Good soils can increase yields as well as help create more healthy crops.

Natural Pest Predators- It is critical to consider the farm as an ecosystem rather than a factory in order to maintain effective pest control. Many birds and other animals, for example, are natural predators of agricultural pests.

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Bio intensive Integrated Pest Management- Integrated Pest Management (IPM) is an approach, which basically relies on biological as opposed to chemical methods. IMP also emphasizes the importance of crop rotation to combat pest management.

Polyculture Farming- This technique is similar to crop rotation that tries to mimic natural principles toachieve the best yields. It involves growing multiplecrop species in one area. These species often complement each other and helps produce a greater diversity of products at one plot while fully utilizing available resources.

Agroforestry- It has become one of the most effective techniques available to farmers in dry regions with desertification-prone soils. When addressed effectively, it entails the establishment of trees and shrubs among crops or grazing land, combining both agriculture and forestry practices for long-term, productive, and diverse land use.

Better Water Management- The first step in water management is the selection of the right crops. Local crops that are more adaptable to the weather conditions of the region are selected.

Benefits of Sustainable Agriculture

1. **Contributes to Environmental Conservation:** The environment plays a critical role in meeting our basic necessities for survival. In turn, it is our responsibility to protect the environment so that future generations do not go without. Sustainable agriculture contributes to the replenishment of the soil and other natural resources like as water and air. Farmers will reduce their dependency on nonrenewable energy, cut chemical use, and conserve rare resources by adopting sustainable methods. Given the expanding population and demand for food, this replenishment assures that these natural resources will be able to sustain life for future generations.

2. **Saves Energy for Future:** Modern agriculture is heavily dependent on nonrenewable energy sources, especially petroleum. Sustainable agricultural systems have reduced the need for fossils fuels or nonrenewable energy sources and a substitution of renewable sources or labor to the extent that is economically feasible.

3. **Public Health Safety:** Sustainable agriculture avoids harmful pesticides and fertilizers. As a result, farmers are able to produce fruits, vegetables and other crops that are safer for consumers, workers, and nearby communities. Through careful and proper management of livestock waste, sustainable farmers can protect humans from exposure to pathogens, toxins, and other hazardous pollutants.

4. **Prevents Pollution:** Sustainable agriculture means that any waste a farm produces remains inside the farm's ecosystem. In this way, the misuse cannot cause pollution.

5. **Prevents Air Pollution:** Agricultural activities affect air quality by smoke from agricultural burning; dust from tillage, traffic and harvest; pesticide drift from spraying; and nitrous oxide emissions from the use of nitrogen fertilizer.

   By absorbing agricultural residue into the soil, employing appropriate amounts of tillage, and planting windbreaks, cover crops, or strips of native perennial grasses to prevent dust, sustainable agriculture can enhance air quality.

6. **Prevents Soil Erosion:** Our continued ability to produce adequate food has been a serious threat to soil erosion. Selection of suitable species and varieties that are well suited to the site and conditions on the farm can improve crop yield and diversification of crops (including livestock), and cultural practices enhance the biological and economic stability of the farm.

7. **Reduction in Cost:** Sustainable agriculture reduces the costs of farming in general. Everyone involved in the agriculture industry has benefited from smarter farming and more efficient food transportation from farm to fork. Sensor data from seed drills, sprayers, and spreaders, as well as drones, satellite photos, and soil, makes it so that surprises are rare.

8. **Biodiversity:** Sustainable farms produce a wide variety of plants and animals, resulting in biodiversity. During crop rotation, plants are seasonally rotated, and this results in soil enrichment, prevention of diseases, and pest outbreaks.

9. **Sustainable Livestock Management:** Sustainable agriculture includes sustainable livestock production by selecting appropriate animal species, animal nutrition, reproduction, herd health, grazing management, which leads to the overall development of livestock for the long term.

10. **Social Equality:** Practicing sustainable agriculture techniques also profit workers as they are offered a more competitive salary as well as benefits. They also work in humane and fair working conditions, which include a safe work environment, food, and adequate living conditions.

11. **Beneficial for Environment:** Sustainable agriculture decreases the need for nonrenewable energy resources, benefiting the environment as a result. Due to population growth, it is anticipated that by 2050, we would require around 70% more food than is currently produced in order to meet the required daily calorie intake of the estimated 9.6 billion people on the planet. This isn't a small task, but unlike many other sustainability concerns, it's one that everyone can help with. We all

need to eat, but we can make a difference by simply decreasing food loss and waste, eating lower-impact diets, and investing in sustainable produce.

Factors affecting sustainability: Climate, soil, fertilizer, and water resources for an agricultural site are the most essential aspects that determine sustainable farming. Water and soil conservation are the most responsive to human control among these factors. Farmers remove some nutrients from the soil when they cultivate and harvest crops. The land suffers from nutrient depletion and becomes unusable or has lower yields if it is not replenished. Sustainable agriculture relies on soil replenishment while reducing the use of non-renewable resources like natural gas and mineral ores.

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Popular Article

Lameness in dairy animals: Causes, type and its preventive management practices

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DOI: https://doi.org/10.5281/zenodo.6640803

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Introduction

With the emergence of intensive commercial livestock production to meet the growing demand for animal-based products, there has been an increase in food production diseases, subsequently resulting in animal welfare issues. After mastitis and infertility, lameness is one of the three major issues affecting dairy cattle globally, resulting in reduced productivity, economic losses, and animal welfare problems. Lameness is associated with reduced milk yield, lack of weight gain, poor fertility, and frequently, animal culling. Lameness constitutes any foot or leg condition of infectious or non-infectious origin that negatively impacts cow mobility, posture, and gait (Archer et al., 2010). The financial impact of lameness includes losses from decreased production, cost of treatment, prolonged calving interval, and possibly nursing labor. Cows in poor condition have a greater predisposition to lameness. Cows that are lame before breeding have a reduced ability to conceive, and cystic ovaries are much more common in lame cows. Lame cows are less aggressive in their struggle for feed and are more likely to die early or be culled. Prevalence rates of lameness in dairy herds range from 17% to 35% globally, with intensive farming systems having greater prevalence compared to grass-fed cows, who display reduced incidence of disease (Blackie and Maclaurin, 2019)

Causes and types of lameness

Common causes of lameness are:

- **Infection** (i.e. foot rot, digital dermatitis, toe tip necrosis, infectious arthritis)
- **Nutrition** (i.e. laminitis, mycotoxin-related necrosis)
- **Physical injury** (i.e. frostbite, sprain, break)
- **Genetics** (i.e. bad conformation, temperament)

Foot Rot

Foot rot is a painful condition that causes lameness and can affect any class of cattle, whether in a feedlot, corral, or pasture. Foot rot is highly infectious and is caused by bacteria, most commonly *Fusobacterium necrophorum*. The infection originates in between the claws of the hoof and may be characterized by heat and swelling in between the claws, as well as along the coronary band where the hoof meets the skin. If it is not identified and treated promptly, the infection can move elsewhere into bones, joints, or tendons, causing delayed recovery or other complications.

Toe Tip Necrosis

A lameness condition affecting the hind feet of feedlot cattle which develops early in the feeding period, and often occurs within clusters of animals. Sometimes referred to as a *toe abscess* or *ulcer*, *apical white line disease*, It has been associated with improper processing or handling, abrasive flooring, as well as flighty animal behavior.

Digital Dermatitis

Digital dermatitis, also known as *hairy heel wart* or *strawberry foot rot*, is a skin infection that affects the area around the dewclaws, between the claws, and sometimes the heel of the hooves. It is characterized by raised lesions often located between the claws and dewclaws. These lesions are very painful, may appear red and bleed easily if disturbed, and some may have long fibrous hairs. Animals appear to walk on their tip toes to avoid putting pressure on their heels.

Joint Infections and Arthritis

Long term sickness in animals is also a risk factor of spreading infection to bones and joints. *Mycoplasma bovis* commonly implicated in cases of pneumonia and mastitis can also travel through the animal's bloodstream and settle in the ankle, stifle, hock, or elbow joints, leading to painful swelling and arthritis.Animals with joint infections may become chronically ill if they**635-638** aren't caught and treated in time, or if tissue damage compromises treatment.

Laminitis (Founder)

Laminitis is a condition where the lamellae is weakened or becomes separated. Laminitis is linked to rumen acidosis which is when the rumen pH drops causing rumen bacteria to produce toxins that can pass through the rumen wall. These toxins can cause swelling in the blood vessels of the hooves, leading to founder or laminitis. Laminitis is usually attributed to diets that are high in fermentable carbohydrates such as grain, and it may occur after a sudden or rapid change in rations.

Mycotoxin-related Necrosis

Ergot bodies or other fungi during wet conditions causes release of mycotoxins in feed which can lead to lameness in animals on feeding that contaminated feed material. Ergot restricts blood flow to the hooves and other extremities which can cause severe lameness and even hoof-sloughing or other debilitating health and welfare issues.

Physical Injuries

Animals may sustain physical injuries, including sprains, breaks, sand cracks, or frostbite. Environment, exposure to moisture, or heavy animals may be contributing factors to the incidence of sand cracks. Frostbite most commonly occurs in young animals although older cattle are not immune. When tissue freezes, blood circulation to the hooves is restricted, and tissue damage – either temporary or permanent – occurs.

Genetic Problems

Poor foot and leg conformation can also be a result of genetics. Genetic causes of lameness can be passed down to offspring and are sometimes slow to appear. Because lameness is multi-faceted, cattle that have proper foot and leg conformation will be better suited to withstand poor pen conditions or other non-infectious risk factors for lameness.

Risk Factors

There are several risk factors that may lead to an increased incidence of lameness.

- Poor pen environments, including excessively frozen ground, very dry environments, or extremely wet and muddy conditions may negatively affect the skin barrier, leading to foot rot and other types of lameness.
- Housing cattle in pens where *Fusobacterium necrophorum*-caused foot rot infection
- Poorly designed facilities, including slick surfaces or abrasive flooring,
- Sharp edges, protrusions, or objects like wire, metal, rocks, ice, and frozen manure, can contribute to physical injuries
- Improper or high-stress animal handling practices can increase risk of slipping and physical injury.
- “Flighty” or nervous cattle are more likely to damage or injure their feet and legs.
- Cattle infected with *Mycoplasma bovis* are at risk of joint infection.
- High grain rations, erratic feed consumption (due to weather factors or feed supply problems), and improper feed processing are risk factors for laminitis.
- Heavier cattle or cattle held on feed for too long are at a higher risk for lameness.

Preventive and Management practices

- Accurate diagnosis is important for successful treatment and prevention of lameness.
- Pain management is an important consideration to improve both welfare and production outcomes in a lame animal. Using steroids by vets. such as dexamethasone, as an anti-inflammatory in certain cases. The increased availability of non-steroidal anti-inflammatories (NSAIDs), such as meloxicam (i.e. Metacam®) or flunixin (i.e. Banamine®) have also helped to improve pain management in lame cattle.
- Regular pen cleaning and landscaping to ensure proper drainage, good footing, and to minimize build-up of manure and bacteria that causes lameness.
- Disinfecting and maintaining hoof-trimming equipment and tools.
- Removing sharp objects, such as rocks, ice, wire or metal, that may cause injury.
- Vaccinating/preconditioning cattle to reduce disease and improve overall health and immunity in order to minimize risk of lameness as a secondary ailment.
- Practicing low-stress animal handling.
- Incorporating proper handling facility designs that include adequate traction and comfortable footing.
- Applying lime to barn floors following cleaning between fills to make the environmental pH less friendly to infectious lameness-causing bacteria.
- Consulting with your veterinarian regarding the potential use of a *Fusobacterium necrophorum* vaccine to prevent footrot.
- Incorporating step-up rations for high-grain diets to reduce the risk of acidosis and laminitis.
- Test feeds for potential mycotoxins that may lead to ergot poisoning.
- Carefully inspect feet and legs on breeding cattle to ensure they are fit and sound.

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Popular Article

Management Of Heat Stress in Farm Animals in India

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Abstract

Heat stress during the summer season hamper the reproductive and productive performance of farm animals by causing physiological (hormonal imbalance, decreased oocyte and semen quality, and decreased embryo development) changes, decrease in feed intake, and development of negative energy balance. The effects of heat stress on farm animals can be minimized via adapting suitable scientific strategies comprising physical modifications of the environment, feeding management, breeding management, and housing management of farm animals.

Introduction

Heat stress is the elevation of body temperature (hyperthermia) over normal body temperature. During the extreme hot humid or hot dry weather in which the physiological system of the body fails to regulate the body temperature, causes a reduction in feed intake, a decrease in milk yield, a lower conception rate, and weakens the immune system. India experiences a tropical climate with moderate to high heat stress in April, May and June due to high THI (Thermal humidity index) ranging from 75 to 85. Developing countries are more susceptible to climate change as they largely depend upon climatic sensitivity (NDRI Vision 2030, 2010). The climatic change affects the performance in terms of production and reproduction, health, and well-being of livestock. Heat stress seems to be one of the most critical factors affecting animal production in many regions of the world. Hence, it is crucial to understand the impact of heat stress on livestock production and reproduction. These efforts may help in identifying the appropriate targets for developing suitable mitigation strategies.

Causes of heat stress

- Rising environmental temperature and humidity and high solar radiation level due to the absence of natural cloud cover.
- Warm cloudy nights may increase the risk of heat stress as the animals dissipate the heat energy during the night.
- Husbandry practices and farm layout may sometimes facilitate the onset of heat stress in animals.

Prone month(s) for heat stress in India: -

Part of India	Comfort months	Stressful month
UttarPradesh, Haryana, Delhi, and Punjab	November-February	May - September
Rajasthan, Gujarat, and some parts of Madhya Pradesh, and Maharashtra	December-January	May-September
Bihar, West Bengal, Jharkhand, and some parts of Assam	Noveber-February	April-October
Tamil Nādu, Karnataka, Andhra Pradesh, Telangana, and some parts of Maharashtra	November-February	April-September

Signs and symptoms of heat stress in India

- Abnormal vital parameters elevation in heart rate (tachycardia) and respiration rate, restlessness, and rise in body temperature (106-108°F). Unusual excessive salivation, along with tongue protrusion.
- Animal become dull and depressed, sometimes unconscious.
- Heat stress affects milk yield and quality (fat % and SNF %) both, affects follicular development, and semen production resulting in a low conception rate.

Management of heat stress in dairy animals-

A) Breeding Management

As cows show lesser heat symptoms during heat stress duration as compared to thermal comfort periods, so it is necessary to accept a good heat detection program to detect cows with minimal heat symptoms. Always prefer artificial insemination (AI) breeding instead

of natural mating by bulls, because in natural mating both bulls and cows suffer infertility due to summer stress.

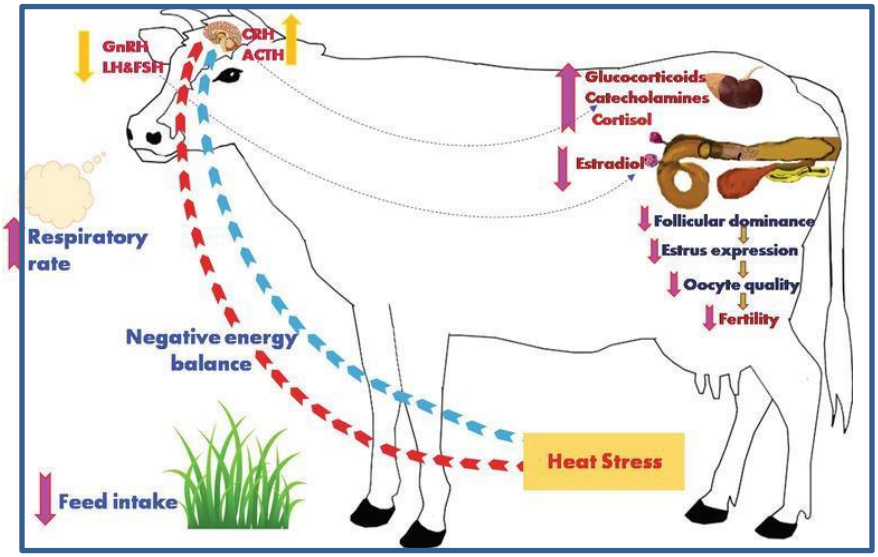

Fig.1: Various effects of heat stress on cattle (Singh *et al.*, 2021)

B) Feeding Management

Feeding of fodders and concentrate should be in the ratio of 70:30 of the total diet. It is advisable to feed additional food in form of cereals and oil cakes. In the summer season, an additional 35 percent protein-rich concentrate mixture is suggested to be fed, and clean and cool water is to be provided 5-6 times a day. Feeding of buffers to farm animals during heat stress will help in the maintenance of rumen pH. Some additional nutritional management tips to manage heat stress are as follows: -

- Increase the frequency of feedings,
- Avoid feeding during hot hours of the day and prefer cooler times of the day for feeding,
- Provide high-quality forage and adequate fibers,
- The use of bypass proteins can enhance milk yield and protein content.

C) Cooling systems in the farm

Provide an appropriate number of fans on the farm along with the water sprinkling facility, as the best cooling option. Avoid excessive sprinkling as it can also result in wet bedding making animals more susceptible to mastitis and other diseases.

The farmers can practice taking buffaloes to ponds for wallowing could be counterproductive if the animals are made to walk to and from the pound in the hot season. Buffaloes should not be allowed in the sun from mid-morning to late afternoon when solar

radiation intensity is at its peak. Studies have indicated that wallowing twice daily from 11.30 pm to 3.30 pm gave the most comfort to buffaloes, which resulted in higher dry matter intake and milk yield.

Fig. 2: Wallowing in buffalo (Wahid *et al*., 2011)

D) Housing

Orientation: prefer east to west **(E→W)** orientation because it will offer more shade than any other orientation and will protect the animals from direct and exhausting sun rays.

Roof material: Use thatch material followed by clay tiles, woods, reinforced concrete cement, galvanized sheets, PVC sheets, and asbestos sheets.

Roof slope and angle: The height of the roof preferably should be 12 feet for the flat type and 20 feet at the center for the gable type with 12 feet at eaves (Saini, 2014). The animal house roof angle should always be less than 45-degree. Thatch material roof angle is limited to 30-35 degrees, for clay tiles it is 25 degrees and for galvanized sheets, it is 15 degrees (Shastri and Thomas, 2016).

Ventilation: There should be appropriate ventilation in the housing to avoid the stagnation of the stale or foul air inside the barn and to provide fresh air to the animals. The most commonly used ventilation modes are windows, furrows, or holes (MWPS, 2000).

Conclusion

Heat stress is the biggest challenge in the context of optimal performance (reproductive and productive) in farm animals, especially in tropical countries like India. Heat stress causes physiological and hormonal imbalances and compromises both male and female

performances in the farm animals. Various managemental practices including breeding, nutrition, and housing help in minimizing the heat stress.

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Popular Article

Management of Mis-mating in Bitch

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Abstract

Termination of unwanted or mis mated pregnancy is one of the most common requests from pet owners. Spaying is the best alternative for owners who does not want pregnancy in future. If the animal is a potential breeder, drugs are available that can prevent or terminate unwanted pregnancy. The use of these drugs must be based on the safety, efficacy, convenience, compliance in treatment, and cost of the drug.

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Introduction

The affectionate and friendly attitude of female dog than the male dogs has made them most likable to pet owners. Accidental mating or an unplanned breeding between sexually intact dogs during an estrus phase is known as mis-mating. On the other hand, termination of an established pregnancy is known as medical termination of pregnancy (MTP). The chances of mis-mating in female dogs is higher because promiscuous behavior of bitches, compounded by longer estrus period. Further, roaming outside the home or shelter during estrus phase and tendency to accept male partner increases the chances of mis-mating to a great extent. Once this happens, request for aborting sequel of mis-mating is one of the most common requests from dog owners (Eilts et al., 2002)

Indications

Prevention of accidental mating at too young or old age.

Control of the pet overpopulation.

Prevent birth of non-descript pups.

Inability of the owner to bear expenses involved rearing and caring of pups.

Therapeutic management of mismating

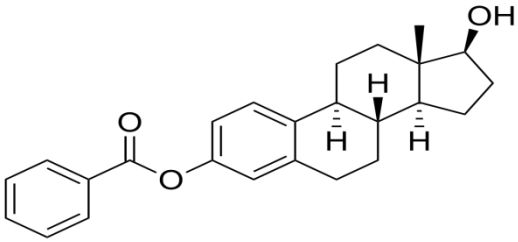

Fig-1 Chemical structure of Estradiol benzoate （Olfati *et al.*, 2018)

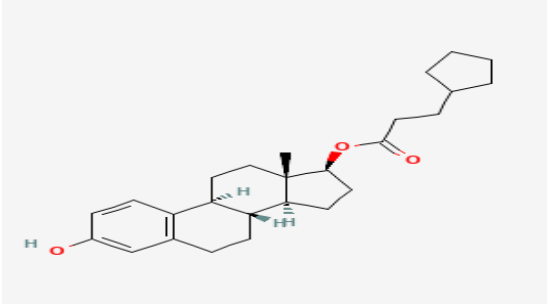

Fig-2 Chemical structure of Estradiol cypionate (Souza *et al.*, 2018)

S. No.	Drugs	Dose	Advantage	Disadvantage
1	Estradiol valerate (pregheat)	0.01 mg/kg b.wt I/M or S/C; on 0, 3rd, 5th and 7th day after mating	Early treatment of mis-mating	Even at low doses estrogens are not efficacious and safe. Side effects include continuous
2	Estradiol cypionate (Depofemin, Depo-Estradiol, Estradep	0.02 mg/kg b.wt I/M, not exceeding 2 mg total dose; only once after mating.		
3	Estradiol benzoate (progynon-c, progynon Depot)	0.2 mg/kg I/M, single injection on 5th day of mating		
4	Conjugated estrogen (permarin)	1.875 mg total dose PO, daily for 3 days within 5 days of mating		

Table-1 Management of mis-mating in bitch by estrogenic compound

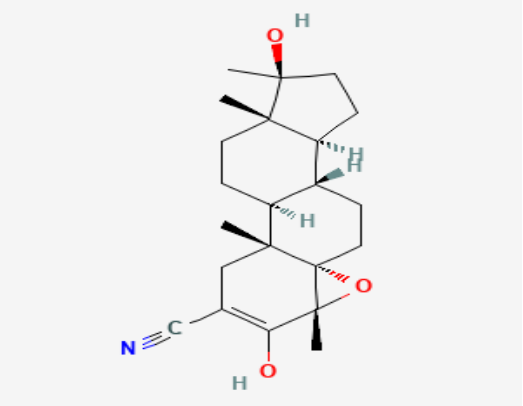

Fig-3 Chemical structure of epostane (**Rannevik *et al*., 1996)**

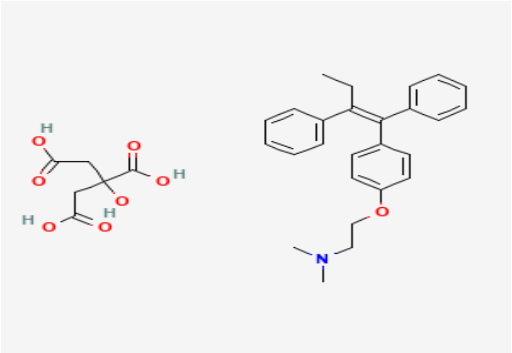

Fig-4 Chemical structure of Tamoxifen citrate (Kojima *et al*., 2007)

S. No	Drugs	Dose	Advantage	Disadvantage
1	Epostance	5 mg/kg b.wt PO for 7 days after the mis-mating	Prevents the progesterone synthesis thereby inhibiting the establishment of pregnancy at early stage	Clinical efficacy is not proven
2	Tamoxifen citrate (Novadax, Oncomox, Oncotam)	1 mg/kg b.wt PO BID for 10 days starting on the day of mis-mating	Prevent establishment of pregnancy at early stage	Side effects like ovarian cysts and endometritis, Clinical efficacy is not proved

Table-2 Epostance and Tamoxifen for management of mis-mating in bitch

Advise for pet owners:

- To identify the females bitch in early estrus phase by observing the symptoms like serosanguinous vulvar discharge, and increased roaming of the male dogs surround the estrus females.
- Not to let loose their bitch in estrous to prevent the occurrence of unwanted mating.
- If the client does not want to breed the bitch in future i would recommend an ultrasound scan 21 days after unwanted mating. If an early pregnancy is confirmed, the bitch can be spayed at this point which will prevent progression of the pregnancy and prevent future pregnancy. It is a slightly bigger surgery to spay a dog that is in the early stage or pregnancy but this approach can guarantee that the pregnancy cannot continue and will prevent accident in future.

Once mis-mating has occurred and the bitch is under medicament regimen, pet owner should be requested to follow below following guidelines:

- Provision of adequate nutritious food and fresh water ad lib to offset side effects of medication like weakness or debility and vomition.
- Follow up of hygienic measures to minimize side effects related to reproductive system
- Inform the owner that it is required to ascertain that bitch was in estrus when so called mating has taken place and undertake steps for confirmation by taking vaginal smear and looking for presence of spermatozoa.

Owner may be requested to wait till the confirmation of pregnancy to avoid unnecessary cost and side effects. Following confirmation of pregnancy at 25-30 days, termination of pregnancy can be prescribed using Cabergoline and Prostaglandins combination which are much safer to use (Parmar *et al.*, 2020).

Conclusion

Due to lack of knowledge in pet owners about estrus cycle and management of bitch. mis mating leads to produce unwanted puppies, which can create chaos in the family. To get relive owners are mostly like to approach the veterinarian for contraceptive measures. Majority of the owners are only interest to get contraceptive drugs or abortifacients' rather surgical treatment. The contraceptive drugs are still in its infancy that need to evaluate for future benefit of pet dogs.

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Popular Article

Summer Anestrus: How to Get Rid of it in Buffaloes

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Abstract

Summer anestrus is a common reproductive problem commonly reported in buffaloes. It is mainly due to endocrinological disturbances in the buffaloes ultimately causing huge losses to the farmers in terms of the economy. Heat stress produced during summer also affects folliculo-genesis, follicular fluid microenvironment and oocyte quality. A large number of hormonal regimens have been used with varying degrees of efficacy in terms of estrus induction and conception rate. A combined strategy of improvement in environment, nutrition and management is a pre-requisite for hormonal manipulation to improve productivity in summer anestrus buffaloes A brief description of summer anestrus with special reference to factors responsible, endocrinology, deleterious effects on reproductive system and possible remedial measures are presented in this article.

Introduction

Due to their enormous productivity potential, buffaloes are referred to as "Black Gold" in the Indian subcontinent. The buffaloes are reared extensively in the Asian subcontinent due to their better milk fat yielding characteristic. The species has a reputation for being a poor breeder, with low fertility in the majority of environments where it is raised (Barile, 2005). They are several innate reproductive issues associated with the buffaloes among which summer anestrus is also a major one. Practically, in all the sections of the country, domestic buffaloes cease to reproduce during the summer. Summer anestrus is the common name for this illness, which affects 36.6 to 59.5%of buffaloes. Because of an abnormal endocrine profile that causes ovarian inactivity, buffaloes with summer anestrus do not show estrus. Increased day length combined with high ambient temperature produces hyperprolactinemia, which suppresses gonadotropin release and alters ovarian steroidogenesis. Folliculo-genesis, the follicular fluid micro-environment, and oocyte quality are all affected by heat stress. Environmental, dietary, hormonal, and managemental factors all play a role in summer anestrus.

Factors affecting buffaloes during summer

A) Environmental Factors

During the summer, due to high ambient temperature and relative humidity, the breeding efficiency of the buffaloes get affected along with the aberration in the duration of the estrus cycle (Pandey and Roy, 1966, Roy *et al.*, 1968). Prolonged exposure to direct sun rays is supposed to have a direct effect on the neuro-endocrine setup which ultimately lead to the aberration in the estrus cycle (Razdan, 1988).

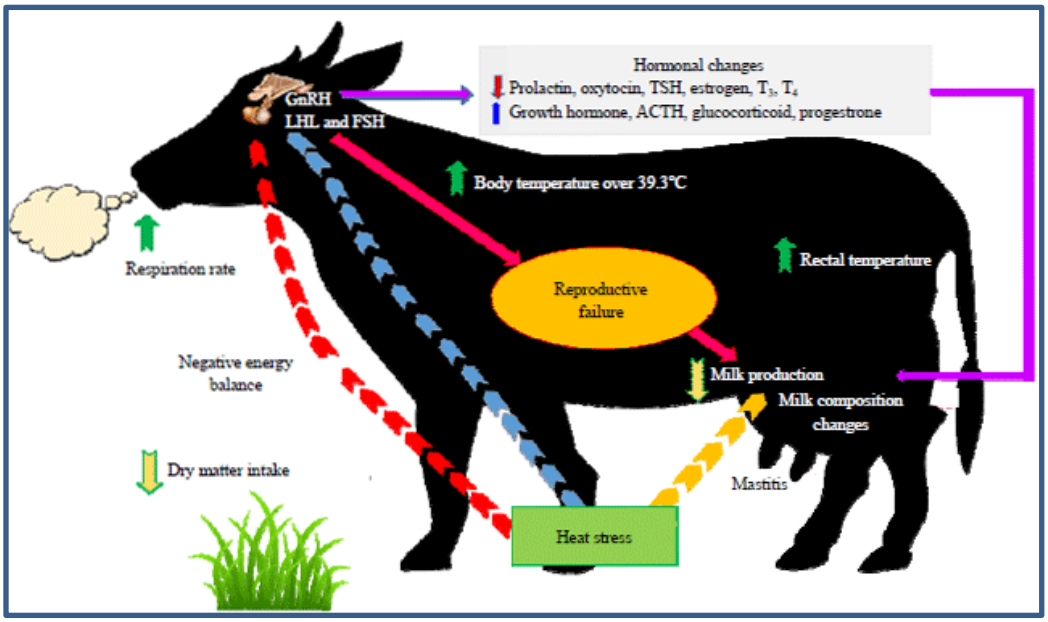

Fig.1: Influence of Heat Stress on fertility (Pratap P. *et al.*, 2017)

B) Nutritional Factors

In general, dietary factors in bovines are blamed for anestrus. However, diet is only one of the factors that contribute to seasonality in buffalo reproduction (Zicarelli, 1997). During the summer season, the forages particularly in the tropical region undergo lignification process and become a deficit in the minerals ultimately causing ovarian inactivity in the forage-dependent animal(s). The serum levels of Zn, Cu, and Co in anestrus buffaloes have also been found to be lower than usual (Singh *et al.*, 2006). Iron and copper are commonly utilized as indicators for FSH, LH, and estrogen activity, and are detected in lower concentrations in anestrus buffaloes as compared to cyclic animals. Anestrus was reported to be caused by phosphorus shortage and hypo-cuprosis due to a low copper–molybdenum ratio during the summer (Randhawa *et al.*, 2004).

C) Endocrine Factors

Heat stress is a crucial factor in buffalo's reduced fertility during the late summer months. Heat stress has a direct impact on reproductive hormones and other physiological systems as a result of an increase in body temperature (De Rensis and Scaramuzzi, 2003; Khodaei Motlagh, 2003). The prolactin is directly related to ambient temperature and mediates the seasonal effects on buffalo reproduction (Singh and Chaudhry, 1992). During the summer season, the buffaloes exhibit the alterations in the pineal metabolism which is responsible for hyperprolactinaemia and ultimately a probable cause of summer anestrus in the species.

C) Managemental Factors

During the summer, management plays a vital part in buffalo rearing. During the summer, the majority of buffalo exhibit silent estrus, which is characterized by less strong indications of estrus and shorter duration (Jainudeen and Hafez, 2000). It was discovered that buffaloes tend to show estrus predominantly at night or early in the morning, which goes unreported by most farmers. As a result, routine surveillance is ineffective in detecting estrus in buffaloes resulting in a longer service time during the warmer months (Bughio *et al.*,2000).

Strategies for Overcoming Summer Anestrus

A) Managemental Practices

Summer buffalo breeding can be successfully carried out by modifying farm management procedures. In order to increase the efficiency of rural buffaloes breeding reared in the field during the hot summer months, the basis of real management is to protect the species from direct sun radiation, which includes providing shade, a loose housing structure, and applying water to the body surface by sprinkling, washing, or offering to wallow. Showers, in addition to wallowing facilities, have been demonstrated to increase the calving rate. A well-designed and comprehensive housing system, as well as a transition from day to night grazing, aid in mitigating the negative impacts on buffalo fertility and productivity during the breeding season.

B) Improving estrus detection methods

One of the variables that increase the calving conception interval in buffalo is poor estrus detection. The typical heat detection procedures employed in buffalo are ineffective in detecting estrus during the summer season (Jainudeen and Hafez, 2000), hence using an entire male during the cooler hours of the day such as early morning or night may increase estrus detection efficacy. To discover buffaloes in estrus in the field, it would be useful to observe the animal at night and early in the morning for symptoms of estrus.

C) Hormonal treatments

To relieve anestrus and increase ovarian activity, and initiate or synchronize behavioral estrus, a variety of hormone therapy regimens are used (Barile, 2005). Various hormones, either alone or in combination, were administered with varying degrees of success. Progesterone-based treatment regimens (PRID, CIDR, CRESTAR, Progesterone injections) are very effective in inducing ovarian activity in summer anestrus buffaloes, either alone or in combination with gonadotropins and PGF2.

Fig.2: Controlled Internal Drug Release (CIDR) with CIDR Applicator

D) Nutritional management

Heat stress in buffaloes can be reduced by providing a roughage diet during night hours and grazing in the morning and late afternoon hours only. Furthermore, summer reproduction efficiency is improved by feeding green fodder, silage, or hay, as well as ad-libitum water and mineral mixture supplementation (Harjit and Arora, 1982). Minerals must be supplemented in grazing animals, especially those that are poor in forages or fodders, and the energy balance in the ration must be maintained.

E) Herbal treatment

In practice; 45.00 percent by feeding boiled methi with wheat bran for three days; 38.84 percent by feeding 0.5–1 kg boiled bajra mixed with jaggery is used to reduce the effect of summer.

Conclusion

Buffaloes with summer anestrus fail to exhibit estrus as a result of aberration in the endocrine profile leading to ovarian inactivity. Increased day length with high environmental temperature causes hyperprolactinemia, suppressing the secretion of gonadotrophins, which leads to an alteration in ovarian steroidogenesis. Heat stress produced during summer also affects folliculo-genesis, follicular fluid microenvironment, and oocyte quality. A large number of hormonal regimens have been used with varying degrees of efficacy in terms of estrus induction and

conception rate. A combined strategy of improvement in environment, nutrition, and management is a prerequisite for hormonal manipulation to improve productivity in summer anestrus buffaloes.

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Short Communication

Fungal Granulomas in Black Chicken (Kadaknath)

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Abstract

Fungal granulomas (Systemic mycoses) were caused by *Aspergillus sps* and diagnosed in Kadaknath chickens of 5-week age. Clinically, birds showed respiratory distress with illness, stunted growth and reduced body weight. The gross lesions included yellowish white nodules of varied sizes in lung, thoracic air sacs, proventriculus, liver and heart. Cultural examination on Sabouraud Dextrose Agar (SDA) revealed fungal growth in the culture plates and staining with lactophenol cotton blue (LPCB) revealed the presence of *Aspergillus sps*., spores and hyphae.

Key Words: Fungal granulomas, Kadaknath, *Aspergillus* sps, Cultural examination.

Introduction

Mycosis is a fungal infection of animals, including humans. A variety of environmental and physiological conditions can contribute to the development of fungal diseases. Inhalation of fungal spores or localized colonization of the skin may initiate persistent infections; therefore, mycoses often start in the lungs or on the skin. Aspergillosis is an infectious, non-contagious fungal disease caused by Aspergillus species in wild and domestic birds characterized by primary involvement of lower respiratory system (Saif et al., 2008). It's a common mis managemental problem and predisposing factors are immunocompromised host and exposure to overwhelming spores (Reddy et.al., 2020). Mycosis of poultry, mainly affects the lung, but may spread to other visceral organs results in to systemic mycosis (Sawale et al., 2012 and Aparna et. al., 2020). Disease mainly occurs due to inhalation of fungal spores from litter and feed (Oglesbee, 1997). Aspergillus fumigatus (A. fumigatus) is one of the most common causes of fungal granuloma (mycosis) in chickens and poults (Kunkle, 2003 and Pascal et al., 2011). The present communication reports the fungal granulomas in kadaknath (Black chicken).

Materials And Methods

History revealed that there was illness, stunted growth and reduced body weight in few birds of 5 weeks age group. The farm size was 1000. The carcasses were presented for disease diagnosis. The birds were examined and collected suspected samples for further investigation. Lungs were severely affected and suspected of fungal infection due to presence of granulomas. Apart from lungs, these granulomas were also identified in proventriculus, liver and heart. The tissue samples were subjected to fungal culture for confirmation of fungal growth on Sabouraud Dextrose Agar (SDA) in the Department of Veterinary Pathology, College of Veterinary Science, Hyderabad as per the standard protocols. This fungal growth was subjected to cultural examination and staining with lactophenol cotton blue (LPCB).

Results and Discussion

Grossly, the lesions observed were multiple yellowish white coloured nodules of varied size (1-3 cm in diameter) in lung, thoracic air sacs, proventriculus, liver and heart (Fig.1 and 2). On cut section of these granulomas greyish white caseous material was observed. Sabouraud Dextrose Agar (SDA) is a selective medium primarily used for the isolation of fungi from suspected lung tissue. The culture plates were streaked with specimen and incubated at 25 – 30°C in an inverted position (agar side up) with increased humidity and examined after one week for the growth of fungus. After one-week, fungal growth was observed in the culture plates (Fig.3) and the growth was subjected to lactophenol cotton blue (LPCB) staining and found the presence of Aspergillus sps., spores and hyphae (Fig. 4). The findings of present study were in accordance with the results of Sawale et al. (2012) and Aparna et.al. (2020).

Fig.1: Multiple grey to white coloured nodules of varied size in the thoracic cavity.

Fig.2: Granulomas over lungs, proventriculus, liver and heart.

Fig.3: Fungal growth was observed on Sabouraud Dextrose Agar (SDA) from suspected lung tissue.

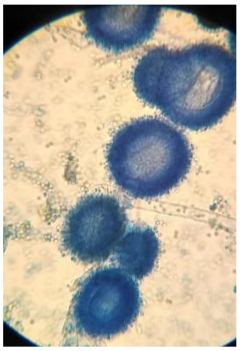

Fig.4: Lactophenol cotton blue (LPCB) staining revealed the presence of *Aspergillus* sps., spores and hyphae (Original magnification x100).

Conclusion

In conclusion, the present case was diagnosed as fungal granulomas caused by *Aspergillus sps*. in kadaknath (Black chicken) by gross lesions like nodules in thoracic cavity, heart; cultural examination for fungal growth and fungal staining for identification of the presence of *Aspergillus sps*., spores and hyphae.

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Popular Article

Transgenic Animals and Their Benefits in Livestock Production

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Abstract

Transgenic animals are those animals that have been altered through the transfer or deletion of genes into or from the organism under consideration. They are used in safety testing, pharming, biological and medical research, agriculture, and xenotransplantation. This alien gene of interest is prepared by various gene editing techniques and incorporated through various vectors like bacterial plasmids, cosmids and yeast artificial chromosomes. The gene with the vectors is inserted to the host cell through different gene insertion methods like heat shock, electroporation, viruses, gene gun, microinjection, and liposomes. Transgenesis may be done through the gonads, sperm, fertilized eggs and embryo by DNA microinjection, retroviruses, stem cells, and cloning. If this technology can alleviate welfare and ethical issues, it will be the most promising technology in the future.

Introduction

Transgenic animals are created by deliberately inserting a gene into the genome of an animal. An animal that gains new genetic information from the addition of foreign DNA is described as **Transgenic** while the introduced DNA is called the **Transgene**.

Methods of gene transfer in transgenesis

Various gene editing techniques are used for preparing the foreign gene of interest. For example- recombinant DNA technology, and novel technologies for gene transfer like Transcription activator-like effector nucleases (TALENs), Zinc-finger nucleases (ZFNs), and CRISPR/cas9 (clustered regularly interspaced short palindromic repeats). The gene of interest can be incorporated by using different methods like transgenic vectors, microinjection, electroporation, heat shock, viruses, gene gun and liposomes.

Methods of Transgenesis

There are several methods which can be used to produce transgenic farm animals which will later serve as bioreactors. The most commonly adopted traditional transgenesis technique is Somatic Cell Nuclear Transfer (SCNT) where nuclear donors can be genetically modified somatic cells or stem cells.

a. **Retroviral vectors** that infect the cells of an early-stage embryo prior to implantation into a receptive female.

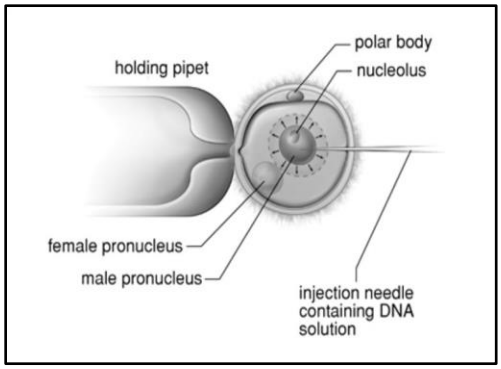
Table 1. Some common vectors used for transgenesis technology

VECTOR	ORIGIN	INSERT SIZE
Multicopy plasmids	Multicopy plasmids	up to 20 kb
Lambda vectors	Bacteriophage λ	up to 30 kb
Cosmid	Bacteriophage λ	up to 40 kb
P1 artificial chromosome	Bacteriophage P1	80-90 kb
Bacterial artificial chromosome (BAC)	arge Bacterial plasmid	100-300 kb
Yeast artificial chromosome (YAC)	Yeast chromosome	100-1000 kb

Limitations of this method include

- Size limit on the amount of DNA inserted (usually 9-15 kb)
- Unable to replicate in early embryonic cells and lower efficiency than the natural.
- Increased frequency of mosaicism.
- Possible interference by integrated retroviral sequences in transgene expression.

a. DNA microinjection into the enlarged sperm nucleus (the male pronucleus) of a fertilized egg.



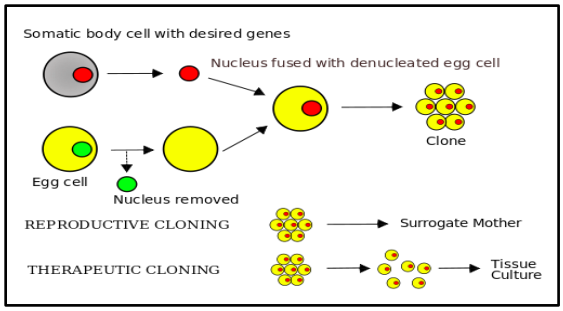
Advantages:

- Technical simplicity and widely used
- applicable to a wide range of species

Limitations:

- Low embryo survival
- Low integration frequencies of the injected DNA into the genome

b. Transfer of diploid **somatic nuclei** into an enucleated oocyte i.e. **Somatic Cell Nuclear Transfer (SCNT) method**



Limitations of SCNT

- Inefficiency due to stresses placed on both egg cell and the introduced nucleus.
- Trying to use one-cell embryos

c. Introduction of genetically engineered **embryonic stem cells** into an early stage developing embryo prior to implantation into a receptive female.

Benefits in Livestock Production: Table 2 depicts various biological products produced from different species of transgenic animals.

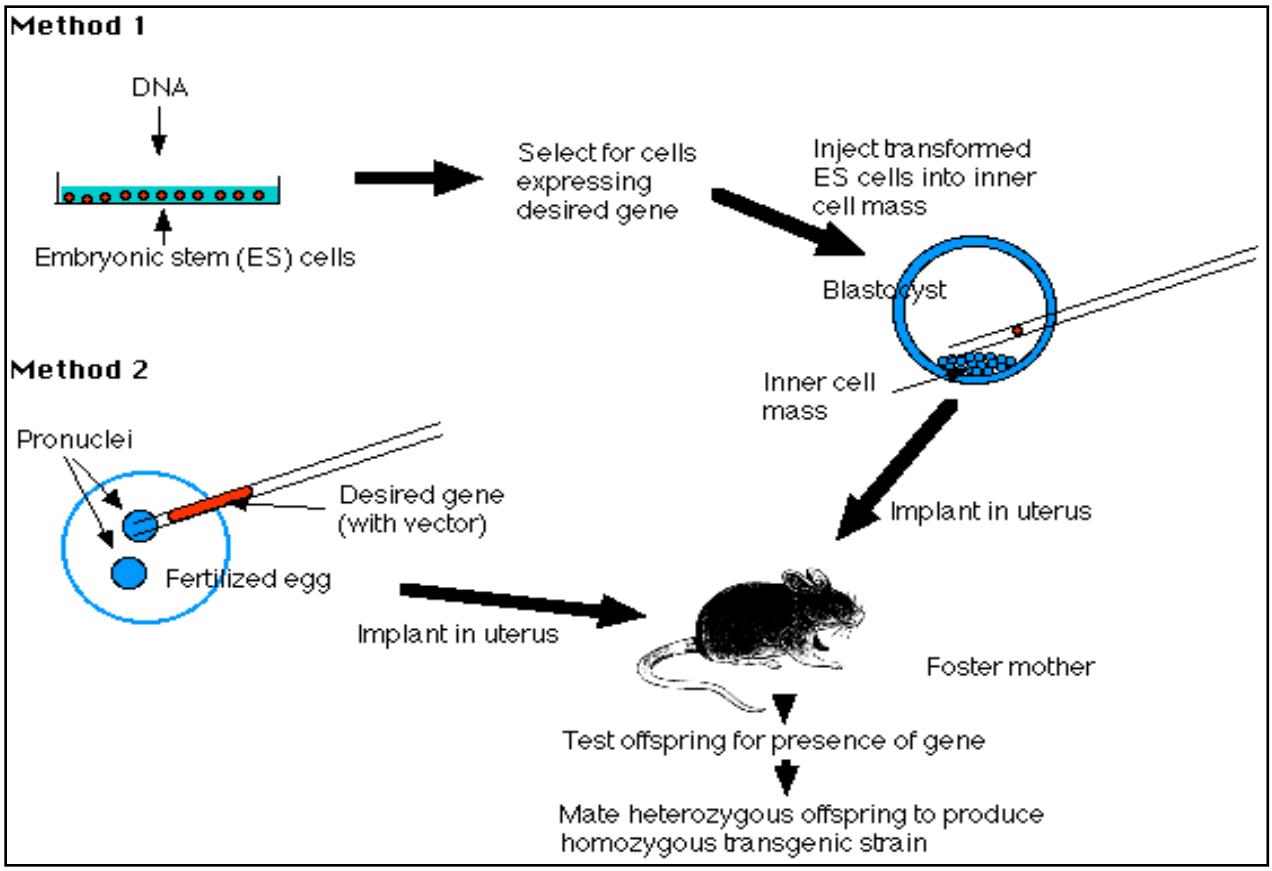


Table 2. Different transgenic animals used for production of various biological products

Transgenic Animal	Product
Goat	Monoclonal Antibodies (MAbs), Ig fusion proteins, tPA (tissue Plasminogen Activator) and Atryn® (recombinant human antithrombin III).
Pigs	Organs for xenotransplantation, human hemoglobin, human protein C.
Cows	Factors VIII and IX, protein C, recombinant antithrombin III (rATIII), rHSA, and human milk protein.
Mice	Expression of malaria protein for vaccine development; MAbs, ATIII, beta interferon; Factor X, HSA, tPA, prolactin; fibrinogen and antineoplastic urinary protein
Sheep	Factor IX, activated protein C and alpha-1-antitrypsin.

Conclusion

Animal transgenesis technology will be a promising technology in the near future to replace conventional use of drugs. This will be accomplished through the creation of disease-resistant animals and other methods of improving production potential of animals. It will also assist in improving human health by filling organ gap and production of important pharmaceutical products to treat human diseases. Animal welfare and ethics are the major issues which make the acceptance of the technology controversial and the efficiency of transgenesis is low. Therefore, the efficiency of transgenesis should be enhanced by the innovation of other efficient technique with a high level of ethical values and keeping the welfare of animals.

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Popular Article

Dermatophytosis in Canines and Felines

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Abstract

Dermatophytosis is one of the most common superficial fungal diseases in dogs and cats. Dermatophytes are a group of keratinolytic fungi which includes 7 genera namely Microsporum, Trichophyton, Epidermophyton, Nannizzia, Arthhroderma, Paraphyton and Lophophyton. The main etiological agents in canines and felines are Microsporum canis (zoophile), Nannizzia gypsea (geophile), and Trichophyton mentagrophytes. Direct contact with infected animals, humans, or fomites is the most common mode of transmission. Multifocal alopecia, mild or severe pruritus, and round scaly lesions with erythematous and scaly borders are common clinical signs. Dermatophytosis is diagnosed using a combination of clinical history, physical examination, and diagnostic tests such as Wood's light, direct microscopic examination of infected hairs and/or crusts, fungal culture, and biopsy. Dermatophytosis in dogs and cats requires a combination of topical, systemic, and environmental disinfection to be successfully treated.

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Introduction

Dermatophytes are keratinolytic fungi that infect animals and humans, causing superficial skin disease. They're regarded as a serious issue in shelter animals and household pets. Microsporum canis (zoophile), Nannizia gypsea (geophile), and Trichophyton mentagrophytes are the most common dermatophytes that affect small animals (zoophile). They are spread by cats (M. canis), soil (N. gypsea), and rodents (T. mentagrophytes) and can be transmitted by carriers or infected animals (Moriello KA et al., 2017). Dermatophytes are spread either directly or indirectly through contact with infected animals or contaminated objects such as furniture or grooming tools. For zoophiles like M. canis, the arthrospores attached to the hairs shed by infected animals are the main sources of infection. These arthrospores attach to the epidermis of a susceptible host and produce hyphae that infect the stratum corneum and hair. Infected animals are more likely to be young, stressed, or geriatric. (DeTar LG et al., 2019). The majority of infections in cats are caused by M. canis, but most infected cats recover mycologically within three weeks of receiving appropriate treatment (Moriello KA et al., 2020).

Dermatophytosis in dogs has a prevalence of 4 to 10%, but this can vary depending on regional differences and other epidemiological factors (Cabanes FJ *et al.*, 2000). Young dogs, aged 6-18 months, are more susceptible to infection than dogs older than one and a half years, followed by those older than three years (Singathia R *et al*., 2014). Male dogs are more likely to become infected than female dogs (Singathia *et al*. 2014 and Bhardwaj *et al*. 2012). Yorkshire terriers had a statistically significant higher incidence of infection, especially that caused by *M. canis*, than other breeds, indicating breed predispositions in canine dermatophytosis (Bhardwaj *et al*. 2012). The prevalence of a specific agent in small animal dermatophytosis can be influenced by seasonal variations. *M. canis* ringworm was more prevalent in the fall/winter season, whereas *N. gypsea* was more prevalent in the spring and summer (Lewis DT *et al.*, 1990).

2. Predisposing Factors to dermatophyte infection

- Young age (first 2 years of life)
- Immuno-suppression (including immunosuppressive treatment)
- Nutritional deficits (especially vitamin A)
- High temperature and humidity
- Skin trauma
- Injury from scratches or ectoparasites
- Aggressive behaviour
- Poor hygiene conditions
- Overcrowding in catteries

3. Clinical signs

Multifocal alopecia, mild or severe pruritus, and round scaly lesions with erythematous and scaly borders are common clinical signs. Other clinical forms of dermatophytosis include:

3.1. Folliculitis

Folliculitis is caused by dermatophyte infection of the hair. It appears as papules and pustules that rupture quickly, leaving epidermal collarettes, alopecia circularis, and crusts.

3.2. Nodular Lesions

Inoculation of dermatophytes into the dermis by accident (for example, during an injury) can cause a severe inflammatory response and the formation of a nodular lesion known as a kerion (Cornegliani L *et al*., 2009). It's a severe localised inflammation with swollen, boggy skin and pus oozing from it. It's frequently associated with secondary bacterial infection and appears on the face and limbs of hunting dogs who spend a lot of time outside in direct contact with the ground (Cafarchia C *et al.*, 2004). This nodular lesion is most commonly found on the bridge of a dog's nose in dogs who used to dig in the dirt. The most common species associated with the development of kerion are *N. gypsea* and *T. mentagrophytes*. The severe inflammatory response

can last even after the dermatophytes have died. Dermatophytic mycetoma, also known as pseudo-mycetoma, is another manifestation of dermatophyte-caused nodular disease. This uncommon dermal/subcutaneous infection mostly affects Persian cats and manifests itself as nodules with draining tracts on the back. These cats usually arrive in hospitals with a history of antibiotic resistance.

3.3. Nail Lesions

Dermatophytes can also harm the pads of the feet and the nails. Nails infected with dermatophytes become brittle and deformed, especially in dogs infected with *N. gypsea* (Moretti A *et al.,* 2013).

4. Diagnosis

Dermatophytosis is diagnosed using a combination of clinical history, physical examination, and diagnostic tests such as Wood's light, direct microscopic examination of infected hairs and/or crusts, fungal culture, and biopsy (Gross TL *et al*., 1992).

4.1. Wood's Lamp

The use of a Wood's lamp as a screening tool is still recommended, and it is now widely accepted that most *M. canis*-infected clinical samples will fluoresce apple green under a Wood's lamp. It can be used as a screening test to determine whether or not an animal is infected with *M. canis*. This technique's percentage positivity ranges from 91 percent to 100 percent (Moriello KA *et al*., 2017). The presence of a tryptophan metabolite causes fluorescence to develop under UV light. After the first week of infection, the ability to fluoresce develops, and it can last at the tip of the hairs even after the infection is gone. When using Wood's lamp, clinicians should be cautious. Starting at the patient's head and slowly moving back while holding the lamp close to the skin (2 to 4 cm above the skin), distinguishing the green fluorescence of dermatophytosis hairs from the false blue fluorescence associated with scaling and some topical products (Moriello KA *et al*.,2017).

4.2. Direct Microscopic Examination

After treatment with 1-2 drops of 20 percent KOH on a clean glass slide, clinical samples such as hair and epidermal scales/debris are examined for characteristic spores (arthrospore) or hyphae. For better visualisation, any clumps should be teased with a teasing needle before placing the cover glass. The slide should be gently warmed over a flame after placing the cover slip and allowed to cool for 20 minutes at room temperature. After that, the slides are examined at 10 X and 40 X magnifications. The presence of septate hyphae and the distribution of spores inside (endothrix) or outside (ectothrix) the hair should be noted during microscopic examination of

clinical samples.

4.3. Fungal Culture

For dermatophyte isolation, clinical samples are inoculated on suitable fungal media such as Sabouraud dextrose agar or Potato dextrose agar. To prevent saprophytic fungi and bacteria from growing, the media should be supplemented with cycloheximide and chloramphenicol, respectively. Incubate the inoculated media for up to 45 days at 25-30 ^{o}C. *Microsporum* and *Trichophyton* spp. colony morphology is as follows:

Dusty, grainy colonies with a cottony surface and a yellowish-orange colour are formed by *Microsporum* spp. It produces pyriform, fusiform, or cylindro-fusiform macroconidia with echinulate or verrucous walls and 1–15 septa that are moderately thick to thick, with a size of 6–150 by 6–26 μm. It has sessile or clavate microconidia that are borne in clusters or directly on the hyphae (Molina de Diego A *et al.,* 2011).

Trichophyton spp. have a variety of macroscopic characteristics that differ between species; for example, the colonies can be grainy, cottony, cerebriform, or hairy. Reddish or brownish pigmentation can be found on the colonies' undersides. When present, macroconidia have smooth, usually thin walls with 1–12 septa, clavate to fusiform, that are either individual or clustered. Their dimensions range from 8 to 85 by 4 to 14 μm. Microconidia have a spherical, clavate, or fusiform shape, are sessile, and are borne laterally directly on the hyphae or in pedicels and are more abundant than macroconidia (Molina de Diego A *et al.,* 2011).

4.4. Skin Biopsy

Because cultures are frequently negative, skin biopsy for the diagnosis of canine dermatophytosis is only used for kerion reactions and granulomatous infections. However, this method does not allow for the identification of the dermatophyte's species. Common stains like haematoxylin and eosin (H&E) aren't very sensitive, so special stains like periodic acid Schiff (PAS) and Grocott methenamine silver (GMS) are required (Moriello KA *et al.,*2017). The lesion is described histologically as a nest of ruptured hair follicles replaced by suppurative to pyogranulomatous inflammation, with eosinophils oriented around hair fragments containing fungal hyphae and surrounded by fungal spores.

4.5. Molecular techniques

Molecular techniques are commonly used to differentiate the species and strains of dermatophytes. Various types of PCR, restriction fragment length polymorphism (RFLP), amplified fragment length polymorphism (AFLP), sequencing of genomic regions and MALDI-TOF are commonly employed in research laboratories. Genotyping of isolates based on

conserved regions like ITS (internal transcribed spacer region), beta-tubulin and TEF (translation elongation factor) regions will help us to understand the inter- and intra-species variations.

5. Treatment

Dermatophytosis in dogs and cats requires a combination of topical, systemic, and environmental disinfection to be successfully treated.

5.1. Topical Treatments

Because dermatophytosis is spread through contact with arthrospores, topical therapy is a critical component of small animal dermatophytosis treatment. Topical treatment aids in the resolution of infection and reduces arthrospore shedding into the environment.

5.1.1. Clipping

Hair clipping was once thought to be an important part of treating dermatophytosis in dogs and cats; however, it is now being reconsidered because whole-body clipping is stressful, and common micro-trauma to the skin can exacerbate the infection. Clipping is not necessary for short-coated animals, so it should be decided on a case-by-case basis (Moriello K *et al*., 2013).

5.1.2. Dips, Shampoos, and Rinses

Dips in lime sulphur are a common topical treatment for dermatophytosis. The effectiveness of lime sulphur dips has been documented in several studies, with twice weekly application being more effective than once weekly application (Moriello K *et al.,* 2013). Shampoos have a shorter duration of activity on the coat than dips. Dryness and yellow discoloration of the skin and hair coat are common side effects of lime sulphur. Recent studies have ruled out the possibility of oral ulcers in people who lick their wet coats (Newbury S *et al*., 2007). The majority of current veterinary lime sulphur formulations contain 97.8% saturated lime sulphur, which is applied at a dilution of 240 ml per 4.54 L of water (Moriello K *et al.,* 2013). Due to their ease of use, shampoos are the most popular choice among pet owners. The most effective topical treatment is a two-weekly application of miconazole and chlorhexidine (Moriello KA *et al*.,2017, Moriello KA *et al.,* 2020). Despite the fact that chlorhexidine has antifungal properties, its efficacy for dermatophytosis has been demonstrated to be poor (DeBoer DJ *et al.*,1995)

5.2. Systemic Treatments

Drugs that are keratinophilic and lipophilic and accumulate in the skin and keratin are the best choices for systemic therapy. Oral itraconazole or oral terbinafine are currently the most effective systemic treatments for both canine and feline dermatophytosis (Moriello KA *et al.*, 2017).

5.2.1. Itraconazole

In cats, itraconazole has a long half-life and a high proclivity for accumulating in hair and skin. This property allows for the use of pulse therapy, which lowers therapy costs. Clinical success has been demonstrated by daily administration for one week, followed by one week on and one week off. After giving the drug daily for four weeks, a pulse regimen can be started. Itraconazole is most commonly given to dogs and cats at a dose of 5 mg/kg once daily. Because itraconazole affects cytochrome P450, it's important to think about drug interactions and reduce the doses of other medications if this interaction affects their metabolism (for example, cyclosporine) (Colombo S *et al.,* 2001, Liang C *et al.,* 2016, Puls C *et al*., 2018).

5.2.2. Terbinafine

Because terbinafine is highly keratinophilic and accumulates in hairs, it can be used in pulse therapy, reducing costs and side effects. It has excellent anti-dermatophyte activity, and one study found that it is effective and could be a suitable and less expensive alternative for shelter cats. Terbinafine is commonly given at a dose of 20 mg per kilogramme once daily (Kotnik T *et al.*,2001, Foust AL *et al*.,2007). Although terbinafine does not have the same effect on cytochrome P450 as azoles, it does involve the liver in its metabolism, so liver function monitoring may be required if treatment is prolonged.

5.2.3. Ketoconazole

Although ketoconazole is effective against dermatophyte infection, it is not as effective as itraconazole or terbinafine as a treatment option. Ketoconazole has been used in cats, but it is best reserved for dogs because it is not well tolerated in cats and frequently causes anorexia and nausea. Ketoconazole is usually given to dogs at a dose of 5 mg/kg PO every 12 hours, and it is best given with food to reduce side effects and increase absorption (Medleau L *et al.,* 1992).

5.2.4. Fluconazole

Fluconazole has poor in vitro activity against dermatophytes and is no longer recommended for dermatophytosis treatment (Begum J *et al*., 2020).

5.2.5. Griseofulvin

Griseofulvin has long been used to treat dermatophytosis, but there are now safer and more effective alternatives. As a result, griseofulvin is rarely used as a treatment option.

5.3. Environmental decontamination

In the treatment of dermatophytosis, environmental decontamination is crucial. It also reduces the number of fungal culture results that are falsely positive. Despite the fact that separating animals for the purpose of reducing contamination has been advocated for decades,

confinement must be done with caution because it can be extremely stressful for animals, especially young ones. As a result, the length of isolation should be kept to a minimum in order to decontaminate the environment. Weekly cleaning and topical therapy can help to reduce the need for prolonged isolation (Newbury S *et al.*, 2015). Weekly cleaning has been shown to be very effective in removing infective arthrospores in studies. The actual hard cleaning, which involves the removal of debris and hairs, is the most important part of the decontamination process. Over-the-counter household detergents can be used to clean. Hard surfaces can be disinfected with a 1: 100 solution of household bleach or accelerated hydrogen peroxide. Soft fabrics should be machine washed on the longest cycle possible to maximise spore removal (Moriello KA *et al*., 2013, Moriello KA *et al.*,2015, Moriello KA *et al.*, 2019).

Conclusion

Dermatophytosis is a zoonotic disease that can be treated. A step-by-step logical approach is critical for proper diagnosis of patients with folliculitis or alopecia. A combination of clinical signs and positive fungal culture results can be used to make a diagnosis. Positive panderm PCR or culture results in the absence of clinical signs may simply indicate the presence of arthrospores on the coat without active infection. The source of the arthrospores should be determined because dermatophytes are not part of the normal flora. For quick screening of M canis infection, Wood's lamp examination is still recommended. The majority of patients who are affected require a combination of topical and systemic treatments. Itraconazole and terbinafine are the most effective oral medications. which can be used in conjunction with topical lime sulphur dips twice weekly and/or shampoos containing both miconazole and chlorhexidine. A combination of resolution of clinical signs and negative culture should be used to determine whether a patient is completely cured.

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Popular Article

Bovine Tuberculosis in India: Zoonotic Perspective and Available Diagnostics

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Introduction

Bovine tuberculosis (bTB) and is a chronic and contagious bacterial disease of bovines caused by *Mycobacterium bovis* (*M. bovis*). *M. bovis* constitutes an undeniable portion of human TB cases worldwide which line this disease as an important global threat to animal and public health.

Distribution in India

The situation of bovine TB in developing countries like India is more dreadful due to a huge susceptible livestock population (300 million), and that too in close existence with human population. In India, bTB has been reported from several states (Fig. 1) with a varying pooled prevalence. Overall, India has a prevalence of 7.3% for the bTB, meaning around 21.8 million bovine populations in India might have bTB.

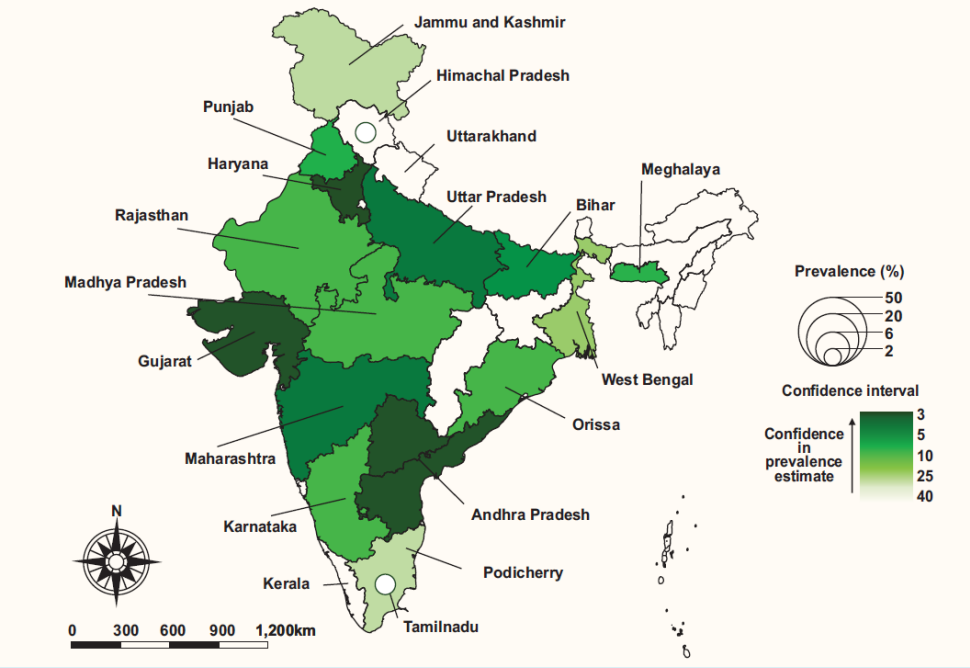

Fig. 1. Distribution and prevalence of bovine TB (bTB) in India (Srinivasan et al. 2018)

A survey conducted in central India with three different groups of population reported an incidence of 8.9 to 12.6% of bTB. However, the actual prevalence of bTB in humans seems to be under-estimated due to lack of surveillance of *M. bovis* in humans, ineffective differentiation between *M. bovis* and *M. tuberculosis* and lack of awareness among people, which results in under diagnosis and under-reporting of human cases due to *M. bovis.*

Transmission

As per the environmental conditions, *M. bovis* may survive for several months in soil, feed and faeces. However, direct exposure to sunlight, dry environment and high temperature may kill the bacteria within days or weeks.

***Transmission in animals*:** Infected animal can shed *M. bovis* organism intermittently in respiratory secretions, milk, feces and other bodily fluids (urine, vaginal secretions and semen) and act as source of infection to other susceptible animals. Inhalation of droplets containing *M. bovis* bacilli is a major route of infection in bovines. Furthermore, direct contact via mucous membranes and broken skin are other possible routes in disease transmission. Dogs with the renal signs for tuberculosis can transmit the infection through urine.

***Transmission in human*:** Ingestion, inhalation, entry through mucous membranes and breaks in the skin are major routes of disease transmission. Humans acquire *M. bovis* infection by drinking of raw/unpasteurized milk and dairy products and by eating of under-cooked meat products from *M. bovis* infected animals. Human to human transmission by aerosol route can also occur, if a person suffers from respiratory form of bTB. Farmers, dairy workers, slaughterhouse workers and animal handlers in close-contact with animals are at greater risk of acquiring infection.

Clinical signs

Animals: Bovine tuberculosis is a chronic and debilitating disease, but may have a quick onset. Infected cattle are asymptomatic during early stages of the infection but as the disease progress, loss of appetite, low grade intermittent fever, weakness and gradual weight loss are observed. If the respiratory tract is involved there is difficulty in breathing with moist, intermittent cough that aggravates in the morning and during cold weather seasons or exercise. Enlargement of lymph nodes such as retropharyngeal and superficial lymph nodes can be seen and sometimes these lymph nodes may rupture and drain. Intermittent diarrhoea or constipation may develop. Some other less common signs might include eye lesions, repeated abortions and infertility. Symptoms of bTB are generally similar in other species of animals as well, but the predominant syndrome or course of the disease may differ.

Human: Symptoms due to TB caused by *M. bovis* are more or less similar to the TB caused by *M. tuberculosis*, which may include fever, tooth abscess, chronic weight loss, chest pain and night sweats. If lungs are involved symptoms of persistent cough, shortness of breaths and blood spitting may be there. The involvement of gastrointestinal system can cause abdominal pain and diarrhoea. Lymph node enlargement is also a prominent clinical sign associated with *M. bovis.* In children consuming raw milk or improperly pasteurized milk from *M. bovis* infected animals may develop cervical lymphadenopathy of the tonsillar and preauricular lymph nodes and these nodes may suppurate and drain to the skin, which results into chronic skin lesions. Skin lesions have been given various names like scrofuloderma and lupus vulgaris. Cutaneous lesions can appear as papules, suppurative lesions, ulcers, soft gelatinous plaques with a central atrophy, reddish-brown to gradually enlarging subcutaneous nodules or as a vegetative lesion looks like a tumor. Central Nervous System (CNS) form of bTB causes chronic meningitis, has an insidious onset and is most often seen in immune suppressed young children and older adults. Meningoencephalitis is also reported in all age groups. Disseminated disease usually affects both pulmonary and extrapulmonary organs and occasionally includes widespread skin lesions.

Diagnostic tests available

In animals

Smear microscopy: Acid-fast staining (Ziehl–Neelsen) of smears directly prepared from the clinical samples and tissue samples to visualize the presence of acid fast bacilli of Mycobacterium species. Fluorescent acid-fast stain also can be used.

Culture and identification: For primary isolation, Lowenstein–Jensen, Coletsos base or Stonebrinks supplemented with either pyruvate or pyruvate and glycerol are in practice. An agarbased medium such as Middlebrook 7H10 or 7H11 supplemented with ODAC and egg yolk also can be used for isolation. A minimum incubation of 10–12 weeks (8 weeks optimum) at 37°C with or without CO2 is required to visualize the colonies. *M. bovis* shows dysgonic growth, is negative for nitrate reduction, niacin accumulation, nicotinamidase and pyrazinamidase. *M. bovis* is positive urease test. *M. tuberculosis* has eugonic growth, is positive for nitrate reduction and niacin accumulation. A major criterion for the differentiation of *M. bovis* is its intrinsic resistance to pyrazinamide.

Nucleic acid detection assays: Polymerase chain reaction (PCR) or Gen Probe TB complex DNA probe targeting 16S–23S rRNA, the insertion sequences (IS6110 and IS1081), MPB70 and the 38 kDa antigen genes have been used for rapid identification of *M. tuberculosis* complex. For specific identification of *M. bovis,* PCR targeting a nucleotide mutation at positions 285 (adenine residue for *M. bovis* and guanine residue in other MTBC) in the oxyR gene, 675/756/1311/1410 and 1450 of the

gyrB gene and 169 in the pncA gene and presence or absence of Regions of Difference (RD) are routinely employed. Spacer oligotyping (spoligotyping) is the most widely used DNA fingerprinting technique to differentiate *M. tuberculosis* complex, including *M. bovis* and also to distinguish *M. tuberculosis* from *M. bovis.*

Single intradermal tuberculin test: The test involves intradermal injection of bovine tuberculin (Purified Protein Derivative-PPD) of 2000-5000 IU (not more than 0.2 mL/injection) on the mid neck or caudal fold of the tail and measuring of the skin of swelling/thickness (delayed hypersensitivity) 72 hours after injection.

Comparative intradermal tuberculin test: The comparative intradermal tuberculin test need to be used for differentiation of animals infected with *M. bovis* and other mycobacteria. It involves the intradermal injection of bovine tuberculin and avian tuberculin into different sites on the same side of the neck and measuring delayed hypersensitivity 3 days later. In India, ICAR-IVRI provides PPD for *M. bovis* to be used for intradermal tuberculin test in bovines.

Gamma interferon (IFN- γ) assay: This test is based on the measuring of lymphokine gamma interferon (IFN- γ) released from the whole blood culture sensitized for 16–24 h with avian tuberculin and bovine PPD. Released bovine IFN- is detected with sandwich ELISA, which uses two monoclonal antibodies against the bovine gamma-interferon. The test is available commercially for bovine species and primates.

***In human*:** Tuberculin skin tests, direct microscopy for acid-fast bacilli, imaging techniques (chest X-rays, CT scans and MRIs), culture, IFN- γ release assays, PCR, Real Time PCR-based and/or other nucleic acid assays are used for the diagnosis of tuberculosis including *M. bovis.* Cartridges Based Nucleic Acid Amplification Test (CBNAAT) is nowadays used readily for quick and effective TB diagnosis. Another indigenously developed TruNAT test showed promising results for TB diagnosis and is being used for quick diagnosis and antimicrobial sensitivity of Mycobacterial species.

Treatment

Animals: Treatment of bovine TB is not recommended. The infected animal should be culled or removed from the herd.

Humans: Treatment regimen for new TB cases includes intensive phase of HRZE (Isoniazid (H), Rifampicin (R), Pyrazinamide (Z), and Ethambutol (E) for 8 weeks and a continuous phase of HRE, which lasts for 16 weeks. In cases of drug resistant TB such as MDR-TB, XDR-TB, different drugs are used in combination, details of which are available on official website (https://www.mohfw.gov.in/) of Ministry of Health and Family Welfare, Govt. of India.

Prevention

***Animals*:** The spread in animal population can be prevented by regular herd screening using intradermal tuberculin testing and segregation of the test positive animals. Before introducing new animals to herd, bTB test either by blood based or i/d skin test should be done. Animal handlers and other staff in close contact with animals must be tested for TB prior to handling animals using suitable tests. Currently there is no vaccine validated to be used in animals; however, BCG vaccine has been used in some countries.

***Humans*:** The raw/unpasteurized milk and milk products made from unpasteurized milk and under-cooked meat must not be consumed. The individuals in frequent contact with bovines (animal handlers, butchers, veterinarians, para-veterinary staffs) are being at the most risk should use protective clothing and equipment such as mask, gloves, etc. while dealing/handling animals. Open wounds, if any, should be covered properly before handling of bovines. Individual showing signs relevant to TB must get tested themselves as they can be the source of infection to other humans as well as animals. Vaccination in early childhood (up to 1 year of age) with BCG vaccine is recommended in India. The goal of WHO's End TB Strategy is to end the global TB epidemic by 2030. India also has set NTEP to eradicate TB by 2025.

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Popular Article

Paratuberculosis in cattle

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Introduction

In India, paratuberculosis, also known as Johne's disease (JD), is endemic in domestic livestock and was first reported in Hisar, India, in 1913. National estimates of the prevalence of MAP in India are still unavailable (Kumar *et al*, 2007, Sharma *et al*., 2008). John's disease causes enormous economic losses and has a significant impact on the livestock industry due to premature culling of animals, reduced weight gain, reduced feed efficiency, and high morbidity (Kaur et al., 2011); reduced carcass value, reduced milk production, increased susceptibility to mastitis and reproductive disorders, resulting in increased calving intervals, decreased fertility, and additional veterinary costs (Hasonova & Pavlik, 2006). Paratuberculosis causes significant economic losses in the dairy industry in the United States, estimated at more than $200 million per year (Groenendaal et al., 2015), and thus has a significant impact in both developing and developed countries. No country claims to be free on MAP (Yue et al., 2016). Paratuberculosis, often known as Johne's disease, a chronic intestinal disease that mostly affects ruminants and camelids. In animals, paratuberculosis causes intermittent or chronic diarrhoea, chronic weight loss, and generalized stinginess (Whitlock and Buergelt, 1996).

Etiology

The disease is caused by Mycobacterium avium subspecies paratuberculosis (MAP). The organism is acid-fast, aerobic, and slow-growing, and its in-vitro growth requires exogenous mycobactin (Merkal and Curran 1974, Chiodini *et al* 1984).

Epidemiology

The disease occurs in most parts of the world and the prevalence seems to be increasing in some countries. Paratuberculosis is predominant in cattle and sheep in temperate climates with adequate rainfall and ground waters and in some humid, tropical areas. The incidence of paratuberculosis is high in animals kept intensively under environmental and husbandry conditions which are conducive to the spread of the infection (Chiodini et al., 1984a).

Mode of transmission

The important route of MAP transmission is the fecal-oral route between infectious cows and susceptible young calves via ingestion of contaminated milk, water, or uptake from the environment (Lombard 2011). Recent studies on the risk of faecal shedding in calves born to faecal culture positive dams or fed MAP-containing colostrum failed to confirm these proposed risk factors (Pithua *et al* 2012). In cows in the subclinical and clinical stages of the infection, intra-uterine transmission of MAP has been described (McQueen and Russell 1979, Sweeney *et al* 1996). The respiratory tract of cattle was proposed as an additional route of infection for MAP (Eisenberg et al 2012).

Clinical signs

In cattle the disease is characterized by chronic and intermittent diarrhoea that is not responsive to treatment, oedema of the throat and abdomen, loss of coat colour, emaciation and eventual death. Due to the chronic nature of the disease, clinical manifestations of paratuberculosis can appear as late as 3 to 5 years after infection (Riemann and Abbas, 1983; Chiodini et al., 1984a).

Post mortem findings.

The ileum often has a severely thickened and corrugated appearance due to the granulomatous infiltrate. Histologically, *M. paratuberculosis* is found in macrophages which infiltrate into the lamina propria of the intestine (Kubo *et al*., 1983). In cattle, there is no caseation, calcification, or fibrosis associated with paratuberculosis lesions (Hines et al., 1995).

Diagnosis.

Primary diagnosis can be made based on clinical signs, postmortem lesion, and histopathology, and it can be confirmed by a battery of diagnostic tests such as faecal culture, acid-fast staining, agar gel immunodiffusion (AGID), complement fixation test (CFT), delayed type hypersensitivity (DTH), interferon gamma assay, and enzyme linked immune-sorbent assay (ELISA). Culture-based methods are the "gold standard" for MAP infection diagnosis. These methods, however, are time-consuming and have a low sensitivity. Recently, molecular biological methods such as polymerase chain reaction (PCR) have been developed to detect MAP infection in animals (Fang et al., 2002).

Prevention and control

The prevention and management of John's disease in humans and animals, particularly dairy animals, is critical, and requires a robust control mechanism to prevent disease spread within species and between people and animals. One of the most limiting issues is the lack of a reliable, cost-effective, and quick diagnostic test (s).

Vaccination

Vaccination of cattle against paratuberculosis is not routinely recommended. Although it may have served a purpose in the past, recent information indicates it is of limited value in controlling *M. paratuberculosis* infections, causes a false sense of security in owners, is a serious health risk for veterinarians and prevents use of serologic tests in a herd (Collins, 1994).

Treatment

Currently, no antimicrobials are approved for the treatment of Johne's disease. M. paratuberculosis is more resistant to chemotherapeutic agents in vitro than M. tuberculosis so that prospects for suitable treatment are poor. Because of this lack of efficacy and the failure of any of the antimicrobials to provide a bacteriological cure, treatment is not recommended. (Radostits and Blood,1994)

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Popular Article

Native Herbs: Remedies for Reproductive Health

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Introduction

Herbs are plants that are used for medicine, cooking, food, flavor, etc. Herbs have additive and synergistic effects. Secondary metabolites of herbs increase therapeutic feasibility. The World Health Organization estimates that 80% of the world's population is dependent on traditional medicine, with more than 7500 plant species (herbs, etc.) are being used.

Benefits of Herbs: -

1. Herbal medicines are very cheap.
2. They have a negligible adverse effect on health.
3. The body's natural detoxification process is effectively enhanced by the herbs.
4. Herbs help in regulating the immune system and mental health.
5. Herbs are effective in curing various diseases.

- **Some of the important herbs used for improving female reproductive functions: -**

  Aloe vera, Bael, Ashoka, Peepal, Fennel, Ultakambal, Shatavari, Black cumin, Curry leaves, Sowa, Dong quai, Sundhi, Neem, Chitraka, Gokshura, Castor.

1. Aloe Vera

Scientific name - Aloe barbadensis (Aloe barbadensis)
Active ingredients – Two glycosides- Aloin, Barbaloin are obtained from it.
Uses – (i) Treatment of various uterine disorders.
(ii) Aloe vera induces the onset of puberty.
(iii) Steroidogenesis induces the initiation of folliculogenesis

2. Bael

Scientific name - *Aegle marmelos*

Active ingredients – Its husks contain two alkaloids – aeglenine and aegline.

Uses – Its estrogenic effect leads to the early onset of puberty, folliculogenesis and steroidogenesis.

Bael

3. Ashok

Scientific name – *Saraca asoca*

Active ingredients – Deoxyprocyanidin B, catechins, leucopelargonidin, and leucocyanidin are found in its bark.

Uses – (i) Stimulant action on uterus and ovaries.

(ii) Puberty at a young age through estrogenic effects.

Ashok

4. Peepal

Scientific name - *Ficus religiosa*

Active ingredients – (i) Its leaves contain calcium, iron, copper, manganese, zinc, tannic acid, amino acid, sterol substances

(ii) Vitamin K is found in its bark.

Uses – Its estrogenic effect leads to the early onset of puberty, folliculogenesis, and steroidogenesis.

Peepal

5. Fennel (Saunf)

Scientific name – *Foeniculum vulgare*

Active Ingredients – Anethole and its polymers such as dianethol and photoanethol are obtained from it.

Uses – (i) Its estrogenic effect induces the oestrus cycle.

(ii) Increase in libido.

Funnel

6. Devil's horn

Scientific name - *Abroma augusta*

Common name- Ulatkambal

Active Part – Its roots and leaves have estrogen activity.

Uses – Stimulating action of estrogenic effect on uterus and ovaries.


Devil's horn

7. Black cumin / Kalonji (Black cumin)

Scientific name- *Nigella sativa*

Active part – Volatile oil is made from its seeds.

Uses – This volatile oil relaxes the muscles of the uterus and acts against oxytocin-induced uterine contractions.


Black cumin

8. Curry leaf plant

Scientific name- *Murraya koenigii*

The active part – in its leaves – Ca, P, Fe, carotene, vitamins A and C, and amino acids are obtained.

Uses – (i) Induces the female animal who has trouble in coming to the estrus cycle in them.

(ii) Induction of estrus in anestrous condition


Curry leaf plant

9. Shatavari

Scientific name – *Asparagus racemosus*

Active Ingredients – Steroidal glycosides and aglycones, Shatavarin are obtained from it. Shatavariin is rich in Ca, Mg, Cu, Fe, Mn, Fe, Ti, Z mineral elements.

Uses – (i) Early onset of puberty.

(ii) It is used in the treatment of the problem of reproduction of animals.


Shatavari

10. Neem

Scientific name – *Azadirachta indica*

Active Ingredients – Nimbin, isoprenoids, and norisoprenoids are


Neem

obtained from their seeds, bark, or leaves.

Uses – (i) The aqueous extract of neem is used to strengthen the immune system (Immunostimulant).

(ii) Neem oil is used in the prevention of inflammation in the uterus.


Sowa

11. Sowa / Dill Seeds

Scientific name – *Anethum sowa*

Active Ingredients – N-butanol and petroleum ether are obtained from it.

Uses – (i) It is used for expulsion of fetal membranes after birth.

(ii) Giving in combination with calamus, crystal sugar, neem leaves, and onion bulb is used to treat fibroid uterus.


Castor bean

12. Castor bean/ Arandi

Scientific name - *Ricinus communis*

Active Ingredients – Phytosterol from its leaves and Ricinoleic acid from seeds.

Uses – (i) Phytosterols – Used for the expulsion of the placenta.

(ii) Ricinoleic acid - acts to increase the contraction of the uterus.


Chitraka

13. Chitraka/ White leadwort

Scientific name – *Plumbago zeylanica*

Active Ingredients – Plumbagin is obtained from its roots and leaves.

Uses – It stimulate the uterus, reduce inflammation, antioxidants and

strengthen the immune system (Uterotonic, ecbolic, anti-inflammatory, antioxidant, immunopotentiating action).


Dong quai

Herbal drugs			
Exapar	**Aloe barbadensis, Citrullus colocynthis, pippali (Scindapus officinalis), Rubia cordifolia (Mangistha). Leptadenia reticulatea (jivanti).**	**Expar - earlier expulsion of fetal membrane (4-3 hrs) earlier disappear- ance of lochia (2-9 days) and earlier onset of post partum estrous**	
Uterotone	***Saraca asoca, Aloe barbadensis, Aegle marmelos, Solanum xanthocarpum,* Na tetraborate,ferrus sulphate and cupper sulphate.**	**Clinical trial with uterotone have shown 63% cases placenta came out within 6-18 hrs**	
Utrifit	***Caespinia bonducela, Peganum hormonela* (antimicrobial and antiseptic action), Plumbago zeylanica (immunopotenting effect)**	**Retained placenta -** **82% success rate in early cases and in dealyed cases i .e after 48 hrs, S R in 60%.**	
Involon	***Adhatoda vasica. Gloriosa superba.*** ***Plumbagin of Plumoago zeylanica.*** ***Hermene, Hermaline present in Harmal (Peganum harmala).***	**Antiinflammatory** **Antioxidant** **Ecobalic Uterotonic Effect** **Antimicrobial, Antiseptic**	
Prajana	***Mrigashi dharmpattan (Pippali – pipur longum), Black piper.***	**Prajana estrus induction similar to that of synthetic estrogens**	

14. Dong quai

Scientific name – *Angelina sinensis*

Active part-whole plant

Uses – Its aqueous extract is used to cause contraction of the uterus.

- **Herbs to improve male fertility: -**

1. **Gokshura (*Tribulus terristis*)-** Stimulates spermatogenesis, improves semen production, is used to improve libido and fertility.

2. ***Panax ginseng* –** Contains ginsenoside which is used for penis stimulation and for improving fertility in male animals.

3. **Ashwagandha (*Astragalus membranaceus*) –** It is used to improve sperm motility and increase the number of live spermatozoa and motility of sperms.

Conclusion

Medicines made from herbs do not have any adverse effect on the body. These medicines are easily available and cheap. 70% of milch cattle are owned by small, marginal farmers and landless laborers. Hence it is the need of the hour that suitable, effective, and affordable alternative medicine should be used to fulfill this need. Many herbs/plants are used for the treatment of various reproductive disorders and show good results; however, scientific validation of these herbs is needed now.

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Popular Article

Impact of Minerals on Reproduction of Animals

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Abstract

Infertility in dairy animal is a complex and multifactorial phenomenon. In addition to energy and protein deficiency, minerals play an important role in preventing reproductive problems in dairy animals. Minerals are required for maintaining membrane integrity, hormone production and maintenance of strong immune system which are helpful for preventing reproductive problems in animal. Mineral supplementation strategies are very complex, because differences in mineral status and requirement of all livestock in order to obtain optimum production. Subclinical or marginal deficiencies may be a larger problem than acute mineral deficiency because specific clinical symptoms are not evident to allow the producer to recognize the deficiency. Trace element deficiency may be linked to problems such as retained foetal membranes, abortion and weak calf born. Subsequently mineral deficiency leads to decreased milk production in lactating cows

Introduction

The most critical components of a successful dairy farm are animal productivity and reproductive efficiency for having a successful dairy enterprise with consistent revenue. In India, the key factor affecting reproduction is nutrition, which includes minerals. Therefore, a decent return from cattle requires balanced feeding. Minerals have a vital role in regulating domestic animal production and reproduction. Nutritional deficits are most common in productive animals as a result of excessive production and inadequate feeding. Deficiencies in macro and micro minerals have a significant impact on the reproductive physiology of animals, and their imbalances produce a variety of problems, including decreased reproductive efficiency. Since most roughages, concentrates, and even most commercial diets are lacking in trace minerals, adequate mineral supplementation is essential. Minerals play an important role in immunological function, oxidative metabolism, and feed utilization (Bhalakiya et al., 2019). They are engaged in the growth, production and reproduction directly or indirectly. Currently, the best recommendation is to give a reproductive feeding program that is mineral-balanced and satisfies all needs of the animals. To boost reproductive efficiency, proper mineral feeding at various phases of the life cycle is required.

Minerals as cofactor

Minerals act as cofactor or constituents for several enzymes and hormones that are required for both normal metabolic and reproductive process. Some minerals involved directly to the reproduction are presented in the following table.

Reproductive stage	Enzymes involved at that stage	Minerals associated with the enzyme
Proliferation and Differentiation of cells in zygote	DNA Polymerase	Zn, Mg ,Mn
Capacitation of sperm	c AMP, Tyrosine phosphorylase	Ca, P
Increase fertilizing capacity of sperm and uterine receptivity	Alkaline phosphates	Zn

Mineral act as antioxidant

When there is leakage from electron transport chain in mitochondria during normal cellular metabolism and from peroxidation of polyunsaturated fatty acids in the pathway of conversion of arachidonic acid to prostaglandin and related compound, then it generates free radicals. These free radicals are highly reactive due to incomplete electronic configuration. They damage the cells more specifically rapidly dividing cells like germinal epithelium by disrupting their cell membrane. So antioxidants are required to protect the cells from oxidative damage. These minerals act as natural antioxidants in the body by either inhibiting its formation or by donating electron or hydrogen ion making highly unstable radical to stable molecule (Uniyal *et al.*, 2018).

Antioxidant	Mineral associated with it	Mechanism of action
Selenium	Glutathione peroxidase	Converts H_2O_2 to H_2O
Copper	Cu-Zn superoxide dismutase	Converts O_2^- to H_2O_2
Zinc	Cu-Zn superoxide dismutase	Converts O_2^- to H_2O_2
Manganese	Mn superoxide dismutase	Converts O_2^- to H_2O_2
Iron	Catalase	Convert H_2O_2 to H_2O

Minerals affecting the energy and protein metabolism

During reproductive phase of animal, both gonadal activity and synthesis of sex hormone are proportionately associated with energy and protein metabolism. In animals, the energy metabolism is turned on energetic cost of puberty, pregnancy, lactation *etc.* For example, decrease calorie intake affect ovulation and fertilization rate by impairing secretion of gonadotropin from anterior pituitary gland. Movement of sperms and parturition process is highly energy dependant. Similarly, reduction in protein intake in late pregnancy results in delay in return to estrus cycle. High intake of crude protein particularly rumen degradable protein leads to decrease fertility due to toxic effect of blood urea or ammonia. These reduce the pH of uterine environment during luteal phase of cycle leading to foetal death. Several minerals are actively involved in energy and protein metabolism as a cofactor. So, they are not directly affecting but indirectly influencing the reproduction process in animal.

Minerals affecting physical condition of body

Physical condition of the animal has a greater impact on reproduction. This physical condition is proportional to the bone and muscle mass, whose major components are mineral like calcium and phosphorous. Low concentration of these minerals results poor body condition, stunted growth,

debilitating condition that severely affect the onset of puberty and future reproductive events. For example, age of puberty of an animal does not depend on age but depends on body weight of the animal. When cattle attain 70% of the adult body then only it will show its 1st heat. High plane of nutrition and low plane of nutrition cause early and delayed puberty in animal respectively. Body reserve also very important during pregnancy as it supplies the nutrient requirement of own as well as growing foetus and nutrient demand of upcoming lactation.

Minerals affecting the activity of rumen microflora

Several minerals like phosphorus, iron, cobalt, manganese etc are having a key role in maintaining rumen environment by either balancing the pH of the rumen or by altering the microbial population in the rumen. When rumen environment is good then utilization of nutrients by microbe is higher consequently it has a positive effect on nutrient demand for reproduction by making available in ample amount. Deficiency of these minerals affect badly on reproductive physiology of the animal. As minerals were affecting all the physiological activities of animals, the effect of some of the important minerals was presented below.

Calcium

Calcium (Ca) is the major inorganic constituents found in the animal body. It is not only the major component of skeletal system of body (provides structural rigidity and strength) but also performs a significant role in muscle contraction, myocardial function, blood clotting, neuromuscular excitability *etc*. It assists during delivery of foetus, muscle contraction, maintaining proper uterine tonicity and uterine involution. GnRH stimulation of LH release from pituitary gland involves Ca dependant pathway. When Ca deficiency occur, then contraction of muscle and rumen function decreases leading to reduced feed intake and energy state of the animal becomes negative. In order to fulfil energy demand fat mobilization increases, animal are prone to fatty liver syndrome and ketosis may occur. This affects the milk production and will impair the fertilization. Deficiency of Ca increases the incidence of difficulty in parturition, retention of foetal membrane and uterine prolapse. Excess calcium impairs the reproductive function by deficiency of P, magnesium (Mg), zinc (Zn) and copper (Cu). Ration containing 0.75-0.80% Ca on DM basis should be provided to lactating animals to avoid this deficiency problems.

Phosphorus

After Ca, phosphorous (P) occupies second major inorganic element in the animal body. Like Ca, P is also the important constituent of bone and teeth. It is involved almost every aspect of metabolism of carbohydrates, protein, fat and other nutrients in the body. As P is a component of

ATP, ADP it plays an important role in energy metabolism. It may induce follicular development or oestrus initiation. It affects the reproduction through impairment of P dependant biochemical reactions. Cyclic AMP and tyrosine phosphorylation is required for capacitation of sperm which must require P. Deficiency of this causes delayed onset of puberty in heifer, anestrus, irregular estrus cycle in cow, low conception rate, increase incidence of cystic follicle. Along this above symptoms it is associated inanition, poor hair coat, decrease appetite. Less than 4mg/100 ml serum shows deficiency symptoms. Ration containing 0.45-0.50% P on DM basis should be supplemented. It is fed through dicalcium phosphate or bone meal or by adding 1% tripolyphosphate or monosodium phosphate in grain ration. Tonophosphan injection is given to anestrus cow to come heat quickly.

Copper

Copper (Cu) is required for the synthesis of haemoglobin and maturation of erythrocytes. It is an integral part of many metalloenzymes such as cytochrome C oxidase, lysyloxidase, tyrosinase, uricase, plasma amino oxidase *etc*. it is also the main component of superoxide dismutase, lysyl oxidase, thiol oxidase that eliminate free radicals and protects from oxidative damage. Recent studies show that progesterone synthesis from luteal cell is regulated by superoxide dismutase which involves both Cu and Zn. Cu enhances both release of PGE_2 from astrocytes and binding with the receptor that in turn stimulates GnRH production automatically increases FSH and LH synthesis. It also activates plasminogen that helps rupture of matured follicle. It is associated with the synthesis and secretion of releasing hormone that modulate the extent of secretion of LH. Its deficiency leads to anestrus, sub estrus, poor pregnancy rate, early embryonic death, dystocia, retention of placenta, necrosis of placenta, increased calving interval, low fertility associated with anaemia, lack of appetite, loss of condition (Harley and Doare, 1989). Anaemia causes decrease in blood and oxygen supply that results inactive ovary and depressed oestrogen synthesis. Cattle fed diet with less than 3mg/kg Cu show this symptom. Indirect deficiency has been observed in animals due to excessive Mo or S intake.

Zinc

Zinc (Zn) act as cofactor for number of enzymes (carbonic anhydrase, alcohol dehydrogenase, alkaline phosphatase *etc*) and directly involved in many metabolic reaction occurred in avian and mammalian species. Zn acts as a biological antioxidant having component of superoxide dismutase. Zn is constituent of thymidine kinase enzyme which is essential for spermatogenesis. It also involved in motility of sperm, membrane stability and tail morphology through involvement of ATP. It decreases the asthenozoospermia in male by reducing oxidative stress. Maintenance and repair of

uterine epithelium after parturition is controlled by Zn which causes early involution. Synthesis of prostaglandin from arachidonic acid has a greater effect on reproduction and maintenance of pregnancy that process is incomplete without Zn. The binding of steroid receptor complex to DNA must require Zn fingers that are present on nucleic acids. Zn increases plasma ß- carotene concentration that results improved conception rate and cleavage of embryo. At cellular level, Zn effects on pregnancy by modulating the action of insulin like growth factors (IGFs). IGFs are known as potent stimulator of tissue differentiation and cell proliferation. Deficiency of Zn effect spermatogenesis, quality of the semen detoriated, size of testes and libido in bulls decreased. This causes atrophy of tubular epithelium in buck and lambing difficulty in ewes. Recommended dose for dairy cattle is 40 ppm according to the feeding standard NRC (2001).

Manganese

The metabolism of carbohydrates, protein, fat and nucleic acids involve Mn as an activator of several enzymatic processes. It is also thought to be involved in oxidative phosphorylation. It has ubiquitous role in steroid synthesis (Two limiting enzymes during cholesterol synthesis *i.e*. mevalonate kinase and farnesyl pyrophosphate both require Mn as a cofactor). Cholesterol synthesis is prime necessary for synthesis of steroids hormone. It is having antioxidant role and helps in gluconeogenesis process occurred in the animal body. Deficiency results insufficient steroid production leads to decrease circulating concentration of the reproductive hormone causes irregular estrus cycle in female and abnormal sperm in males. Its insufficiency leads to anestrus, poor follicular development, delayed ovulation, silent estrus, and decreased conception rate. Dairy cow shows anestrous after parturition has proven to be increased conception rate when supplemented with Mn.

Selenium

Selenium (Se) and vitamin E synergistically show as a protective biological antioxidant system in the body by removing free radicals. Se is essential for normal spermatogenesis process in male. The phospholipid hydroperoxide glutathione peroxidase (PHGPx/GPX_4) system must involve Se as a component. Glutathione peroxidase catalyses removal of peroxide and prevent stress in animals. The structural protein which contributes normal sperm motility involves PHGPx. A variant of this protein is necessary for condensation of chromatin and formation of head of spermatozoa. The behaviour and function of spermatozoa is regulated by incorporation of Se with sperm mitochondria capsule. It may regulate growth of granulosa call and 17 ß estradiol biosynthesis in ovaries. It is believed that Se is important dietary mineral that have direct link to uterine involution. It also affects iodothyronine deiodinase that converts T4 to T3. Se deficiency results in impaired

reproductive performance in males by reducing viability of semen. Reproductive problems associated with Se deficiency included retained placenta, abortion, birth of premature, weak, dead ones, cystic ovaries, metritis, erratic or silent heat and poor fertilization. In sub clinical Se deficiency there is increased services per conception and mastitis. In males, there is reduction in both semen quantity and quality. Impaired motility with flagella defects localised primarily to the mid-piece has been a consistent feature of Se deficiency animals. Research indicates that both Se and vitamin-E combination decrease incidence of retention of placenta, cystic ovarian degeneration, mastitis and metritis. Se supplementation also improves the conception rate.

Iodine

Among all the trace minerals only iodine is very much essential for the synthesis of thyroxine hormone in thyroid gland which is a metabolic and mitochondrial regulator. When thyroxin concentration is increased automatically it stimulates hypothalmo-pituitary gonadal axis thereby affecting oestrus cycle. Thyroid stimulating hormone (TSH) has a synergistic effect with follicular stimulating hormone (FSH) in promoting proliferation of granulosa cells. On the other hand, thyroid hormone regulates FSH stimulation in follicle and prevents their apoptosis. Iodine has a positive effect on TSH secretion which in turn causes more prolactin secretion that influence length of oestrus cycle. It plays an important role in implantation and early development of foetus by regulating the invasion of trophoblastic villi against matrix. Supplementation of iodine to ewes before mating increases twinning rate. Congenital abnormality is one of the most outstanding consequences of reduced thyroid hormone concentration. Deficiency symptoms occur in animals supplemented with iodine less than 1mg/kg DM. Deficiency of iodine results in

1) Hairless, weak/dead young, brain development impaired
2) Embryonic death, abortion ,still birth or weak goitoric calves.
3) Depressed libido and defective semen quality in bull.
4) Non specific poor growth, irregular estrus
5) Goitrogenic substances (present in lentils, soyabean, linseed) leads to anestus in heifer.

Cobalt

Cobalt (Co) is the major component of vitamin-B_{12} or cyanocobalamin. Vitamin B_{12} acts as cofactor for the synthesis of methionine synthase, leucine mutase, malonyl coA mutase. This is required when propionate gets converted into glucose (carbohydrate metabolism) and folacin metabolism. Co plays a vital role in thymine synthesis which is essential for synthesis of nucleic acid required for cell growth and reproduction. Its deficiency leads to hamper carbohydrate and folic acid

metabolism. In cobalt deficiency along with anaemia, animal is associated with the reproductive problems like increased number of silent oestrus, delayed puberty, anestrus, poor pregnancy rate, increased calf mortality, irregular inter estrus interval.

Iron

It is the most abundant micromineral found in the biological system. It is a constituents of pigments like haemoglobin, myoglobin enzymes like cytochrome C oxidase(electron transport chain), peroxidase, catalase etc. its deficiency causes negative energy state (as ATP production is disrupted) and less oxygen supply to tissue level (as haemoglobin synthesis is hampered) and more prone to free radical damage (catalase and peroxidase act as natural antioxidant in the body). Due to iron deficiency animal suffer anaemia, decrease appetite, poor body condition. Deficient animal may have chance to show repeat breeding, increased services per conception or may abort occasionally.

Molybdenum

The relationship between molybdenum (Mo and Cu are antagonistic in nature means deficiency of Cu occur when there is high Mo and reverse. Therefore, a proper balance in feeding Cu and Mo must be followed to avoid reproductive problems. Molybdenum toxicity results copper deficiency thereby affecting reproduction. At higher quantity, it affects the hypothalamus-pituitary axis, LH pulse reduced hampering the reproductive cycle of the animals. Reproductive problems associated with Mo toxicity shows lack of libido and damage to germinal epithelium in bull calves, delayed puberty in heifer, failure of estrus in cow.

Chromium

Chromium (Cr) mainly effect on reproduction by release of pregnancy specific protein from endometrium of uterus that prevent early embryonic death. It has got remarkable influence on maturation of follicle and LH release. It is highly concentrated in nuclear protein thus a role in gametogenesis and for healthy foetal growth. Its deficiency leads to oligozoospermia and decreased fertility and influences foetal growth and development.

Conclusion

Though minerals are required in very minute quantities, but they are created a significant position in reproductive life of the animal by involving each and every step directly or indirectly. So now time is coming to emphasize and giving similar weightage to minerals in feed just like other major nutrients like energy and protein.

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Popular Article

Goat: Foster mother of man & Poor man's cow

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Introduction

At the national level, goats play a significant part in the rural economy. They are raised by more than 70%of landless agricultural laborer's and marginal and small farmers in rural India. For poor farmers, goat farming offers a huge socio-economic benefit when compared to other livestock species. Low input, high fecundity, easy marketing, and unprejudiced social acceptance of their products are just a few of the many benefits of this business that guarantees a greater revenue. Goats are also one of the most common meat producing animals in India, and their flesh (chevon) is widely consumed regardless of caste, creed, or religion. They generate a wide range of items, including meat, milk, skin, fibre, and dung. In 2019, the country's total goat population was 148.88 million, a rise of 10.14% over the previous Livestock Census (2012). Goats account for around 27.8% of total livestock.

Goat milk

1. Goats are known as man's foster mother since their milk is regarded to be superior for human nourishment than that of other animal species.
2. Goat milk is inexpensive, healthy, easy to digest, and nourishing.
3. Goat milk is finer than cow milk, which means the lipids and proteins are present in a finer state and are easier to digest, especially for children and the elderly.
4. Goat milk causes fewer allergy reactions than milk from other animals.
5. Humans have less lactose sensitivity while drinking goat milk
6. Ayurvedic medicine uses goat milk to treat asthma, cough, diabetes, and other ail ments.
7. Goat milk has higher buffering qualities and good for patients suffering from peptic ulcers, liver dysfunction, jaundice, biliary disorders and other digestive problems.
8. Goat milk is beneficial for vegetarian communities due to higher phosphate content.
9. Goat milk is known to help in recovery from Dengue fever.
10. Goat milk has a higher content of B-complex vitamins.
11. Goat milk is suitable for preparing various milk products.
12. Goats can be milked as often as required, preventing milk storage problems and refrigeration costs.

Poor man's cow: Goat has been referred to as a poor man's cow (or mini-cow) due to its significant contribution to the poor man's economy. They not only provide their children with nutritious and easily digestible milk, but also provide a consistent source of supplemental revenue for impoverished and landless or marginal farmers. Women and children may readily manage goats because they are little animals. Feeding, milking, and caring for goats do not necessitate a lot of equipment or effort. Feeding costs and capital investment are both low. Four goats can be kept for the same price as one indigenous cow. Goats can be effectively raised in regions where there are few fodder resources and milch animals do not thrive. Returns on capital of up to 50% and a 70% recovery rate are possible.

Advantages of goat farming / Utility of goats: -

1. Goats provide a variety of products, including meat, milk, hide, fibre, and faeces. In mountainous locations, it's used for light-weight transportation.
2. Goats require little in the way of housing and management. They don't require separate housing and get along swimmingly with their owners' other pets.
3. Goats can be grown by landless agricultural labourers, women, and children since they can eat a variety of leaves, shrubs, bushes, and kitchen waste.
4. Goat farming can be a profitable enterprise for a farmer if it's integrated into a mixed farming operation (mixed farming means animal husbandry and agriculture).
5. Goats are less expensive to keep, have a kind demeanour, and are commonly available.
6. Goats can adapt to a variety of agroclimatic situations, from desert to cold arid to hot and humid. Plains, hilly areas, sandy zones, and high altitudes are all good places to raise them.
7. Goats, on the other hand, are more tolerant of hot weather than other farm animals.
8. Goats have improved crude fibre digestibility and can produce even on low-quality roughages.
9. Goats produce more per unit of investment than other animals.
10. Goats are smaller and slaughtered at an earlier age.
11. There are no religious restrictions on goat meat, and it is consumed by people from all walks of life
12. Goat meat is lower in fat and more popular.
13. The skin of a goat is utilized to make leather products.
14. The hairs of goats are used to make rugs and ropes.
15. Pashmina shawls and Mohair carpets are in high demand and sell for a lot of money.
16. The nitrogen and phosphoric acid content of goat dung is 2.5 times that of cow manure.
17. Goats are a great animal to study for physiological and medicinal studies.

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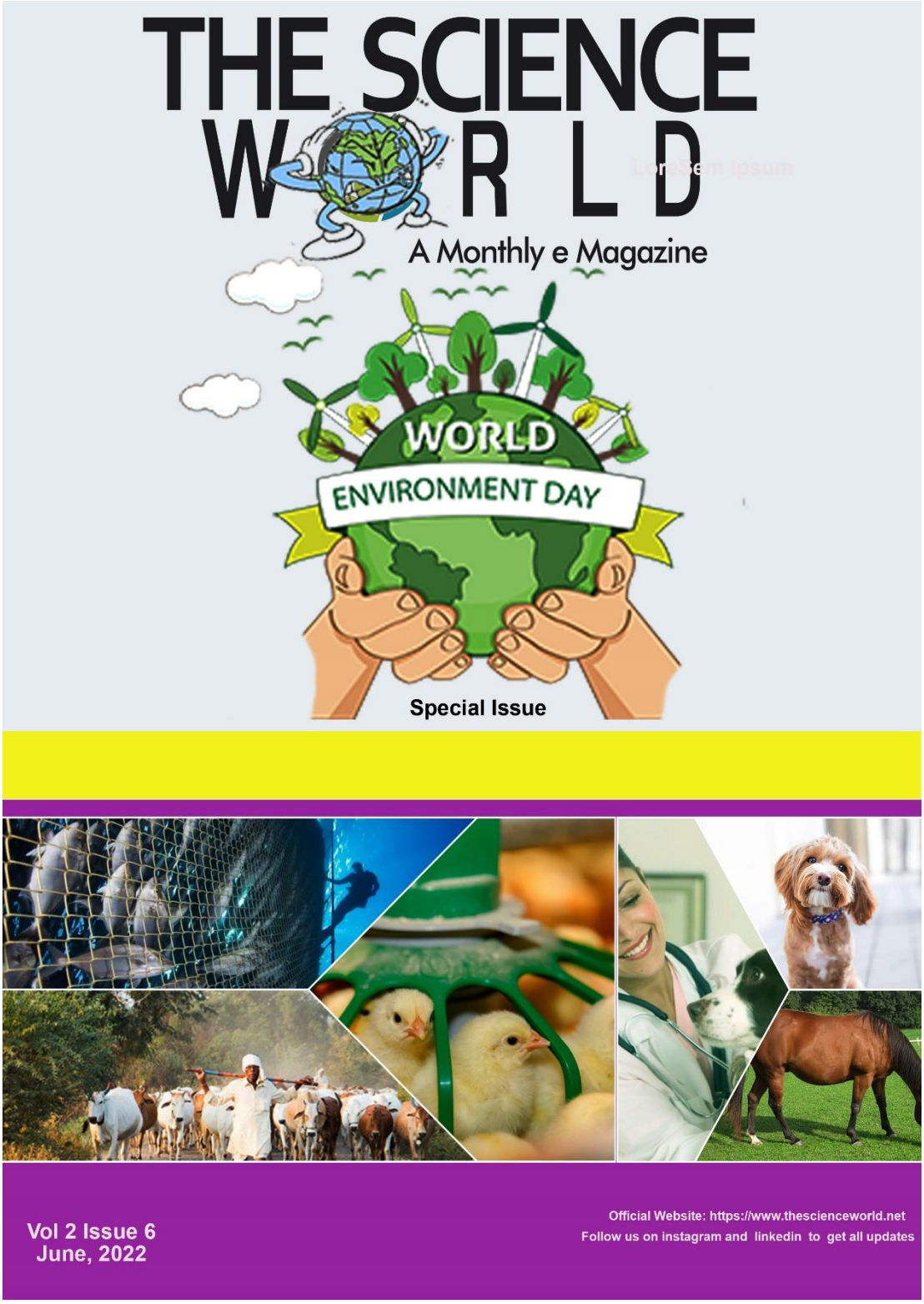

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Popular Article

Animal Hostel-A New Concept

Amandeep[1] and Komal Jaglan[2]

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Abstract

Animal hostel is a unique Comprehensive–Collaborative-Cooperative approach towards sustainable rearing of livestock which can be utilized as much as possible in large cities. This concept will not only help in reducing poverty but also lead to integrated livestock management. As there is minimum initial investment and there is major advantage of getting good quality milk as well as their products, it should be promoted at national level. The concept is pro-poor and pro-women along with eco-technology base with economic as well as social returns

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Introduction

The animal hostel is a place where the cattle of the village/city are kept and maintained together and have all necessary infrastructure facilities to take care of them. It has been conceptualized as a sustainable management mode. This concept is adequately fits into urban scenario. It is an opportunity to invest their money in dairy animals for unadulterated milk, which are then reared on their behalf at Animal Hostel. These should be built on the outskirts of every metropolitan city. Transparency is the USP of this concept as cows are being fed accordingly to her milk yielding capacity so we know exact feeding and management cost such data allows our investors to evaluate return on their investment. India's first animal hostel was inaugurated by Prime Minister Sh. Narender Modi in Akodara village of Sabarkantha district (Gujrat). It is the revolutionary move in the livestock-rearing history of the nation.

Aim of Animal Hostel:

- Reduction of Drudgery of Women Folk
- Collective Village Resource Management
- Improvement of Human Health
- Better Management of Dung and Urine
- Hygienic Environment
- Integrated Animal Care
- Production of Gobar Gas
- Production of Organic Manures

Advantages of Animal Hostel

- Production of Unadulterated milk of own cow or buffalo which is easy to digest and best for new born baby and old aged member of family
- Minimum investment
- Invest for once and earn for long time
- Anytime can sell their cow
- Monthly transfer of money generated by extra milk/processed milk
- Proper documentation of animal between owner and cow hostel in charge
- Risk is minimum as animals will be insured under government scheme
- Cow dung and urine can also be used for making organic manure and running gobar gas plants to generate money for maintaining such hostels
- Protection of cows and conservation of indigenous breeds
- Paucity of space doesn't allow anyone to keep cows in cities

A pregnant/milk yielding cow/buffalo will be bought by investors from farmers and then pay a small fee each month for their cow to be looked after. In return owner can get milk from cows & to generate revenue can sell raw milk/paneer/ghee/butter-milk to available customers. This concept is aimed at people who have some money to invest for profit and unadulterated milk. People want to have own animals but don't have the land, time and skills to rear the cows.The facilities in the hostel include in house fodder production, fodder storage, electricity generation through bio gas plants, vermin compost production, milk collection room, veterinary service centre and a water storage tank.

Beneficiaries have to pay specific amount per animal. Recipient will keep their allotted area neat and clean. The recipients will collect cow dung and dump it in to gobar gas plant unit. Slurry of this gobar gas unit is being used for the vermin compost unit. The produce of these vermin compost units are used as an organic fertilizer to increase agriculture production and improved soil quality, which generates an additional income.

Comprehensive–Collaborative-Cooperative Model

The Animal Hostel Project is unique in terms of its concept of vertical and horizontal integration and participation. It is a Comprehensive model which includes integration of animal husbandry, pasture development, renewable energy and ecofriendly technology, organic farming and Biometrics based animal identification. It is a good collaborative model with participation by various departments/agencies of Government, Panchayat Raj institutions and Milk Co-operative Societies. What is unique to this project is that the village level institutions i.e., Village Milk Cooperative Society,

and Gram Panchayat are the key stake holders in development of the Animal Hostel. This project also provides a good example of cooperation in terms of participation of all stakeholders in provision of technical & financial inputs. It can be managed by Village milk co-operative society, which in turn would create a good model of people's participation in managing personal and community resources with Government help. It is expected that the role of the Government will become over time more and more an enabling one and the model will become self-sufficient and scale able.

Eco-Technology

Eco technologies are the tools for sustainable management of the local resources with pro-nature orientation and participation of all level people with the idea of conservation of natural resources. It is a good example of an "Eco-technology" model due to its uniqueness in people's participation, creation of alternate sources of energy, integration of animal husbandry & crop husbandry practices, reduction in use of non-renewable energy sources, promotion of organic farming, employment generation, reduction in carbon footprint and other activities, these activities put together ensure that the hostel is a sustainable model towards achieving the objectives of the project.

Pro-Poor/Pro-Woman

Another unique feature of the Animal Hostel is that the project is women centric and works for the poor families. Animal hostel project will reduce drudgery of women in regular animal care activities and provide alternate options for their involvement in other livelihood development activities. Extra facilities and benefits have been given to BPL families of the village without any differentiation in care of animals in the hostel at lower participatory cost. This Pro-Poor and Pro-Women model will help in achieving the development of the village which is equitable and aims at economic and social justice.

Returns

The Animal Hostel gives multiple returns such as direct economic returns, improvement in social conditions and better environment management. Though this is a new venture and the data is too recent to allow for a comparative analysis, certain inferences can be drawn.

Conclusion

The animal hostel project is therefore a revolutionary step in cooperative management of livestock as well as conservation of natural resources with its unique model of integration, cooperation and conservation.

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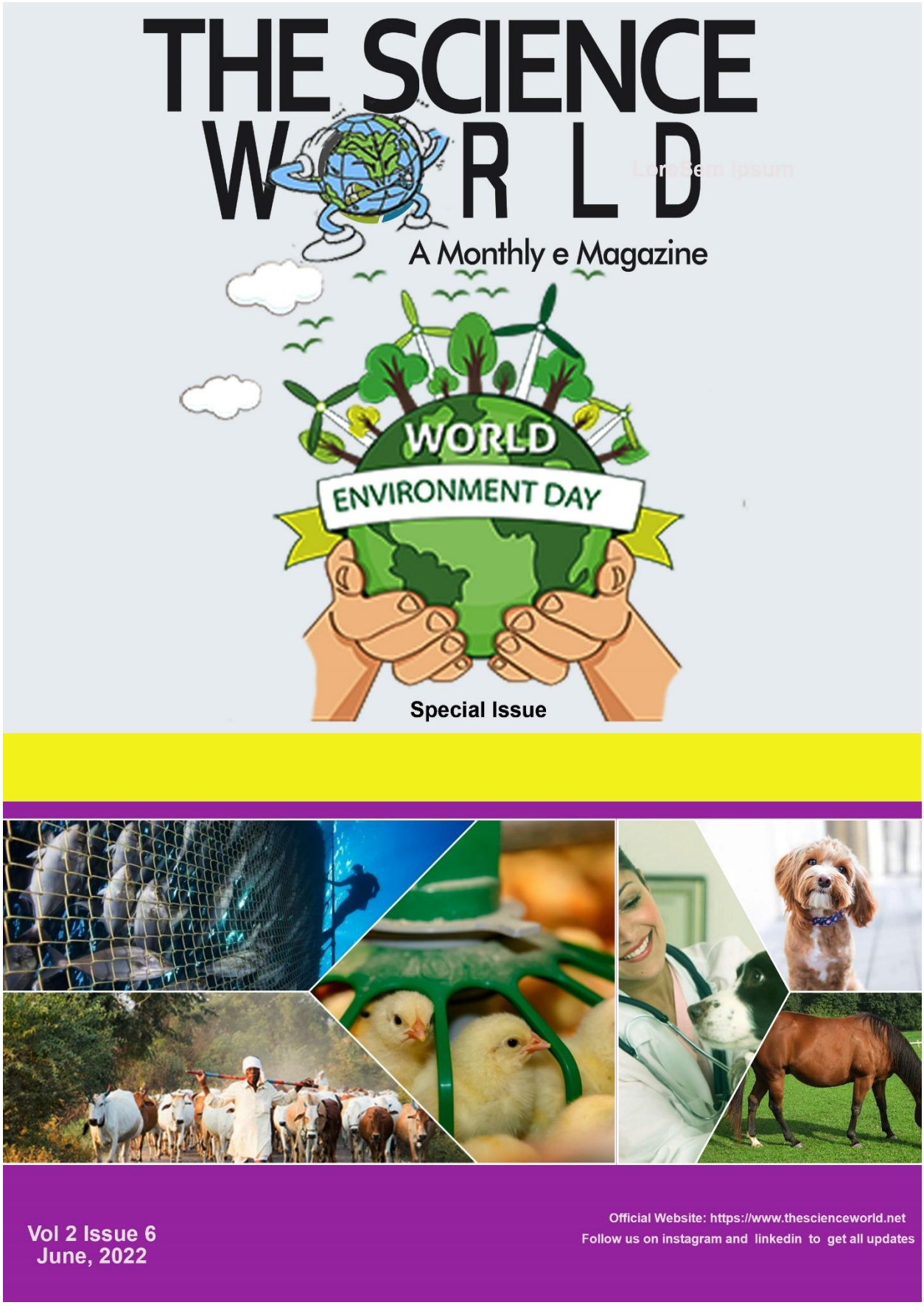
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Popular Article

In this COVID-19 pandemic, is it safe to use hand sanitizer frequently ?

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DOI:

Abstract

In the international health emergency brought on by COVID-19, several experts advise using hand sanitizers as a COVID-19 safety strategy. The popularity of hand sanitizers has skyrocketed. As a result of the heavy and abrupt misuse of hand sanitizers and cleaning supplies during the pandemic may contribute to an increase in the antimicrobial resistance. It will put more on on our already stressed-out healthcare systems, possibly resulting in more fatalities. Skin that is sensitive to ethanol may become toxic to the body and respond when exposed. Exposure to ethanol on a frequent basis might result in contact dermatitis, cracking, itching, skin dryness and redness.

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Introduction

Since the spread of the COVID- 19 pandemic, hand sanitizers have been the most sought-after personal care items, which previously not in widely use. However, the growing demand for hand sanitizers may provide an advantage to produce and supply possibly fake or low-quality goods in the markets. If you have any doubt, do not buy those items. Few guidelines have been published by the WHO regarding the standard formula of hand sanitizers and how to use them properly. Generally, an alcohol-based hand sanitizer contains a mixture of isopropyl alcohol, ethanol (ethyl alcohol), or n-propanol, with the most powerful formulations containing 60 to 95 % alcohol. Hand sanitizer based on alcohol acts against a large variety of microorganisms but not spores. Usually, non-alcoholic versions contain benzalkonium chloride or triclosan, but are less successful than alcohol-based variants (Prajapati et al., 2022).

Merit and demrit of use of hand sanitzers

The clean hand campaign of the US Centres for Disease Control and Prevention (CDC)'s instructs the public to wash their hands. Hand sanitizer based on alcohol is only recommended if there is no soap and water available. Directions for using an alcohol-based hand sanitizers are as follow:

1. Apply the product to the palm of one hand.
2. Rub hands together.
3. Until the hands are completely dry, rub the product all over the surfaces of your hands and fingers.
4. When using hand sanitizer, stay away from flames and anything else that is burning. (CDC, 2021).

Hand sanitizers dependent on alcohol cannot be successful when the hands are greasy or soiled. The hands of health-care staff are frequently polluted with the contaminants in hospitals, but seldom soiled or greasy. On the other hand, grease and soiling are normal in community settings from the following activities such as handling food, playing sports, gardening, and outdoor works. Similarly, hand sanitizers can network on pollutants like heavy metals and pesticides (Trampuz et al., 2004). Rubbing with alcohol kills many different types of bacteria. They also kill the other forms of viruses including the flu virus, common cold virus, coronavirus, and HIV, however, handwashing with soap and water is preferred over hand sanitizer in a sense to remove the spores of *Clostridioides difficile* bacterium and parasites such as *Cryptosporidium* (Gold et al., 2018 & CDC, 2020). Anyone can experience dryness and potentially cracked skin after frequent hand washings. The alcohol content in hand sanitizer can also cause skin burning, particularly compromised skin. It can be reduced by adding glycerol into hand sanitizers. It is not recommended to use hot water, since it can further inflame the skin and disrupt the skin barrier. Inversely, it is advised to use a hand moisturizer every time after washing the hand to maintain better infection control and barrier protection.

For many years, alcohol-based hand sanitizers and cleaning fluids have been used on the front line to kill antibiotic-resistant bacteria before they can get close to infect vulnerable patients but the bacteria are fighting back now. New strains have achieved the tolerance level against alcohol in the sanitizers. As per the WHO, our fixation with germ-killing has resulted in antibiotic-resistant bacteria in every corner of the globe (WHO, 2019).

What is antimicrobial resistance?

Antimicrobial resistance occurs as bacteria, viruses, fungi, and parasites change in ways that make antibiotics unsuccessful in treating the infections they cause. When the microorganisms withstand most antimicrobials, they are called "superbugs." This is a major concern because a resistant infection may kill or spread to others and imposes huge costs to the individuals and society (WHO, 2017).

Antimicrobial resistance is the wider term for resistance in various microorganism groups, which includes resistance to antibacterial, antiviral, antiparasitic, and antifungal drugs. Resistance to antimicrobials occurs naturally but mostly it is encouraged by the imbalanced use of medicines such as antibiotics for respiratory infections such as coronavirus or flu or sharing antibiotics. Low-quality medications, incorrect prescriptions, poor prevention, and heavy use of hand sanitizer can lead to antimicrobial resistance (WHO, 2017). Inadequate monitoring, a growing arsenal of tools for

diagnosing, managing, and preventing antimicrobial drug resistance, as well as a lack of public engagement to address these issues, both contribute to a lack of regulation (WHO, 2021).

Can bacteria become alcohol-resistant?

Yes, particularly enterococcal infections caused by bacteria affecting the digestive tract, bladder, heart, and other parts of the body have begun to increase. This is not only happening in India but also in the other parts of the world. The research shows that the several strains of enterococcal bacteria have begun adjusting to alcohol-based hand sanitizers. They are not resistant to alcohol but they are becoming tolerant to it (Higuita and Huycke, 2014). Now the condition will become worst as many of these alcohol-tolerant bacteria are resistant to multiple drugs as well. The researchers studied that the half of the strains cannot be treated with β- lactumsas a last-line antibiotic. It means that the bacteria spread rapidly inside hospitals, and there are not many treatment options available. People are washing their hands less with soap these days because alcohol-based hand sanitizers help them feel safe. Nevertheless, you can become a vehicle for alcohol-resistant microbes (CDC,2021).

Additionally, a genetic analysis of the alcohol-resistant bacteria found that they had acquired mutations in specific cell metabolism-related genes. Resistance to alcohol, however, appeared to have a different genetic basis than the resistance of the bacteria to antibiotics in general. Vancomycin-resistant enterococci (VRE), a community of bacteria are especially harmful to patients who have undergone a course of antibiotics because it has disturbed their bacterial composition in the gut. In other words, the sickest patients in the hospital are at the highest risk. However, these hand rubs should always be used in combination with other treatments and should always be used correctly. People's lack of willingness to clean their hands for a full 20-30 seconds may be one of the reasons why this bacterium has had a chance to mutate and become resistant (O'Driscoll and Crank, 2015).

As the use and abuse of antimicrobials have become more common, the number of resistant strains is growing. Infections that were earlier quickly handled are now life-threatening. We typically (and correctly) equate antimicrobial resistance with drug abuse, such as antibiotics. Misuse can involve failing to complete the course of antibiotics or avoiding daily dose intervals. Both will increase the risk of the most resistant strains of bacteria, but bacteria can also become immune to inappropriate or unnecessary use of other chemicals, including cleaning agents. Dilution or sporadic and inefficient use of sanitizing agents may provide a survival advantage for the most resistant strains, which may convert them utimately into superbugs.Since antimicrobial resistance is already causing more than 8 lakhs deaths worldwide a year, we must act cautiously to prevent further effects.

Alcohol does not differentiate between healthy microbes and poor ones. The role as a killer of all-microbes has become a critical component of public health. We learn that, in addition to the

harmful microbes that can destroy us, our bodies contain beneficial bacteria that aid in digestion, help us prevent autoimmune diseases, and boost our immune system. Unfortunately, antibacterial also do not discriminate between good and bad microorganisms. The benefits of using a hand sanitizer is to avoid COVID-19 far along with the other microbes, such as bacteria, virus, and fungi that live on our bodies on a daily basis. While sanitizers destroy potentially harmful microbes, they change the populations of beneficial bacteria on the skin as well. Remember, what has just hit your palms? If you have spent a time in a hospital, a doctor's clinic, or at the bus stand or railway station next to someone coughing and sneezing, it's not a bad idea to use hand sanitizer. But if you're just going on your normal day without touching too many other people, you probably don't need to be sanitized. Remember we don't have to use hand sanitizer more and more, instead of that, we can use regular soap and water (WHO, 2020).

Conclusion

After the start of the coronavirus pandemic, scientists and governments have been educating people on safe hygiene practices to protect themselves. This recommendation has drastically increased the selling and use of cleaning products and hand sanitizers. Unfortunately, these guidelines rarely include the instructions on their usage and side effects. There is a concern that the sudden overuse of cleaning products and hand sanitizers during the pandemic may lead to a rise in the numbers of antimicrobial-resistant species of the bacteria. It will pressurized our already troubled healthcare systems, potentially leading to more deaths. Moreover, the problem could continue long after the end of the current pandemic

Anywhere we repeat a procedure over and over and over again, whether it's in a hospital or at home or anywhere else, you're giving bacteria an opportunity to adapt Tim Stinear

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Popular Article

Care and Management of Calf

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Normally cow will lick and dry the calf immediately after parturition which may stimulate circulation and respiration. If the cow fails to do, it can be stimulated to lick by sprinkling handful of bran or salt over the body of the calf. Sometime primiparous cows may be nervous and inexperienced or cow may exhaust after a prolonged labor. Under such circumstances, the mucus (phlegm) from the nostrils of the newborn calf should be wiped and cleaned with a dry towel. The calf should be massaged vigorously for some times with a handful of straw rolled into a ball. Sometimes respiratory passage may be block with mucus and interfere with calf's respiration. Under such condition the calf should be lifted by holding the hock in such a way that the head is down, so that the phlegm may flow off. Care should be taken while lifting the calf, it may slip off. A hand full of straw can be used to have a grip while lifting. The calf can also made to sneeze by tickling a twig of hay or grass inside the nostrils. If the above methods are failing, little time is left to lose. The attending person should apply his mouth to the nostrils of the animal and suck out the mucus. After that, he should blow in his expired air through the calf's nostrils closing its mouth. Carbon dioxide in the expired air, which has been blown-in the lungs of the calf, will act as respiratory stimulant to initiate respiration. This should be followed with intermittent pressing and releasing of pressure on the chest wall of the calf to give artificial respiration.

Attending naval:

Naval or umbilical cord should be ligatured with a sterile thread one inch from the body (under field condition, the thread can be soaked with tincture iodine) severed 1 to 2 cm distal to the ligature and tincture iodine or povidone iodine should be painted liberally. This is very important because infection can gain easily through naval and cause serious illness like naval ill, naval abscess and joint ill. Neonatal ascariasis is common in buffalo calves and deworming should be made as early as possible, preferably in the first week of life. A single oral dose of 10 g piperazine adipate is recommended for the calves. Newborn calf should void meconium in 4 to 6 hours of first colostrum feeding and first faces is tarry in colour and consistency.

Colostrum Feeding:

Colostrum is the first milk secreted after parturition. It contains large amount of gamma globulins, which are nothing, but antibodies produced by the cow against antigens encounter during her life including those against may disease-producing organisms. Absorption of these antibodies provide the calf with an umbrella of passive immunity.

Colostrum is highly fortified source of nutrient having 7 times the protein and twice the total solids of normal milk, thus it gives an early boost in portion and solid intake. It contains higher amount of minerals and vitamin A, which are essential to combat disease. Ingestion of these through colostrum substantially increase the calf's survivability. Colostrum gives a laxative effect, which is helpful in expulsion of meconium (first faeces). The cows should be vaccinated against contagious and infectious diseases, which help to increase the quantity and quality of gamma globulins in colostrum. Similarly, colostrum of mature cow possesses large quantities of gamma globulins because they have greater chance of exposure to infection. The gamma globulins must be absorbed as such across the intestinal wall into blood stream without being broken down into the constituent peptides or amino acids. If it broken down before entering blood stream it will act as ordinary protein. The intestinal wall of the calf will allow the globulin to pass from inside the intestine to the blood stream for only a short period after the calf is born. This permeability is rapidly lost after the first few hours of life. Many studies have shown that these globulins pass across the gut wall at the most rapid rates during the first 1-2 hours of life. Taking this into view. It will be highly useful to feed colostrum in the first 15-30 minutes followed by a second dose in approximately 10-12 hours. The absorptive cell lining the small intestine are immature at birth. In this stage, they indiscriminately take up large molecules like immunoglobins.

As the calf grows older hour by hour, there is a transition of epithelia cells of small intestine from immature type to mature type, which cannot allow large protein molecules. As the more and more cells mature, the capacity of the calf to absorb immunoglobins diminishes proportionately until 'closure' when no more absorption can take place. This phenomenon is called **'gut closure'**. Concentration of antibodies at 'closure' is directly related to the disease resistance of the calf.

If at closure the calf had absorbed only a small amount of immunoglobins from colostrum, the diminishing concentration soon puts the calf into a critical immune position. This increases morbidity and often leads to mortality of the calves.

Quantity of colostrum to be fed is 1/10th of body weight.

- 15-30 minutes of life - 5-8 % of body weight
- 10-12 hours of life - 5-8 % of body weight
- 2nd day - 10% of body weight
- 3rd day - 10% of body weight

Excess colostrum can be milked out daily otherwise the calves can drink in excess and results in calf scour. The excess colostrum can be stored by refrigeration and can be used to other calves or orphan calves. Colostrum can also freeze and stored indefinitely. Colostrum can also be fermented naturally and stored for 5-7 days and can be used.

Colostrum substitute:

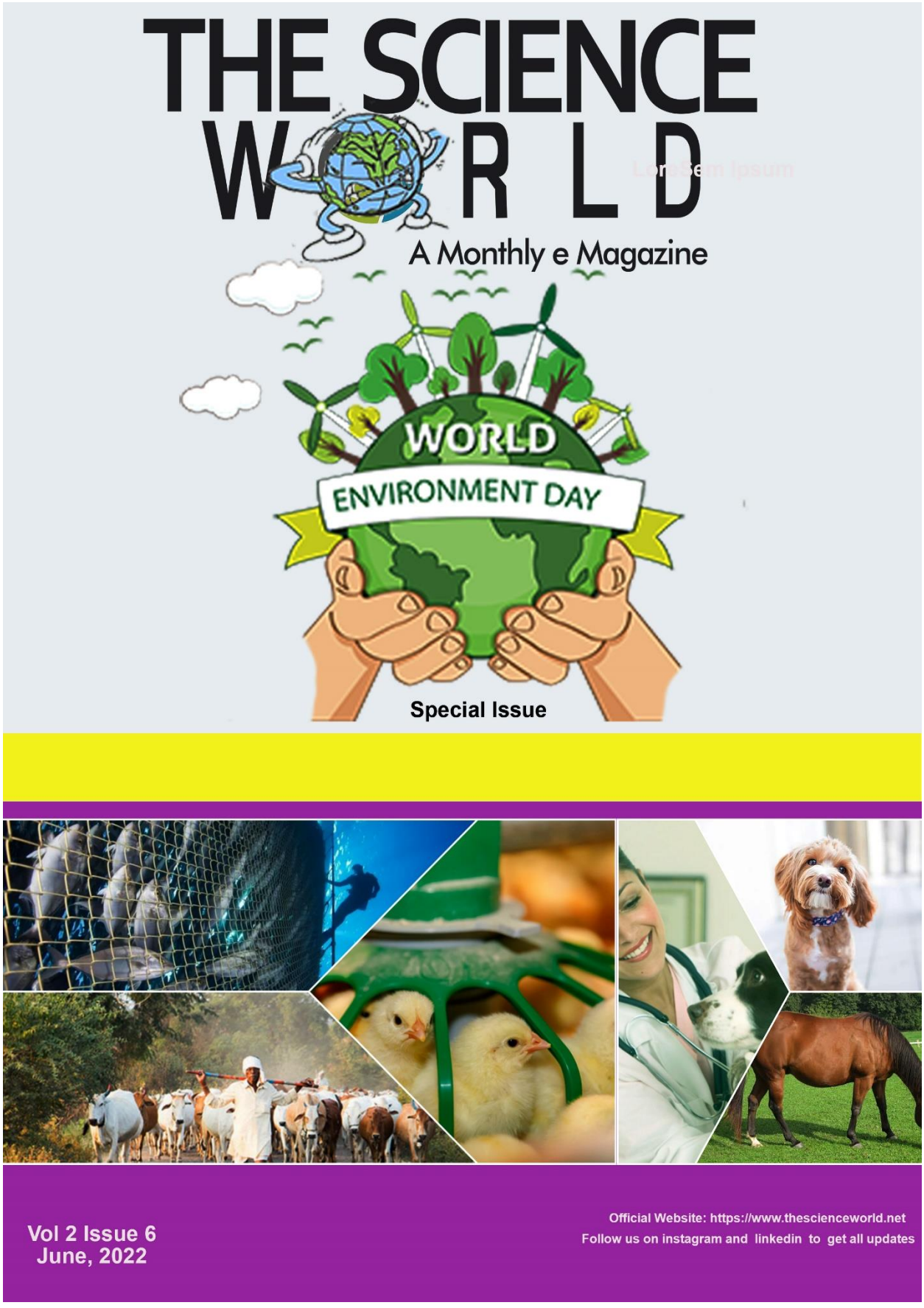
In case of non-availability of colostrum due to accidental death of mother or agalactia colostrum substitute can be used. It can be prepared by mixing 2 whole eggs in one litre of milk and 30 ml of castor oil. It should be fed three times in a day.

Weaning:

Making the calf independent of its mother is known as weaning. Under early weaning system, the cow is not allowed to suckle its calf. Instead, the cow is completely milked out and required quantity of whole milk or skim milk are fed to the calf.

Disadvantages of Weaning:

1. Weaning is a problematic in Bos indicus and buffaloes due to strong maternal instinct.
2. 0-day weaning can cause reduced milk yield in such animals, and cause early drying and temperamental problems.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Popular Article

Feeding of Mare

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The most important period of feeding of a pregnant mare is the last 90 days of gestation. 60-65 percent of weight of fetus is deposited during these last 90 days, as growth rate of embryo is the greatest during this period. During lactation, the mares are estimated to produce milk equivalent to 3 and 2 2 percent of body weight daily during early lactation (1:12 weeks) and late lactation (13-24 weeks) respectively. Therefore, a lot of body energy of mare is utilized for synthesis of milk energy and this process of conversion of digestible energy of feed into milk energy is about 60 percent efficient.

The dietary requirements of the breeding mare can be arbitrarily divided into three stages:

1. Requirement up to 8 months of gestation,
2. Requirement during last 3 months of gestation,
3. Lactation and 0-4 months post parturition.

The first 8 months of gestation have no practical impact on the nutrient needs i.e. they do not raise requirements above maintenance level nor do they increase the already high requirement of the lactating mare. Thus, mare's energy requirement during this stage is approximately those of maintenance. The DE requirements for the ninth, tenth and eleventh months of gestation are formulated by multiplying the maintenance requirements by 1.11, 1.13 and 1.20 respectively. The protein requirements also increase during period and with a protein utilization efficiency of 60 percent, a 500 kg gestating mare requires 127, 130, 178 gm of DP/day for foetal deposition above maintenance, for a total of 427, 430 and 478 gm of DP during the ninth, tenth and eleventh months respectively. Presuming digestibility of protein to be 55 percent, a 500 kg mare would need 776, 782 and 869 gm of CP daily during ninth, tenth and eleventh months respectively.

The requirements of calcium would be 11, 25 and 11 gm/day for ninth, tenth and eleventh month of gestation assuming the efficiency of calcium absorption to be 50 percent, whereas phosphorus requirements have been estimated to be 7, 12 and 6, 7 mg/kg of body wt. /day during ninth, tenth and eleventh month of gestation respectively. The requirement of other macro and micro minerals are enhanced during this period. The requirement of fat-soluble and water-soluble vitamins too increases considerably. The requirements of energy, protein, minerals and vitamins are the maximum for a mare during the first phase of lactation i.e. from 1 to 12 weeks post parturition. The energy requirement of lactating mares depends upon the composition and amount of milk produced. The requirement of energy are 792 K Cal of DE/kg of milk produced above the maintenance level. The protein content of milk is highest immediately after parturition and it decreases gradually as lactation progresses. Crude protein requirements are calculated presuming that mare's milk contains 2.1 and 1.8 percent protein in early and late lactation respectively. Utilisation of digestible protein for milk protein formation is 65 percent and digestibility of protein in the digestive system is 55 percent. The requirement of calcium for lactation ranges from 1.2 gm/kg of milk during the first post-partum week to 0.8 gm/kg of milk during 15 to 17 weeks postpartum, above maintenance requirement, whereas requirement of phosphorus ranges from 0.75 gm/kg of milk in early lactation to 0.50 gm/kg of milk in late lactation. In the last quarter of pregnancy, foetus occupies an increasing proportion of mare's s abdominal cavity.

Accordingly, her capacity for bulky feeds declines during the period in which nutrient requirement increases. The quality of hay and concentrate should improve during the last 3 months of gestation. The diet in this period should contain concentrate mixture with 16 percent protein upto 25 to 35 percent of the diet, which can increase, or decrease depending upon the condition of the mare, its response to feed and quality of the hay and pasture used. It is recommended that the total diet fed during gestation contains at least 12 percent protein, which means that hay, or pasture should contain 11 to 12 percent protein. The higher level of protein should provide a safety factor for hay and pasture, which may have protein of low digestibility depending upon kind of pasture used and its stage of maturity when consumed.

The concentrate diet should contain 16 percent protein, 1 percent calcium and 0.9 percent phosphorus. A study on pony mares has revealed that protein percentage in diet does not affect general reproduction parameters (oestrus or ovulation) but did affect progesterone concentration that in turn may be responsible for the differences in conception rate that is low with low level of protein and high with optimum protein levels. Needless to mention that pregnant and lactating mares require high quality of protein for proper foetal development and milk production.

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Popular Article

Classification, Method and Types of Animal Breeding in India

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Introduction

A group of animals related by descent and similar in most characters like general appearance, features, size, configuration, etc. are said to belong to a 'breed'.

Animal breeding is producing improved breeds of domesticated animals by improving their genotypes through selective mating.

Breeding means, the manner in which selected males and females are mated. Breeding makes new combination or sequencing of genes in the individual.

The breeders identify and select desirable qualities in animals for future mating and discard fewer desirable qualities.

For the improvement of livestock (= farm animals) selection and breeding must be practiced simultaneously.

Continuous selective breeding leads to homozygosis in a population resulting a loss of variability. If all the individuals are alike, the breeder cannot make progress in future. Hence, there is a need to create variability in population. This can be achieved by breeding. Therefore, selection and breeding go hand in hand for the improvement of livestock.

Objectives of Animal Breeding:

The main objectives of animal breeding are:

- Improved growth rate.
- Increased production of milk, meat, egg, wool, etc.
- Superior quality of milk, meat, eggs, wool, etc.
- Improved resistance to various diseases.
- Increased productive life.

Classification of Breeding Systems

Breeding Methods:

There are two major breeding methods: inbreeding and out breeding.

1. Inbreeding:

It is defined as "breeding of more closely related individuals (males and females) than the average relationship of the population." Depending upon the closeness among mated individuals, inbreeding is of 3 types.

They are:

- Close inbreeding (mating individuals have relationship above 0.25),
- Mild inbreeding (mating of relatives beyond 2nd generation and upto 6th generation),
- Line breeding (mating of relatives between 4th-6th generations).

Advantages of Inbreeding:

- Due to increase in homozygosity, the stamping ability or prepotency of inbred line increases.
- It helps to eliminate lethal and semi lethal due to homozygosity.
- It increases genetic variance between lines and reduces genetic variance within lines.

Disadvantages of Inbreeding:

- Many lines are lost due to homozygous lethal or semi lethal.
- Due to loss of heterozygosity, the hybrid vigor is lost.
- Inbreeding leads to lower birth weight, post-natal mortality (baby death after birth), poor growth, reproductive disorder and low resistance to diseases.

2. Out-breeding:

It is opposite of inbreeding where unrelated individuals are mated. The breeding individuals have relationship less than the average relationship of the population. Out-breeding results in increase in heterozygosity and decrease in homozygosity.

Out-breeding can be classified into two major classes:

- Out-breeding within a breed and
- Out-breeding between two species/strain/line/breed.

Advantages of out-breeding:

- Out-breeding increases heterozygosity which results in hybrid vigor (increase in weight, faster growth, increased resistance to disease, low mortality).
- It covers the defects of recessive lethal and semi-lethal genes.
- It increases genetic variance within lines.

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Popular Article

Japanese Encephalitis (JE) - A Major Public Health Concern

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Abstract

Several zoonotic diseases are serious issues for global public health, not only in India. Some of these have afflicted humanity for all of recorded time, while others have only recently become significant issues. Major public health concerns in India have included illnesses like the plague, Japanese encephalitis, leishmaniasis, rabies, leptospirosis and dengue fever, among others. These illnesses are significant because of the high morbidity and mortality rates they create among people.

Introduction

In Asia and the western Pacific, the Japanese encephalitis (JE) virus is the most common cause of vaccine-preventable encephalitis. The risk of JE is extremely low, although it varies depending on the place, duration of vacation, season, and activities. It is characterized by a quick onset of headache, high temperature, disorientation, coma, tremors, and convulsions, as well as inflammation of the brain (encephalitis). Approximately one out of every four cases are fatal.

Transmission

The flavivirus that causes Japanese encephalitis (JE) is closely linked to the viruses that cause West Nile and St. Louis encephalitis. Infected Culex species mosquitoes, particularly Culex tritaeniorhynchus, transmit the JE virus to humans by their bite.

Mosquitoes and vertebrate hosts, mostly pigs and wading birds, keep the virus alive in a cycle. Humans are accidental or dead-end hosts because they do not have enough JE virus in their bloodstreams to infect feeding mosquitos. JE virus transmission occurs principally in rural agricultural areas, often accompanying with rice production and flooding irrigation. In temperate areas of Asia, JE virus transmission is seasonal. In the subtropics and tropics, transmission ensue over a year, often with a peak during the rainy season.

Symptoms

- Less than 1% of people infected with Japanese encephalitis (JE) virus develop clinical illness.
- In persons who develop symptoms, the incubation period (time from infection until illness) is characteristically 5-15 days.
- Preliminary symptoms often include fever, headache and vomiting.
- Mental status changes, neurologic symptoms, weakness, and movement disorders might develop over the next few times.
- Seizures are common, especially among children.

Prevention

The virus that causes Japanese encephalitis is transmitted to humans by the bite of an infected mosquito. Mosquitos bite at all hours of the day and night. The easiest strategy to avoid getting infected with the Japanese encephalitis virus is to avoid mosquito bites. Before travelling, use bug repellent, wear long-sleeved shirts and pants, treat clothing and gear, and be vaccinated.

Surveillance Three main areas make up the component of Japanese encephalitis surveillance:

(1) Sero-surveillance to identify populations at high risk and to track JE-specific antibodies in sentinel animals or birds as a sign of rising viral activity.

(2) Vector surveillance in JE-prone locations to track vector behavior and population growth and deploy intervention strategies in good time.

(3) clinical surveillance using the PHC system for JE patient early diagnosis and appropriate care.

Control

(i) Transmission Interruptions Controlling vectors can stop transmission from happening. Before the start of the transmission season, residual insecticidal spraying with the right insecticide has been advised in all animal habitats for the effective control of vectors.

(ii) Vaccination There are now three different JE vaccines manufactured and used globally. China produces inactivated and live attenuated primary hamster kidney cells, which are used in Japan, Korea, Taiwan, Thailand, Vietnam, PR China, and India. However, the JE vaccine created in a mouse brain is sold commercially and is accessible worldwide. In most areas of Asia, the mouse brain vaccine produced from the Nakayama strain is given subcutaneously in 2 doses of 0.5 ml, 1 to 4 weeks apart with a booster dose at 1 year and additional booster doses thereafter at 1 to 3 years intervals.

Management of cases

a) For patients with JE, there is no specific curative therapy. Early identification, appropriate management, and symptomatic treatment serve to minimize related fatalities and neurological sequelae.

b) Community involvement and health education the delay between the onset of symptoms and the start of therapy has been demonstrated to be directly correlated. The likelihood of death is significantly decreased when cases are handled right away. Making people aware of the disease encourages early reporting because it is more common in rural regions. Encouragement of personnel protection is aided by additional health education.

Vaccination

- The only JE vaccine licensed and available in the United States is the inactivated Vero cell culture-derived Japanese encephalitis (JE) vaccine (marketed as IXIARO). This vaccine was licensed for use in persons aged 17 and above in March 2009, and in children aged 2 months to 16 years old in May 2013. IXIARO is administered in a two-dose sequence separated by 28 days. Adults between the ages of 18 and 65 can receive the second dose as soon as seven days following the first. The final dose should be administered at least one week prior to departure.

- For adults and children aged 3 years or older, each dose of IXIARO is 0.5 ml. For children aged 2 months through 2 years, each dose is 0.25 ml.

Treatment

- No specific treatments have been found to benefit patients with JE, but hospitalization for gentle care and close observation is usually required.

- Treatment is symptomatic. Rest, fluids and use of pain reliefs and medication to reduce fever may let go some symptoms.

Outcome

- Among patients who develop encephalitis, 20% – 30% die.

- Although some symptoms improve after the acute illness, 30%-50% of survivors continue to have neurologic, cognitive, or psychiatric symptoms.

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Popular Article

Gout: A primitive disease in a new perspective

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Abstract

Gout is a chronic illness characterised by the deposition of monosodium urate (MSU) crystals. Gout often manifests like an acute, self-limiting inflammatory monoarthritis of the lower limb joints. This is the most well-known and well-described kind of arthritis. The main risk factor for MSU crystal deposition and the development of gout is an elevated serum urate level (hyperuricaemia). Although generally thought to be a purine metabolism problem, abnormal urate transport, in both stomach and the kidneys, plays an important role in the pathophysiology of hyperuricaemia. Important discoveries into to the pathophysiology of hyperuricemia and gouty arthritis, both acute and chronic, provide a deeper knowledge of the condition. Gout is classified into four clinical stages: asymptomatic hyperuricemia, acute gouty arthritis, the intercritical period, and chronic tophaceous gout. Gout is far more common in males than in women. Chronic conditions such as hypertension, diabetes, and renal impairment are more common in female gout patients.

Introduction

Gout has played an important role in the evolution of Homo sapiens from ancient times. It first featured in medical records throughout the early days of medical writing. More recently, we have a better knowledge of the illness and a more powerful arsenal owing the quantum leaps in molecular biology, diagnostic modalities, and pharmacology. Gout is a systemic illness caused by the buildup of monosodium urate crystals (MSU) in tissues. The development of uric acid crystals requires an increase in serum uric acid (SUA) over a certain threshold. Gout is biochemically defined by extracellular fluid urate saturation, which manifests as hyperuricemia in the blood, with plasma or serum urate concentrations surpassing 6.8 mg/dL (about 400 micromol/L); this level represents the approximate limit of urate solubility. Gout is mostly diagnosed by identifying pathognomonic MSU crystals in joint fluid or in tophi aspirate. Gout begins as an acute joint inflammation that is readily cured by NSAIDs and colchicine. Tophi and renal stones are late manifestations.

Epidemiology

Gout illness has a significant disease burden and is expanding in Developed nations and sections of the worldwide that are becoming Westernized, implying the possibility of a modern gout epidemic similar to the obesity pandemic. Both disorders are symptoms of the metabolic syndrome, the frequency of which has risen in tandem with the rise in hyperuricemia. Gout affects about 1-4 percent of the total population. In certain countries, prevalence might reach up to 10%. Men over the age of 80 have a 10% prevalence, while women over the age of 80 have a 6% prevalence. Gout has a yearly incidence of 2.68 per 1000 people. It affects males 2-6 times more than women. Gout is becoming more common across the world as a result of bad eating habits such as fast food, a lack of exercise, an increase in obesity, and metabolic syndrome.

Etiology

As hyperuricemia is widespread in humans, homo sapiens have been the only known animals can acquire spontaneous gout. The greatest risk factor for the development gout is a sustained increase in serum urate levels. Different variables that cause hyperuricemia, such as medical diseases, obesity, lifestyle factors, and drugs, are therefore linked to an increased chance of developing gout. Hyperuricemia is not really the main risk factor of gout, and only a small percentage of these people acquire the disease. The lower physiological uric acid ranges can be used to evaluate the effect of food on uric acid levels in non-uricase-producing animals. Consumption of animal foods such as shellfish and red meat is one dietary source that can lead to hyperuricemia and gout. Some beverages, such as alcoholic beverages, sugar drinks, soda, and high-fructose corn syrup, may also contribute to this condition. Gout is infrequent in women before menopause, and hormone replacement treatment reduces the incidence of incident gout in postmenopausal women. Women with gout have a later age of onset than males and are much more likely to be have comorbidities, including CKD, hypertension, and diseases needing diuretic therapy. Several genes have been linked to gout by genome-wide association studies (GWAS). SLC2A9, ABCG2, SLC22A12, GCKR, and PDZK1 are examples.

Pathophysiology

In humans and higher primates, uric acid is the end result of purine metabolism because the gene encoding the enzymes uricase is silenced by mutation. Urate is an ionised form of uric acid that is found in the body. Uric with a pH of 5.8, weak acid. When serum uric acid levels above the usual threshold, urea crystals begin to form in tissues. The pathologic threshold of

hyperuricemia has been established as 6.8 mg/dL. Uric acid is the most prevalent naturally occurring antioxidant in the body, and its traditional job was thought to be the removal of reactive oxygen species. Because of the high sodium content, it exists in the ionized form at pH 7.4 and operates as monosodium urate (which is less soluble). Uric acid occurs in non-ionized form in acidic fluids such as urine, that is less soluble even in physiological range. In contrast to MSU, this explains the existence of uric acid crystals and stones within urinary system.

The overproduction of UA is caused by a lack of enzymes involved in purine metabolism. Purines are composed of nine carbon purine nuclei formed by fused pyrimidine and imidazole rings. Purines play critical roles in all living cells via the purine-based nucleic acids adenine, guanine, and hypoxanthine. The endogenous purine synthesis route, known as de-novo purine synthesis, includes the conversion of ribose-5-phosphate into PRPP (5-phosphoribosyl 1-pyrophosphate) to nucleotide inosine monophosphate in ten stages. Hypoxanthine and guanine are the urate precursors of purine breakdown. The majority of them are rescued, and any remaining guanine is deaminated to xanthine. Xanthine oxidoreductase converts hypoxanthine to xanthine. Xanthine oxidoreductase is a flavoprotein that contains a molybdenum-pterin and iron sulphide cluster. It exists in two forms: oxidase, which utilizes large amounts of oxygen hypoxanthine to xanthine and xanthine to urate, and dehydrogenase, which uses NAD+. The most common goal of urate-lowering in gout patients is inhibition of xanthine oxidoreductase. Lesch-Nyhan syndrome, for example, is an inborn metabolic mistake caused by a lack of hypoxanthine-guanine phosphoribosyl transferase, an enzyme involved in UA metabolism. It is an X-linked recessive genetic disease. In addition to renal stones, the symptoms of this condition include dystonia, chorea, cognitive impairment, obsessive harmful behavior, self-mutilation, and articular manifestations. If untreated, it can result in tophi formation and renal failure.

Gout has historically been thought to be a purine metabolism problem. However, urate overproduction is just a minor reason of hyperuricemia in a minute percentage of gout patients. When renal urate excretion is reduced, intestinal uricolytic increases to account for half of overall urate elimination, and the transporter ABCG2 plays an important role. Serum urate concentrations over 6.8mg/dl are saturating, increasing the likelihood of deposition. The SLC22A12 gene encodes URAT1, which is highly selective for uric acid. It influences renal uric acid transportation by regulating anion exchange. SLC22A12 mutations cause hypouricemia, hyperuricosuria, and exercise-induced renal functional impairment. Probenecid, benzbromarone, and leisured are uricosuric medications that inhibit URAT1 and promote uric acid excretion. The ABCG2 transporter in the gut is responsible for extrarenal urea excretion. Urate overproduction

hyperuricemia is a type of renal overload that includes subtypes of "extrarenal underexcretion" and "real urate overproduction."

Diagnosis

1. **Laboratory diagnosis** -non-rheumatologists frequently incorrectly diagnose gout based on hyperuricemia. Hyperuricemia is typically asymptomatic and does not require a gout diagnosis. Only 0.09 percent of people with SUA values between 7 and 7.9 mg/dL will develop gout each year. Gout may occur in 0.4 percent of people with SUA between 8 and 8.9 mg/dl. Only 0.5 percent of people with hyperuricemia above 9 mg/dl may develop gout. The detection of MSU crystals in synovial fluid aspirate using polarized light microscopy is the gold standard of diagnosis. When utilizing a compensator, diagnostic findings can be improved.

   A standard light microscope, on the other hand, may be used to identify crystals and distinguish MSU from other crystals such as calcium pyrophosphate dehydrate (CPPD) crystals. MSU crystals can be seen in synovial fluid at any stage of the illness, including attacks, the inter-critical phase, and chronic tophaceous gout.
2. **Radiological diagnosis -** It is critical in clinical practice for diagnosis and follow-up. Its utility as an outcome metric in clinical studies is also expanding. Recent technological advancements are changing the stage and even the kind of gout terminology.
3. **Ultrasound (US) -** Recently, advancements in US technology (machines, transducers, procedures) have prompted rheumatologists to adopt it for the diagnosis and therapy of gout. These include detecting joint effusion and synovitis, distinguishing between active and inactive synovitis, analyzing cartilage, characterizing bone shape for erosions and osteophytes, evaluating tendons, evaluating crystal deposition, carrying out US-guided operations monitoring disease evolution, and being useful in the differential diagnosis with other arthritis's. US characteristics in gout might be either general or particular. Nonspecific characteristics include:
   1. Synovial fluid
   2. Synovial proliferation and hypervascularization
   3. Bone erosions
4. **Conventional CT (CCT) -**Because CT has good resolution and contrast, it is the ideal tool for assessing and characterizing crystal arthropathies. CCT has a higher specificity for detecting tophi than US or MRI. CCT can assist monitor disease load and treatment response, but it has the downside of exposing patients to radiation.
5. **MRI -** Nonspecific inflammation, synovial thickening, effusion, erosion, and bone marrow edoema are MRI characteristics of arthritis. Depending on the degree of hydration and

categorization, tophi exhibit homogeneous T1 signal intensity (low to moderate) and heterogeneous T2 signal intensity (varying low to intermediate). The role of MRI is limited due to cost and availability.

Treatment and Management

Treatment of gout flares, urate-lowering medication, anti-inflammatory prophylaxis when initiating urate-lowering therapy, and screening and management of gout-related comorbidities are the four main concepts in gout care.

1. **Gout flares** -The therapy of gout flares is based on the rapid and successful management of the acute inflammatory reaction. Gout flare treatments include colchicine, NSAIDs, and steroids, which can be used combined in severe situations and are most effective when administered soon after the flare begins. The anti-inflammatory medicine used is determined on the individual's comorbidities and concurrent medications. An action plan and medicine supply should be accessible so that patients may begin treatment as soon as the flare begins.
2. **Urate-lowering therapy** - The long-term therapy of gout requires a sustained lowering in serum urate levels. Long-term urate-lowering medication reduces blood urate to sub-saturation levels (0.36 mmol/l, 6 mg/dl), resulting in MSU crystal breakdown, avoidance of increasing joint injury, suppression of gout flares, and better function. For such reasons, all main rheumatology organisation guidelines propose that serum urate levels be measured on a regular basis and that urate-lowering medicine be titrated to attain a specified serum urate goal.

   ULT may be divided into three categories (based on the mechanisms): -

   1. Xanthine oxidase inhibitors (XOI)
   2. Allopurinol
   3. Febuxostat
3. **Uricosurics** - Uricosuric medications are second-line urate-lowering treatments for gout. Uricosurics reduce uricemia by increasing urine uric acid production. As a result, they expose patients to the danger of uric acid stone, which is exacerbated at the start of treatment. Probenecid and lesinurad are examples of drugs in this class. They inhibit URAT1 in the apical membrane of the epithelial cell of the renal proximal tubule. Lesinurad was recently licenced in the United States and Europe at a dose of 200 mg/d as an add-on treatment to xanthine oxidase inhibitor when these failed to decrease uricemia to the appropriate goal.
4. **Non-Pharmacologic** - There are several lifestyle and dietary rules that may be followed to defend against flares or to prevent gout from arising in the first place. Reducing alcohol intake,

restricting purine-rich meals and replacing low-fat or non-fat dairy products with higher fat content equivalents are all diet suggestions. Weight loss and appropriate hydration also will help lessen the frequency of gout flare-ups.

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Popular Article

Economic Importance with Prevention & Control of Lumpy Skin Disease

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Abstract

Lumpy skin disease (LSD) is a viral disease of cattle and water buffalo that causes relatively low mortality; however, the disease can result in animal welfare issues and significant production losses. This disease is also known as pseudourticaria, knopvelsiekte, neethling virus disease, exanthema nodularis bovis. The disease is spread primarily by biting insects such as certain species of flies, mosquitoes and possibly ticks. The disease can also be spread by fomites through such things as contaminated equipment and in some cases directly from animal to animal. It does not pose a risk to human health. Infection typically causes an acute disease with fever, depression, and characteristic skin nodules. There may also be a marked reduction in milk yield as well as abortion in pregnant animals. It is recently emergence disease in India. The disease has been reported in several Indian states like Assam, Odisha, Maharashtra, Kerala, Karnataka, Chhattisgarh, Madhya Pradesh, etc.

Etiology

LSD is caused by capripox virus genus of pox viridae Family. The virus can survive in the environment for a long time. It can last 35 days in dry skin crusts, 33 days in necrotic nodules, and at least 18 days in air-dried hides. Although sunlight and lipid detergents can immediately kill viruses, they can survive for months in dark environments such as animal shelters and feed depots.

Transmission

LSD is a devasting disease which is transmit by mechanical transmission, direct or indirect mechanism. Transmission by vectors is primary route for proliferation of disease. The beginning of seasonal rains and summer, which coincides with peak activity of the vectors, greatly increase occurrence of disease. Milk, nasal secretions, saliva, blood, and lachrymal secretions all contain the virus, making them an indirect source of infection for animals who share feeding and watering troughs. LSD virus also spread through intrauterine route. Infection also transmitted through infected mother to calf during suckling via milk and via skin abrasions. The virus persists in the semen of infected bulls so that natural mating or artificial insemination may be a source of infection for females. When a single needle is used for mass vaccination, the virus can be acquired from skin scabs or crusts via iatrogenic route

Epidemiolog

Gout illness has a significant disease burden and is expanding in Developed nations and

Clinical Sign & Symptom

In infected animal LSD is occur in 3 forms acute, sub-acute & chronic. In mild case one two nodules are appear on body mainly at skin of muzzle, eyelids, neck and back with perineum and scrotal area along with fever, emaciation, ocular discharge, nasal discharge, salivation with decrease milk production. In severe case hundreds of nodules are appear on all over the body. After that, the lesions proceed to papules, vesicles, pustules with exudation and finally scab formation. Sloughing of the lesions can result in a hole, known as a "sitfast," which invites screwworm fly invasion and bacterial invasion, which can lead to septicemia. Secondary bacterial infection can arise, resulting in significant suppuration and sloughing, and the animal may become exceedingly malnourished as a result. Swelling of testicles and ovary occuring in infected bulls and cattles so those lesion in reproductive tract cause temporary or permanent infertility in bulls and cows. Edematous and inflammatory swelling are observed in brisket, face and one or more limbs lead to restrictions in movement. Typical LSD lesions are also seen in oral cavity, respiratory tract, genital tract with conjunctiva, enlargement of lymph nodes with lymph adenopathy is important clinical sign in infected animals.

Economic Importance

LSD is a notifiable disease because its cause great economic losses due to severe emaciation, decrease milk production, weight conversion, abortion, infertility with hide damaged. The consequence of the deterioration in animal quality can be seen in the entire trade of live animals and animal products. This might result in significant financial losses for the meat, milk, leather, and other industries that deal with cattle and its by-products. So poor farmer who keep animal suffer from crisis due to this disease.

Diagnosis

Diagnosis can be done by

- On the basis of typical clinical signs & lesions
- By electron microscopy for skin sample examination
- By histopathology
- By virus isolation
- Molecular diagnosis with PCR is most rapid test for diagnosis of disease.

Treatment

Treatment of virus is not still there but symptomatic treatment should be given with anti-inflammatory, antibiotics for treatment of secondary infection. Currently has no treatment for disease so prevention by vaccination is the only effective means to control spreading of disease.

Prevention & Control

Till date effective treatment of LSD is not developed, only symptomatic treatment like anti-inflammatory and antibiotic should be given. Effective control and prevention strategies must be developed to control disease which are: -

- **Restrict the movement of infected animals**

  Movement of infected animal should be strictly prohibited. If animal with such lesions are observed, they should be quarantined for inspection to prevent the spreading of disease. Put the infected animal separate from other healthy animals

- **Restrict movement of vectors**

  Vectors are responsible for the transmission of disease so vector control methods like use of vector traps, use of insecticides can be used to prevent spreading of disease.

- **Vaccination**

  Vaccination is only effective means to control spreading of disease. Live attenuated vaccine is available for lumpy skin disease. Based on various strains of LSD virus, different vaccines are available for LSD. LSD is closely related to sheep pox and goat pox so vaccine against sheep pox and goat pox can be used for LSD.

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Popular Article

Economic Impact of *Toxocara vitulorum* in buffalo and its prevention

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Introduction

In India agricultural production including livestock is predominately produced within mixed smallholder farming systems. These mostly operate at subsistence levels. The majority (95%) of agricultural product is produced by smallholder farmers. Cattle and buffalo are typically kept as assets rather than for optimal production purposes. Gastrointestinal parasitism is one of the major causes of economic losses in dairy and beef buffalo production in all buffalo breeding countries including India. *Toxocara vitulorum* is a pathogenic gastrointestinal parasite causes infection in buffaloes results in Ascariasis. It is most common and pathogenic intestinal parasite of the young buffalo. The severity of infestation varies from place to place, depending upon many factors such as sanitation, management and nutrition. It causes economic losses in dairy, beef industry. Buffalo calves are more susceptible to *T. vítulorum* than cattle calves under conditions of natural infection when they are raised together. Only 20% of cattle calves were found to be infected with Toxocara compared to 100% of buffalo calves. This may have been due to difference in the natural immunity of each specie. The economic impact of these losses, on the other hand, is a tough subject to value because they are typically insidious in nature and difficult to verify statistically on a regular basis. The principal components of impact is probably found in the costs of control of the nematode parasites and in the productivity losses. Most cattle have parasite burdens that are truly subclinical with no obvious sign yet cause large losses in potential productivity. The cost of controlling *Toxocara vitulorum* and the productivity loss are most likely the main components of impact. However, calculating the total losses caused by *Toxocara vitulorum* has significant limits.

Mechanism of infection

Adult worms are exclusively found in calves. Calves with less immunity or poor nutrition are prone for infection and often result in fatalities The usual routes of infection are transplacental and trans mammary. In the first route (postnatal) the calves are infected via colostrum few hours of birth and in the second (prenatal) the foetus is infected by ingestion of larvae present on amniotic fluid. In the adults there are no clinical significance and larvae may remain dominant in tissues. In pregnancy. However, larvae become active and can infect the foetus or sucking newborn. The usual route of infection is trans mammary i.e., through colostrum milk of dam containing second stage migrating larvae. If conditions are suitable, there is further development to the infection form of the helminths. which is then available in the environment to infect other animals. The most harmful impact of this parasite is a rise in intestinal cell epithelial exfoliation, which interferes with protein metabolism after absorption. This decreases the amount of nutrients available for the host's growth and development. Diarrhea, steatorrhea (fat in faeces), colic, mud-colored, foul-smelling faeces, emaciation, tympanism, constipation, anorexia, butyrous odour of breath, weight loss, hypoproteinemia, skin eczema, the loss of glossiness of the coat and mortality are all symptoms of this parasite. This impact is thought to be caused by pain caused by tissue damage at the infection site, changes in protein digestion, changes in intestinal motility, and an increase in intestinal hormone, all of which leads to a decrease in voluntary feed intake.

Economic impacts

(1) Effect on milk production

Toxocara reduces nutrient availability to the adult buffalo through reduce the feed intake and reduction in the efficiency of absorbent nutrients. So, it indicates that milk production is reduced when animal is in first or second lactation are exposed to excessive parasitism where animals are put on a lower plane of nutrition. There is negative effect of Toxocara on milk production of lactating buffalo.

(2) Effects on body weight

The impaired growth caused by Toxocara is partly due to the reduction in the feed intake but increased metabolic activity and nutritional demand on the host animal. Toxocara produces increase loss of endogenous protein, which might be potential cause of decreased weight gain in buffalo. Animals that infected with parasites, gained weight slower rate than animal free from parasite. As the parasite challenge increased, the large negative impact on weight gain in form of impaired growth.

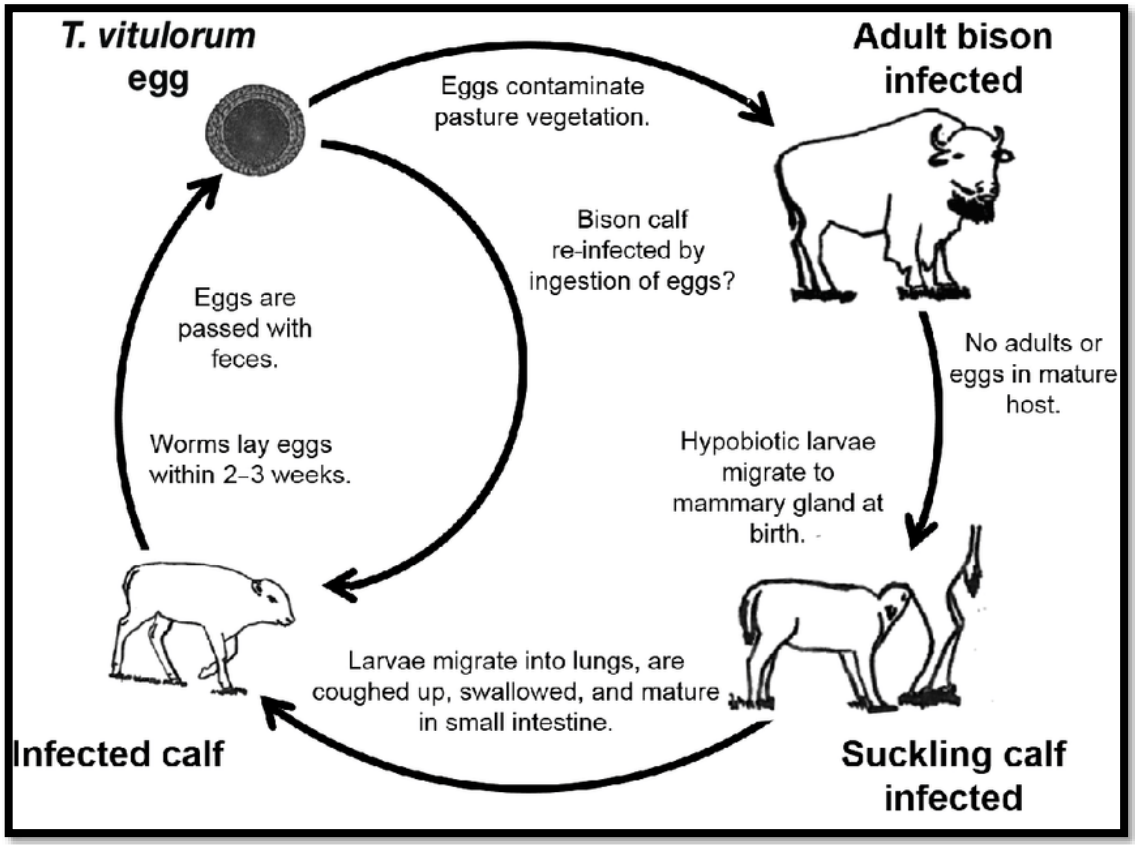

Image source- Woodbury, M. R., Wagner, B., Ben-Ezra, E., Douma, D., & Wilkins, W. (2014). A survey to detect Toxocara vitulorum and other gastrointestinal parasites in bison (Bison bison) herds from Manitoba and Saskatchewan. The Canadian Veterinary Journal, 55(9), 870.

(3) Effect on reproductive performance

Toxocara overload causes reduction in body weight gain so its indirectly affect the reproductive performance because if heifer not gain breeding weight it's not able to attain its puberty age and get conception. The weight gain improvements associated with improved fertility.

(4) Effects on Mortality and Morbidity

Mortality as a direct result of parasitism or as a consequence of increased susceptibility to other diseases is the common event in preweaning buffalo calves. Highest mortality rates are observed in age group of 1 - 3-month-old calves. Main cause of death by toxocariasis are due to pneumonia by larval migration in lungs, obstruction in GIT by adult worm balls. In weaned calves the annual average mortality due to Toxocariasis is approximately up to 3%. Calf mortality rates as high as 80% due to *T. vitulorum* infection have been reported ln buffaloes to 1.5 year the losses observed is not simply in

terms of mortality but more importantly in low production efficiency. In India and Sri Lanka calf hood mortality due to *T. vitulorum* is common.

(5) Effect on carcass quality

Toxocara infection in beef buffalo can result in an inferior product. The poor body weight gain in infected buffalo may be due to decrease feed intake, stress, poor feed conversion ratio and secondary infection. Heavy infection of Toxocara reduced the level of amino acids incorporation in muscle protein results in reduced weight gain and weight loss. Mineral deficiencies also affect the growth rates since skeletal size (bone size) ultimately determines the capacity of growing animal to accumulate muscle. Larvae of Toxocara migrate through liver and lungs inflicting physical damage, especially to lungs and causes decrease cost of offal.

(6) Economic loss during parasite control

The disease's overall cost was calculated by adding control expenditures to productivity losses. Smallholder farmers mostly use basic traditional methods for large ruminant raising and rarely keep written records of production inputs and output. Anthelmintics and other supportive medication use in Toxicara infection are major inputs effect economic outcomes.

Prevention and control

Natural prevention

Since calves are more susceptible against these worms and most infections are acquired perinatally from infected dams, it is essential to try to prevent the infection of pregnant cows. Since most eggs are shed by young calves' pastures occupied by these calves will often be highly contaminated. If buffalo cannot be kept off these contaminated pastures, they have to be treated with appropriate anthelmintics. In properties with a history of *Toxocara vitulorum* infections, thorough hygienic measures (manure removal!) and disinfection of the calf sheds are highly recommended. *Toxocara vitulorum* being buffalo specific, alternate grazing with sheep and/or horses may be considered. The longer the absence of buffalo, the higher will be the reduction of the Toxocara population in the pastures. However, this may not be advisable if the property has other gastrointestinal roundworms that are simultaneously parasitic of cattle and sheep or horses. Numerous herbal products or anthelmintics are available that effective against Toxocara infection

Chemical control

Numerous broad spectrum anthelmintics are effective against adult worms and larvae in the gut. Calf must be dewormed within 10 to 15 days of birth.

Table 1. Commonly used herbal anthelminthics drugs against *T. vitulorum.*

S.N.	Name	ose(mg/Kg b. wt.)	Route
1	(*Azadirachta indica*) Neem	300	Orally
2	*Ficus hirta*	150	Orally

Table 2. Commonly used chemical anthelminthic drugs against *T. vitulorum.*

S.N.	Name	Dose (mg/Kg b. wt.)	Route
1	Piperazine	250	Orally
2	Fenbendazole	7.5	Orally
3	Levamisole	7.5	Orally
4	Pyrantel pamoate	25	Orally
5	Ivermectin	0.2	Orally

Other prevention and control measures including

- Main hygienic condition.
- Provide balance ration with ad-libitum clean water.
- Provide mineral mixture and multivitamin to maintain immunity.
- Keep animals stress free.
- Periodically faecal examination of animals.

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Popular Article

Herbal and chemical treatment of *Ascaridia galli* in commercial poultry farm

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Introduction

Parasitism with protozoa, helminthes and arthropods remains a main threat for poultry industry worldwide. Between helminthes, like Roundworms, Tapeworms and Flukes, Nematodes are the most important ones. *Ascaridia galli*, *Heterakis gallinarum* and *Capillaria spp.* are the most common roundworms of poultry, with *Ascaridia galli* being the most prevalent round worm that live in the intestines of birds. Several studies report incidences of up to 90% in various countries. It is much more abundant in traditional farming with outdoor run than in industrial production facilities. This parasite is responsible for clinical and subclinical parasitism. In heavily infected poultry the clinical signs include droopiness, diarrhea and hemorrhages due to heavy worm infection, particularly in chickens and turkeys. Also, during heavy infestation birds may show signs of decreased weight gain and retarded growth, due to damaged integrity of the intestinal mucosa and subsequent impaired nutrient utilization. In more severe cases and especially in young birds, intestinal blockage may occur, leading to death. *A. galli* infections result in serious economic losses, usually associated with treatment cost, decreased feed efficiency and poor egg and meat production. Another very debilitating factor resulting in economic losses is the ability of *A. galli* eggs to act as vectors for transmission of fatal bacterial infectious organisms, such as Salmonella and *E. coli*. Currently many anthelminthic used for control of *A. galli* infection in poultry farm but due to high cost and resistance against parasites nowadays attention has been drawn to the use of botanicals in poultry diet, due to their anthelmintic properties.

Life cycle and transmission

The life cycle of *A. galli* is direct. From the small intestine, adult female worms pass eggs in the faeces. Infectious larvae develop inside the eggs in around 12 days at 33°C, but frequently take longer at lower temperatures. Infectious eggs can survive for up to a year in the litter of birds. They do not withstand at temperature below 12°C, but they may withstand a little frost. Earthworms are mechanical vectors that can eat vast volumes of infective eggs. Birds become infected after consuming infective eggs, either directly through contaminated food or water or indirectly through infected earthworms. The larvae are released in the stomach lumen after being ingested, where they moult and stay for around 10 days. They then penetrate the stomach lining, where they stay for 1 to 7 weeks until moulting. They then return to the lumen of the gut, where they mature into adult worms and the females begin to lay eggs.

Susceptibility and pathogenicity

Infections with Ascaridia are particularly dangerous to young chickens under the age of 1 to 3 months, especially if they have a vitamin or protein shortage. In poultry husbandry, heavy illness is the leading cause of weight loss and decreased egg production. Intestinal obstruction can occur as a result of severe illnesses. Unscrupulousness, wing drooping, head bleaching, and emaciation are all visible. Infection also results in blood loss, lower blood sugar levels, higher uric acid levels, shrinking thymus glands, stunted growth, and a higher mortality rate. Adult worms may travel up the oviduct and be found in hens' eggs, as well as in the birds' faeces, in cases of severe illness.

Clinical sign and symptoms

Marked lesions are produced when large number of young parasites penetrate into duodenal mucosa may cause severe haemorrhagic enteritis. Birds become anaemic and suffer from diarrhoea. Affected birds become unthrifty, markedly emaciated and egg production is decreased. In heavy infection, intestinal obstruction may occur. The color of egg yolk become pale. As birds get older, they become more resistant to the worms, which limits both the injury and the worms' reproduction, i.e., the contamination of their surroundings with eggs. Resistant is a breed-specific trait. Dietary deficiencies such as vitamin A, B and B12, various minerals and proteins leads to heavy infection.

Diagnosis

A. galli can be diagnosed by the above clinical signs, faecal examination or worms in the intestine at post-mortem. Evidence of enteritis/haemorrhagic enteritis can be seen on PM.

Prevention and control

- For sustainable control of A. galli different approaches have been employed such as, nutrition of poultry, utilization of genetic resistance, biological control, and the use of plants with promising anthelmintic activity.
- General hygiene requirements must be followed, including dry and disinfected flooring, clean feed and water, and separate upbringing of young, growing, and adult birds. Provide clean feeding troughs and drinking water appliances. Because the development of the worm's eggs requires humidity, it is advisable to keep the birds' bedding as dry as possible and to change it frequently to prevent or at least reduce Ascaridia infections.
- To avoid or limit egg contamination, strict sanitation of feeders and drinkers is required. It's also a good idea to rotate your pastures. Parasitic infections should be screened on a regular basis, and all infected birds should be separated and treated properly.

Table 1. Common medicinal plants used for against *A. gall* in poultry

S.N.	Plant	Part use	Dose (mg/kg)	Route	Effect against *A. gall*
1	Azadirachta indica (Neem)	Leaves powder	200	Orally	Increased bird body weight; Parasite death
2	Pomegranate (*Punica granatum*)	Peel powder	1500	Orally	Fecal egg reduction, Increased packed cell volume, total serum proteins, body weight
3	Kadak patti (*Vernonia Amygdalina*)	Leaves powder	100	Orally	Fecal egg reduction
4	Latakaaranj. Malayalam (*Caesalpinia crista*)	Seed powder	50	Orally	Fecal egg reduction
5	*Piliostigma foveolatum* (Dalzell)	Bark	200	Orally	Fecal egg reduction
6	*Melia Azedarach* (Bakain)	Fruit powder	20	Orally	Egg development inhibition

Table 2. Common anthelmintic drugs used for against *A. gall* in poultry

S.N.	Drug	Dose	Route
1	Piperazine	Single dose, 50 mg/bird (less than 6 weeks old), 100 mg/bird (more than 6 weeks old), in the feed at 0.2% – 0.4% or in the drinking water at 0.1% – 0.2%	Orally
2	Hygromycin – B	8-12 g/tons of feed for 8 weeks	Orally
3	Albendazole	5-10 mg/kg	Orally direct by syringe (Not soluble in water)
4	Fenbendazole	14.5 g/ton of feed	Orally
5	Pyrantel tartrate	15–25 mg/kg	Orally

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Popular Article

मिल्क फीवर (दुग्ध ज्वर) का उपचार एवं रोकथाम

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[1]पशु परजीवी विज्ञान विभाग, गोविंद बल्लभ पंत कृषि और प्रौद्योगिकी विश्वविद्यालय, पंतनगर, उधम सिंह नगर, उत्तराखंड

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परिचय:-

दुग्ध ज्वर डेयरी पशुओ मे होने वाला एक पोषण संबन्धी उपापचयी (मेटाबोलिक) रोग है। जो अधिकतर ज्यादा दूध देने वाले पशुओ को ब्याने/ब्यांत के कुछ घंटे / दिन पहले या तुरन्त बाद होता है। ये ब्यांत के 48-72 घंटे के अंदर ज्यादा होता है। इस बीमारी के शीर्षक में फीवर (यानी बुखार) एक मिथ्य है , क्योंकि इसमें बुखार नहीं आता बल्कि पशु के शरीर का तापमान सामान्य से भी कम रहता है व पशु ठंडा प्रतीत होता है। इस रोग को काविंग पैरालिसिस या हाइपोकैल्सिमिया के नाम से भी जाना जाता है। यह रोग गाय, भैंस एवं बकरियों में पाया जाता है। अक्सर ये गाय और भैंस मे तीसरे से सातवें ब्यांत मे अधिक होता है। साथ ही ये 5 से 10 साल के पशुओं मे ज्यादा देखने को मिलता है। पहले ब्यांत में यह रोग प्रायः नहीं होता है। दुग्ध ज्वर (मिल्क फीवर) सामान्यत: शरीर मे कैल्शियम की कमी के कारण होता है। सामान्य तौर पर गाय भैंस के खून मे कैल्शियम का स्तर 10-12mg/dl होता है। जबकी दुग्ध ज्वर मे कैल्शियम का स्तर 7mg/dl से भी कम हो जाता है। इस रोग से ग्रसित पशु में कैल्शियम की भारी कमी हो जाती है तथा माँसपेशियाँ कमजोर हो जाती हैं।

दुग्ध ज्वर के कारण:-

यह रोग निम्न कारणों से हो सकता हैं।

- पशु के रक्त में सीरम कैल्शियम की कमी- शरीर के रक्त में कैल्शियम की कमी होने के कई कारण हैं।
  1. पशु को आहार मे पर्याप्त कैल्शियम लवण न देना।
  2. आहार मे पर्याप्त कैल्शियम देने के बावज़ूद शरीर मे कैल्शियम का अवशोषण न होना।
  3. मादा पशु के पेट मे पल रहे बच्चे के हड्डियों के विकास मे कैल्शियम माता से भ्रूण मे चला जाता है जिसे मादा पशु के शरीर मे कैल्शियम की कमी हो जाती है।
  4. ब्यांत के बाद खिस (कोलेस्ट्रॉल) मे बहुत अधिक मात्रा मे कैल्शियम स्त्रावित हो जाता है और मादा पशु के शरीर मे कैल्शियम की कमी हो जाती है।
  5. पाचन संबधी समस्या होने के कारण भी सामान्य तौर पर कैल्शियम का अवशोषण शरीर मे नहीं हो पाता है यही दुग्ध ज्वर का कारण बनता है।
  6. भूखे एवं कमजोर पशु में मिल्क फीवर (दुग्ध ज्वर) के लक्षण जल्दी प्रकट होते हैं।

दुग्ध ज्वर मे पशु मे दिखाई देने वाले लक्षण:-

सामान्यतः दुग्ध ज्वर के लक्षणों को तीन चरणों मे विभाजित किया है।

प्रथम चरण:- उतेजनशीलता की अवस्था

- प्रथम चरण के शुरुआती समय में पशु उत्तेजित दिखता है
- पशु के सिर व पिछले पैरों में अकड़न का आ जाना और पशु का जमीन पर गिर जाना।

- पशु के कानों का खड़ा होना, दाँतों का किटकिटाना, जीभ का बहार निकलना आदि लक्षण दिखाई देते है।
- पशु के शरीर का ताप समान्य से थोड़ा बढ़ा हुआ महसूस होता है।
- पशु का दाना चारा न खाना।
- इस अवस्था का पता न चलने पर ये दूसरे चरण मे प्रवेश कर जाती है।

द्वितीय चरण:- पशु की गर्दन मोड़कर बैठी हुई अवस्था

- इस अवस्था मे जानवर अपने शरीर का संतुलन नही बना पाता है।जिसे जानवर खड़ा रहने में असमर्थ रहता है।
- इसमें पशु अपनी गर्दन को मोड़कर अपने पीठ (फ्लैंक एरिया) पर रख लेता है और बैठा रहता है।
- पशु लेटने के बजाय सीने वाले भाग (स्टरनम) के सहारे बैठा रहता है।
- पशु की हृदय ध्वनि और नाड़ी कमजोर हो जाती है।
- रोगी पशु का नथूना (मजल) सूख जाता है।
- कान और टाँगे ठंडे हो जाते हैं।
- शरीर का ताप सामान्य से कम हो जाता है।
- आखों की पुतली बड़ी हो जाती है और आँखें झपकना बंद हो जाता है।
- पशु के गुदा की माँसपेशियाँ ढीली पड़ जाती हैं।
- अरेखित पेशियो मे लकवे की वजह से मल मूत्र त्यागने मे परेशानी होती है।

तृतीय चरण:- लेटे रहने की अवस्था

ये सबसे गंभीर अवस्था होती है

- इसमें जानवर पूरी तरीके से जमीन पर लेट जाता है। और बेहोशी की अवस्था मे चला जाता है।

- शरीर का ताप बहुत ज्यादा कम हो जाता है और शरीर बहुत ठंडा हो जाता है ।
- नाड़ी की गति अनुभव नहीं होती है।
- पशु के लगातार बैठे रहने की वजह से आफरा आ जाता है। और अंत मे जानवर की मृत्यु हो जाती है।

दुग्ध ज्वर की जाँच:-

- दुग्ध ज्वर की जाँच पशुपालक से तुरंत ब्यांत का पता करके।
- दुग्ध ज्वर के लक्षण देखकर।
- पशु के रक्त मे कैल्शियम के स्तर का पता लगाकर दुग्ध ज्वर की जाँच करते है।
- रोगी पशु को नशों में कैल्शियम देने के बाद पशु की स्थिति में सुधार होने पर।

दुग्ध ज्वर का उपचार:- इस रोग से पीड़ित पशु की चिकित्सा जितनी जल्दी हो सके शुरु कर देनी चाहिए।

- दुग्ध ज्वर के शुरुआती अवस्था मे नसो मे कैल्शियम बोरोग्लूकोनेट देने से पशु जल्दी ही खड़ा हो जाता है।
- बिल्कुल ठण्डी बोतल से कैल्शियम को नसो मे नहीं देना चाहिए। पहले बोतल को गरम पानी या धूप में रखकर पशु के शरीर 75% के तापमान के सदृश गरम कर लेना चाहिए, फिर धीरे–धीरे खून की नस में देना चाहिए।
- यदि शरीर मे हैपोकैल्सेमिक के साथ हैपोमेग्नेसेमिक् स्थिति हो तो कैल्शियम मग्नेसिएम बोरोग्लूकोनेट देना चाहिए।
- सोडियम एसिड फास्फेट नार्मल सैलाइन या डेक्स्ट्राज के साथ दें।
- कभी भी अत्यधिक तेज गति से कैल्शियम नहीं चढ़ाना चाहिए क्योंकि ये हृदय की गति को बहुत अधिक बढ़ा देता है।

- इस रोग में पक्षाघात होने के कारण तथा रुमन में गति न होने के कारण रोगी पशु गोबर नहीं करता है, ऐसी अवस्था में हाथ द्वारा हल्के हल्के से गोबर निकालना चाहिए।

दुग्ध ज्वर के रोगी मे कैल्शियम देने के बाद निम्न लक्षण दिखते है।

- डकार आना।
- हृदय ध्वनि की तीव्रता बढ़ना।
- थूथन (muzzle) पर पसीना आना।
- फ्लैंक एरिया की पेशियो मे तेज गति होना
- ये लक्षण दुग्ध ज्वर के सही उपचार को बताता है।

दुग्ध ज्वर से कैसे बचा जा सकता है।

- अधिक दूध देने वाले पशु को ब्याहने से 1 महीने पहले सी ही अधिक फॉस्फोरस और कम कैल्शियम युक्त लवण देना शुरू कर देना चाहिए।
- ब्याहने के बाद पशु के थन से पूरी मात्रा मे खिस(कोलेस्ट्रॉल) नहीं निकाले। कुछ मात्रा मे थन के अंदर ही खिस को रखे। ताकि कैल्शियम अधिक मात्रा मे खिस के साथ शरीर से बहार न निकले।
- दुधारू पशुओ को ब्याने से 2 महीने पहले दूध निकालना छोड़ देना चाहिए।
- गर्भावस्था के अंतिम कुछ महिनो मे जानवर को ज्यादा कैल्शियम और कैल्शियम भरपूर चारा (फली चारा) नहीं देना चाहिए। ये दुग्ध ज्वर के होने को उतेजित करता है।इसलिए 100gm/ दिन से ज्यादा ना दे।
- Vitamin D का इंजेक्शन भी पशु को लगवाना चाहिए ताकि आँतो से कैल्शियम का अवशोषण हो सके और शरीर मे कैल्शियम की कमी ना पड़े।

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Popular Article

Feed Additives in Poultry: A Brief Review

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Definition

Feed additives are frequently characterised as non-nutrient compounds that speed up growth, increase feed utilisation effectiveness, or benefit the animal's health or metabolism.

Usually used in micro quantities and requiring careful handling and mixing, feed additives are an ingredient or combination of ingredients added to the basic feed mix or parts thereof to fulfil the specific need. They are used to improve rate of gain, feed efficiency, preventing and controlling disease, and prevention against unfavourable environmental influences.

Types of feed additives

1) **Nutrient feed additives**
   e.g., amino acids, minerals and vitamins
2) **Non nutrient feed additives**
   e.g., antibiotics, hormones, immunomodulators, enzymes, probiotics,

Advantages

- Boost the nutritional value and flavour of feed.
- Boost animal productivity.
- Enhance the finished result.
- It reduces the price of animal protein.

Anti-oxidants

Fats are susceptible to oxidation and the development of rancidity, which decreases their palatability and may result in gastrointestinal and dietary issues. Antioxidants are provided to stabilize fats and fat-soluble vitamins (such as vitamins D and E) and to stop vitamins from being destroyed by oxidation. A good antioxidant for vitamin A, carotene, and fat is vitamin E. The anti-oxidants DPPD (Diphenyl-para phenylene-diamine), BHA (Butylated hydroxy anisole), BHT (Butylated hydroxy toluene), and ethoxyquin are suggested to prevent rancidity of fat.

Antibiotics, arsenicals and nitrofurans:

At effective concentrations, they have been discovered to have bacteriostatic and bactericidal capabilities while having no harmful effects. In addition to being used at low doses as growth promoters, they have also been utilized to assist prevent and control chicken diseases as well as to help safeguard feeds from microbial deterioration.

Bacitracin, chlortetracycline (aureomycin), oxytetracycline (terramycin), procaine penicillin, and Streptomycin are some of the antibiotics that are included in modest levels of feeding, or 5 to 1.0 g per quintal of feed.

Arsenicals include 3-nitro-4 hydroxy phenylarsanic acids, sodium arsenilate, and Arsenilic acid (para-amino hydroxy phenyl arsenic acid).

Anthelmintics

To avoid parasitic infestation, particularly of roundworms, these are the deworming medicatio ns that are periodically added to feed or water.

Example: Benzimidazoles, derivatives of piperazine, avermectins, and pyrazinoquinoline

Antifungals

These are either organic or artificial compounds that stop fungus from growing.

Example: Sorbic acid, sodium propionate, sodium benzoate, etc.

Coccidiostat

These are frequently included in poultry diets to guard against the most deadly illness, coccidiosis.

Examples include sodium Monensin, Lasalocid, Amprolium, and Salinomycin.

Pigments

These carotenoid sources are typically added to feeds to enhance the colour of broilers and egg yolks.

Example: Xanthophyll and other sources of carotenoids.

Pellet binders

These have an impact on the stiffness and texture of pelleted diets.

Ex- Sodium bentonite

Enzymes

These have demonstrated to increase the digestibility of some feedstuffs under specific circumstances.

Hormones

These are occasionally used to change the metabolism of chickens. For example, estrogen is sometimes administered to enhance development and carcass finish; under specific circumstances, thyroactive chemicals are used to enhance egg output, egg shell quality, and to prevent fatty livers.

Example: Stilbesterol, diethylstilbestrol, dienestrol diacetate etc.

Flavoring agents

These have been applied in an effort to make some feedstuffs more palatable.

Example: Sucrose octa-acetate solution

It is impossible to make a general judgement on which non-nutrient feed additive is the most useful, though. In this situation, the nutritionist must determine which feed additives are required under each unique set of conditions.

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Popular Article

Morpho-Anatomical Flight Adaptation of Birds

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Introduction

Adaption is the evolutionary process whereby an organism become better able to live in its habit and habitats. Any alteration in the morphology or anatomy by which the organism become better fitted to survive and multiple in its environment. This causes alteration in the structure and function of an organism. Flight Adaptation- the Adaptation enabling an organism to fly are known as flight Adaptation. Morphological adaptation is a structural change that gives an organism a greater chance of survival in its habitat. The evolution of flight has provided birds with many physical features in addition to wings and feathers. One way to reduce weight in birds is by the fusion and elimination of some unnecessary bones and the "pneumatization" of the remaining ones. Not only are some bones of birds hollow but many of the larger ones are connected to the air sacs of the respiratory system. To keep the cylindrical walls of a bird's major wing bones from sudden change the bones have an internal compressive framework. The fusion of bones in birds makes the skeleton light as well as strong. The coracoid, furcula, and scapula form a strong and well-built tripod for supporting the wings and broad surfaces for the attachment of large flight muscles. One key adaptation is the fusing of caudal bones into a single pygostyle which supports the tail feathers. Birds also lack teeth or even a true jaw, instead of having evolved a beak, which is more lightweight. Birds have uncinate processes on the ribs. These are hooked extensions of bone that help to strengthen the rib cage by overlapping with the rib behind them. There is practically every organ and system that has been modified in relation to flight.

There are two main types of flight adaptation of birds.

1. Morphological Adaptations, 2. Anatomical Adaptations.

Morphological adaptation

Streamlined body- / body contour

The birds have a spindle shaped body to offer less air resistance during flight. This helps the birds to conserve energy and become more efficient at flying.

Compact body

The body of bird is compact and light, strong dorsally and heavier ventrally to maintain equilibrium in the air. Their wings are attached on thorax, Attachment of wings high on the thorax. the light organs like lungs and sacs are positioned high, the heavy muscles placed centrally are other features that help in flight.

Forelimbs modified into wings

The forelimbs are modified into wings which is the only organ of flight. These consist of a framework of bones, muscles, nerves, feathers, and blood vessels. The forelimbs have transformed into unique and powerful propelling organs, the wings. The wings are the sole organs of flight. Both wings spring from the anterior region of trunk. During rest they remain folded against the sides of the body, but during flight they become expanded. The surface area of the wings is increased by the development of elongated flight-feathers, the remiges. The particular shape of the wing, with thick strong leading edge, convex upper surface and concave lower surface, causes reduction in air pressure above and increase below, with minimum turbulence behind. This helps in driving the bird forwards and upwards during flight.

Body Covered with Feathers

The feathers are smooth, directed backwards, and closely fitting which make the body streamlined and reduce friction during flight. It lightens the body weight and protects it from the effect of environmental temperature. They also have a wide surface area for striking the air.

Mobile Neck and Head

The mouth is drawn out into a horny beak which acts as a pair of forceps in picking up the things and in various other activities such as nest building, pruning, which are normally done by forelimbs in other animals. The neck in birds is also very long and flexible for the movement of head necessary for various functions.

Bipedal Locomotion

As anterior part of the body of birds becomes concerned with flight, the posterior part of body becomes modified for movement on land. For locomotion on the ground and to support the entire body weight, the hindlimbs occupy a somewhat anterior position on the trunk and become stouter in case of ratites which are running birds.

Short Tail

The short tail of a bird bears a tuft of long tail feathers or rectrices, which spread out in a fan-like manner and serves as a rudder during flight. They also assist in steering, lifting and counterbalancing during flying and perching.

Anatomical Adaptations

The skull bones are paper-like thin. skull are the large orbits placed between the bulbous cranium and the pyramidal face. The occipital bone encloses the foramen magnum. A single occipital condyle immediately ventral to this articulates with the atlas, forming a joint that enables birds to rotate the head on the vertebral column to a much greater extent than is allowed to mammals. These bones are firmly fused with each other. The posterior portion of the skull is spongy. Teeth are lacking. All the thoracic vertebrae except the last are fused into a single mass giving rigidity to the dorsal part of vertebral column. Fusion of vertebrae provides a firm fulcrum for the action of wings in striking air. Birds can move their neck through 180°, which help in preening feathers in all parts of the body. The shortening of caudal vertebrae and formation of pygostyle has assisted stability in air. Sternum or breast bone is expanded having a median ridge or keel for the attachment of major flight muscles in flying birds. The fusion of the pelvis with ‘synsacrum’ not only supports the weight of the body when the bird is walking, but also counteracts the effect of shocks as the bird alights. The absence of a ventral symphysis of ischia and pubis permits laying of large eggs. The fusion of distal tarsals with the metatarsals to form a tarsometatarsus, and that of proximal tarsals with the lower end of tibia to form a tibiotarsus, help to strengthen the legs for bipedal gait. The skeleton of forelimbs is completely modified for the attachment of feathers (remiges) and flight muscles. There are only three digits, which are more or less fused.

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Popular Article

Brucellosis: a potential threat to livestock and humans

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Abstract

Brucellosis is one of the world's seven most neglected diseases, with the actual incidence ranging from 5,000,000 to 12,500,000 cases each year. Except in a few developed nations, the disease is widespread globally, but it is significantly undetected in undeveloped countries, where it causes significant health, economic, and livelihood costs. Brucellosis not only impacts animal populations in India, but it is also a significant occupational danger for people involved in livestock-related occupations. The disease's economic impact on the country is estimated to be $3.43 billion in livestock losses, with the bovine industry accounting for more than 95 percent of the total. Brucellosis can be avoided by avoiding unpasteurized dairy products and taking measures while dealing with animals or in a laboratory. Joint and muscular discomfort, fever, weight loss, and weariness are possible symptoms. Some people experience stomach ache and coughing.

Introduction

Brucellosis is a highly contagious zoonosis caused by consuming unpasteurized milk or raw meat from infected animals, or by coming into direct contact with their secretions. It is also known as undulant, Malta, and Mediterranean fever. Brucella bacteria are small, Gram-negative, nonmotile, non-spore-forming rod-shaped (coccobacilli) bacteria that cause this illness. They act as facultative intracellular parasites, producing chronic diseases that might last a lifetime. Humans are infected by four species: B. abortus, B. canis, B. melitensis, and B. suis. B. abortus is a cow illness that is less virulent than B. melitensis. Dogs are affected by B. canis. B. melitensis is the most virulent and invasive species, infecting goats and, on rare occasions, sheep. B. suis is an intermediate virulent pathogen that mostly affects pigs.

Host Animals

Species	Main Animal Host(s)
B. abortus	Cattle
B. melitensis	Goats, sheep, camels
B. suis	Pigs
B. canis	Dogs
B. ovis	Sheep, goats
B. neotomae	Wood rats
B. pinnipediae	Pinnipeds (seals, sea lions, walruses)
B. ceti	Cetaceans (dolphins, porpoises, whales)
B. microti	Common vole

Signs and Symptoms

The symptoms are similar to those of many other febrile disorders, but with a focus on muscle discomfort and nocturnal sweats. The disease's course might range from a few weeks to many months or even years. In the early stages of the disease, bacteremia develops, resulting in the typical trio of undulant fevers, sweating (sometimes with a foul, mouldy odour similar to wet hay), and migrating arthralgia and myalgia (joint and muscle pain). Blood tests often reveal a low amount of white and red blood cells, an increase in liver enzymes such as aspartate aminotransferase and alanine aminotransferase, and positive Bengal rose and Huddleston reactions.

Transmission

In animals' transmission of Brucellosis is to animals by contact with infected animals' placentas, foetuses, foetal fluids, and vaginal discharge. In humans, Brucellosis can be spread to humans by the consumption of tainted dairy products. It can also be transferred to people by organism inhalation or direct contact with contaminated animal fluids. Human-to-human transmission is extremely rare, with transmission happening through blood transfusion, organ and tissue transplantation, sexual contact, and nursing.

Diagnosis

The diagnosis of brucellosis can be made by following

- Confirmation of the bacteria - blood cultures in tryptose broth, bone marrow cultures: The growth of brucella is extremely slow (takes two months to grow).

- Confirmation of antibodies against the agent either with the classic Huddleson, Wright or rose Bengal test.
- Histologic evidence of granulomatous hepatitis on hepatic biopsy

Although serological techniques may be the only testing available in many situations, a definitive diagnosis of brucellosis needs the isolation of the organism from the blood, bodily fluids, or tissues. B. abortus is less frequently detected by positive blood culture yield than B. melitensis or B. suis, which varies from 40 to 70%. The standard agglutination test (SAT), rose Bengal, 2-mercaptoethanol (2-ME), antihuman globulin (Coombs'), and indirect enzyme-linked immunosorbent assay is all methods for identifying specific antibodies against bacterial lipopolysaccharide and other antigens (ELISA). In endemic regions, SAT is the most often employed serology.

Prevention and control

Monitoring and reducing risk factors are the cornerstones of brucellosis prevention. Serological assays for surveillance as well as testing on milk, including the milk ring test, can be used for screening and are crucial to efforts to eradicate the illness. Additionally, individual animal testing is carried out for commercial and disease-control goals. Vaccination is frequently used in endemic areas to lower infection rates. It is possible to employ modified live microorganisms in an animal vaccination. For comprehensive instructions on vaccine manufacture, refer to the World Organisation for Animal Health Manual of Diagnostic Test and Vaccines for Terrestrial Animals. A test and eradication campaign is needed to eradicate the disease since it is getting closer to being done away with. Eliminating animal infections is the most effective preventative technique. In enzootic areas with high incidence rates, vaccination of cattle, goats, and sheep is advised. In places with low frequency, serological or other tests and culling can also be successful. It is important to raise knowledge about food safety, workplace cleanliness, and laboratory safety in nations where eradication of animals by vaccination or the removal of sick animals is not practical.

Treatment and care

Flu-like symptoms such as fever, weakness, malaise, and weight loss are common with Brucellosis. However, the condition can manifest itself in a variety of unusual ways. Many patients' symptoms are modest, and hence the diagnosis may be overlooked. The disease's incubation time can range from one week to two months but is generally 2-4 weeks.

Doxycycline 100 mg twice a day for 45 days and streptomycin 1 g daily for 15 days are treatment alternatives. Doxycycline at 100 mg twice daily for 45 days, with rifampicin at

15mg/kg/day (600-900mg) for 45 days, is the principal alternative therapy. Streptomycin can be replaced with gentamicin 5mg/kg/daily for 7-10 days, although no trial directly comparing the two regimens is presently available. The best therapy for pregnant women, newborns, and children under the age of eight has not yet been found; for children, trimethoprim/sulfamethoxazole (co-trimoxazole) combination with an aminoglycoside (streptomycin, gentamycin), or rifampicin are alternatives.

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Popular Article

Care and management of Dog

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Feeding

- Puppies 8 to 12 weeks old-Four meals a day.
- Puppies three to six months old-Three meals a day.
- Puppies six months onwards-Two meals a day.
- Premium quality dry food provides a well-balanced diet for adult dogs and may be mixed with water, broth or canned food. Dog may enjoy cheese, cooked egg, fruits and vegetables, but these additions should not be more than ten percent of daily food intake.
- Puppies may be fed a high quality, brand name puppy food or Home-Made Food. Clean, fresh water should be available at all times.

Exercise

- Dogs need exercise to burn calories, stimulate their minds, and keep healthy.
- Exercise also tends to help dogs avoid boredom, which can lead to destructive behaviours. Supervised fun games will satisfy many of your pet's instinctual urges to dig, herd, chew, retrieve and chase.

Grooming

- It can help keep to the dog clean and reduce shedding of hairs with frequent brushing.
- Check for fleas and ticks daily during warm weather. Before bathing, comb or cut out all mats from the coat.

Carefully rinse all soap out of the coat for better cleaning

Handling

- Small dogs, sometimes referred to as "lap dogs" are the easiest to handle. To carry a puppy or small dog, place one hand under the dog's chest, with either your forearm or other hand supporting the hind legs and rump.
- Never attempt to lift or grab your puppy or small dog by the forelegs, tail or back of the neck. If you do have to lift a large dog, lift from the underside, supporting his chest with one arm and his rear end with the other.

Housing

- Pet needs a warm, quiet place to rest, away from all drafts and off the floor. A training crate is ideal.
- Wash the dog's bedding often. If a dog will be spending a lot of time outdoors, be sure dog has access to shade and plenty of cool water in hot weather, and a warm, dry, covered shelter when it's cold.

Behaviour Information

Training

- A well-behaved companion pet is a joy. But left untrained, dog can cause nothing but trouble.
- Teaching your dog, the basics - "Sit," "Stay," "Come," "Down," "Heel," "Off" and "Leave it" will improve your relationship. If you have a puppy, start teaching him his manners as soon as possible. Use little bits of food as a lure and reward.
- You should always keep your puppy or dog on a leash in public. Just be sure your pet will come to you at all times whenever you say the word.

Health

- Your dog should see the veterinarian for a full check-up, shots and a heartworm blood test every year, and immediately if it is sick or injured.

Dental Health

- Bad breath is most commonly an indication that your dog is in need of a dental check-up.
- You can clean your canine’s teeth with dog toothpaste or a baking soda and water paste once or twice a week. Use a child's soft toothbrush to clean teeth. Veterinarians can clean the teeth as a regular part of your dog's health program.

Bad Breath

- While bad breath caused by dental disease may not be too serious if caught early enough, some odours may be indicative of fairly serious, chronic problems. Liver or intestinal diseases may cause foul breath, whereas a sweet, fruity smell may be indicative of diabetes. If your dog’s breath smells like ammonia or urine, kidney disease is a possibility.
- Any time you notice your pet has bad breath accompanied by other signs of ill health, such as loss of appetite, vomiting, weight loss, depression, excessive drinking or urinating, schedule a visit to the veterinarian.

Fleas and Ticks

- Daily inspections of your dog for fleas and ticks during the warm seasons are important. Use a flea comb to find and remove fleas.

Medicines and Poisons

- Never give your dog medication that has not been prescribed by a veterinarian. Keep rat poison and other rodenticides away from your pet.

Spaying and Neutering

- Females should be spayed (removal of the ovaries and uterus). Spaying before maturity significantly reduces the risk of mammary tumour, a common and frequently fatal disease of older female dogs. Spaying also eliminates the risk of an infected uterus, a very serious problem in older females that requires surgery and intensive medical care.
- Males neutered (removal of the testicles) at six months of age. Neutering males prevents testicular and prostate diseases, some hernias and certain types of aggression.

Deworming

Age	Frequency of Deworming
Birth to 3 months	Every 2 weeks
3 months to 6 months	Every month
6 months old onwards	Every 3 months

Vaccination schedule in dogs

S. No.	Disease	Schedule – I		
		Primary	**Booster**	**Regular**
1.	Rabies	12-16 wks.	3-4 wks. after primary if primary dose is given below 3 months of age	Annually
2.	Canine Distemper (CD)	6-7 wks.	-do-	Annually
3.	Parvo-virus	6-7 wks.	-do-	Annually
4.	Leptospirosis	6-7 wks.	-do-	Annually
5.	Infectious Canine Hepatitis (ICH)	6-7 wks.	-do-	Annually
Schedule – II				
1.	Rabies	12-16 wks.	3-4 wks. after primary if primary dose is given below 3 months of age	Annually
2.	Canine combined Vaccine (CD, Parvo-virus, Leptospirosis and ICH)	6 wks.	9 & 12 wks.	Annually


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Popular Article

Hydroponics technique to revitalize dairy sector

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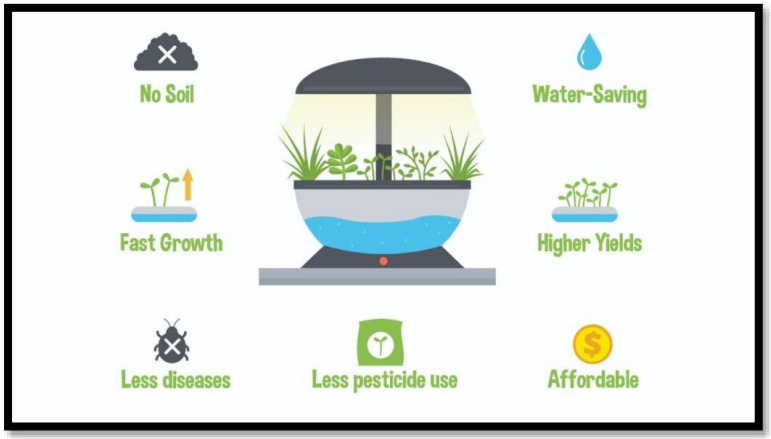
Introduction

"Hydroponics" means the techniques of growing plants without soil or solid growing medium but using water or nutrient rich solution only, for a short duration.

At present most of the Farmers in India either grow feed on their land for Cattle or buy it from the Market. However, dairy farmers are facing various constraints for production of green fodder like small landholdings, unavailability of land for fodder cultivation, scarcity of water or saline water, non-availability of excellent quality fodder seeds, labor requirement, the need for manure and fertilizer, longer growth period (45-60 days), fencing to stop fodder crop from wild animals, natural calamities, etc. Also, the non-availability of the quality of fodder around the year hinders the process of sustainable dairying. Also buying fodder from the Market is costly.

Benefits of Hydroponics



Method of Production of Hydroponics Fodder:

Hydroponics Fodder is produced in Greenhouses under a controlled environment, the greenhouse is a framed or inflated structure covered with a transparent or translucent material in which crops are grown and the environment can be controlled. In India, two types of Greenhouse Cultivation units are used.

- **Hi-Tech Greenhouse type Cultivation Unit:** This has a control unit to automatically regulate the input of water, air, and light through sensors. The daily production potential is 600 kg of fresh fodder. Hi-Tech greenhouse may be a multi-span structure. The cost varies depending on type of crop, the cladding material used and environmental systems incorporated. Average cost of a Hi-Tech Greenhouse per square meter is Rs. 2000.
- **Low-Cost Greenhouse type Cultivation Unit:** The low-cost greenhouses or shade net structures can be prepared from bamboo, wood, MS steel, or galvanized iron steel. The cost of the shade net structures depends upon the sort of fabricating material but is significantly less than the Hi-tech greenhouses. Average cost of a Low-Cost Greenhouse per square meter is Rs 175.

Steps involved in growing hydroponic fodder

- Select suitable quality grains for hydroponic green fodder. Remove the dead and broken seeds and other impurities by soaking them in 5- 7 litres of warm water.
- Seeds should be washed with the solution of sodium hypochlorite and leave the grains for 30 minutes in the solution to avoid fungal production. After draining the grains, soak them in fresh water for a 24 hours.
- Drain the soaked seed from fresh water. Transfer this washed seed to a gunny bag and allow them to germinate for next 24 hours.
- Wash and clean the plastic trays and remove the blockages of holes.
- Transfer germinated seeds from the gunny bags to trays and evenly spread them, and places them on the rack.
- Sprinkle or spray the water frequently to sprouted seeds up to 7 days. Maintain the suitable temperature and proper ventilation.
- Do not disturb the trays till the fodder comes to harvest. After 7 days one tray containing one kilo of maize seeds can produce 7- 8 kilos of fodder.

Advantages of hydroponic fodder production:

- Hydroponics requires 2-3 liters of water to produce 1kg of green fodder where as to conventional fodder production requires 60-75 liters
- Hydroponics greenhouse requires marginal land of 10 meters X 5 meters land for 640 kg green fodder / day/ unit when compared to 1 hectare land for conventional fodder growing.
- Hydroponic system requires less labour work say 2-3 hours / day. It doesn't include traditional management practices like weeding, sowing and irrigation.
- Hydroponic fodder requires just 1 week (7 days) to get nutritious fodder from seed germination to fully grown plant of 30 cm height.
- Hydroponic fodder can be grown throughout the year irrespective of climate situation to meet the fodder demand for animals
- Hydroponic fodder is free from the pesticides and insecticides and it is organic in nature.
- Hydroponic system provides highly nutritious fodder which is very much required for production and reproduction of livestock.

Disadvantages of Hydroponics Fodder:

The initial cost is a crucial factor if a farmer is installing a Hi-Tech greenhouse cultivation unit. These types of units require routine maintenance and that adds up to the fixed cost. Such types of units are susceptible to prolonged power outages and crops can get damaged if generator backup is not there. The risk of water-borne diseases is high and the entire crop is susceptible to the disease if proper care is not taken.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Popular Article

Poultry housing system: Advantages and Disadvantages

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Introduction

Poultry housing system refers to the layout of the farm where the poults are reared for domestic and commercial purposes. Poultry can be housed under different systems based on following factors:

- **Availability of land:** Poultry can be reared in backyard of house form domestic or small-scale business, whereas for large scale business more land is required.
- **Cost of land:** Initial capital is very necessary for any poultry farm to be established; it also includes cost of land. The cost of land should be minimum so that initial expense can be reduced.
- **Type of farming activity:** Architecture of the farm depends on the type of farming which are discussed below.
- **Climatic condition:** Poultry require specific climatic conditions for their management. Availability for air conditioner/ventilation, heaters etc should be kept in mind in order to efficient farming
- **Labour availability:** Basic work do be done in the farm like watering and feeding at the right time, cleaning of the farm, security of the farm etc require workers. Hence labours should be available at low cost.

Need for poultry house

- To protect birds from adverse climatic conditions
- To ensure easy and economic operation
- To ensure scientific feeding in a controlled manner
- To facilitate proper micro-climatic conditions in a near vicinity of bird
- For effective disease control measures
- To ensure proper supervision

Selection of location

- Poultry house should be located away from residential and industrial area.
- It should have proper road facilities.
- It should have the basic amenities like water and electricity.
- Availability of farm laborer's at relatively cheaper wages.
- Poultry house should be located in an elevated area and there should not be any water-logging.
- It should have proper ventilation.

General layout of poultry house

A small size poultry farm doesn't require any special layout as it involves construction of only one house. The medium and large size farms require special considerations for placement of building in the farm premises. The basic principles to be observed for layout are: -

- Layout should not allow visitors or outside vehicles near the birds.
- The sheds should be so located that the fresh air first passes through the brooder shed, followed by grower and layer sheds. This prevents the spread of diseases from layer houses to brooder house.
- There should be a minimum distance of 50-100 feet between chick and grower shed and the distance between grower and layer sheds should be of minimum 100 meter.
- The egg store room, office room and the feed store room should be located near entrance to minimize the movement of people around the poultry sheds.
- The disposal pit and sick room should be constructed only at the extreme end of the site.

Broadly, poultry housing systems are classified into three systems:

1. Free range or extensive system
2. Semi-intensive system
3. Intensive system
    (a) Deep-litter system
    (b) Slatted floor system
    (c) Slat cum litter system
    (d) Cage system

Free range system

This system is adopted only when adequate land is available to ensure desired stocking density by avoiding overcrowding and sufficient space for the birds thus reducing the stress. We can rear about **250 adult birds per hectare**. Arrangement should be provided for availability of shelter, greens, feed, water and shade. Foraging is the major source of feeding for birds. Shelter is usually provided by

temporary roofing supported by ordinary poles. The fields are generally used on rotational basis after harvesting of crops by moving of birds from one field to another depending on cropping programme. All categories of birds can be reared in this system. This system is most preferred for organic egg production. Additional arrangement are to be made available for the nutritional requirement of the birds which are not met by foraging.

Advantages

- Less capital investment
- Cost of housing is least.
- Feed requirements are less since birds can consume fairly good amount of feed from grass land.
- Fertility of soil can be maintained.

Disadvantages

- The scientific management practices cannot be adopted like proper nutritional supply, and disease management.
- Eggs are lost when laid inside the dense grasses unless special nests are provided.
- Losses due to predatory animals are more. Scavengers' wild birds are the most common danger to the birds.
- Wild birds may induce diseases unless proper care is taken.

Semi -intensive system

In this system birds are half-way reared in houses and half-way on ground or range, i.e., birds are confined to houses in night or as per need and they are also given access to runs. The houses are with solid floors while runs are fields only.

The success of rearing depends on maintenance condition of runs to reduce the contamination. Runs can also be used on rotation basis. The stocking density rate on an average for adult birds is **750 per hectare**. This system is usually adopted for duck rearing, as ducks spend their day on the pond as well as the land. The feeding and watering facilities are provided in the pen. The feed requirement is fulfilled partly by foraging and partly by providing supplement.

Advantages

- There is more economical use of land compared to free range system
- Birds are protected from extreme climatic conditions as they can be shielded against rain, storms or direct sunlight.
- Scientific operation to some extent is also possible.

Disadvantages

- Cost for fencing is high.
- There is need for routine cleaning and removal of litter material from the pen.

Intensive system

In this system, birds are totally confined to houses either on ground / floor or on wire-netting floor in cages or on slats. It is the most efficient, convenient and economical system for modern poultry production with huge numbers. It is mostly preferred for the layers as it provide individual care to the bird, its nutrition, number of eggs laid. All such data is required for efficient and profitable farming.

Advantages

- Minimum land is required for farming and hence the cost of land can be reduced. Multistorey building can be made.
- Farms can be located near market area, thus reduce the transportation cost.
- Day-to-day management is easier in this system.
- The production performance is higher as more energy is saved due to restricted movements. So, the energy is utilized in egg/meat production.
- Scientific management practices like breeding, feeding, medication, culling etc. can be applied easily and accurately.
- The sick birds can be detected, isolated and treated easily. This can prevent from sudden outbreaks of diseases.

Disadvantages

- Birds' welfare is affected. As they are restricted in limited space. They cannot perform the natural behavior like roosting, spreading wings, scratching the floor with legs etc.
- Since they are not exposed to outside sunlight and feed sources, all the nutrients should be provided in balanced manner to avoid nutritionally deficient diseases.
- Chances for spreading of diseases are more as they are confined closely.

Deep Litter System

In this system the birds are kept inside the house all the time. There is arrangement for feed, water and nest inside the house. The birds are kept on suitable litter material (paddy husk, saw dust, ground nut hulls, chopped paddy straw or wood shavings) of about 3" to 5" depth. This arrangement saves labour and hence cost involved in frequent cleaning of faecal matter (droppings of birds), however it needs periodical stirring so as to dry the litter and let the toxic gases like ammonia to pass out through proper ventilation.

Slatted floor system

In a slatted floor, iron rods or wood reapers are used as floor, usually 2-3 feet above the ground level to facilitate fall of droppings through slats. In such system, soil borne infection can be controlled. Sanitation is improved and better.

Slat cum litter system

In this system usually, 60% of the floor area is covered with slats and rest with litter. Feeders and waterers are arranged in both slat and litter area. In case of breeder flock, nest boxes are usually kept on litter area.

Cage System

This system involves rearing of poultry on raised wire netting floor in smaller compartments, called cages, either fitted with stands on floor of house or hanged from the roof. Currently 75% of commercial layers in the world are kept in cages. Feeders and waterers are attached to cages from outside except nipple waterers, for which pipeline is installed through or above cages. Auto-operated feeding trolleys and egg collection belts can also be used in this rearing system.

Advantages

- Minimum floor space is needed.
- More number of eggs per hen can be received.
- Less feed wastage.
- Protection from internal parasites and soil borne illnesses.
- Sick and unproductive birds can be easily identified and eliminated.
- Clean eggs production.
- Vices like egg eating, pecking is minimal.
- Broodiness is minimal.
- No need of litter material.

Disadvantages

- High initial investment cost.
- Handling of manure may be problem. Generally, flies become a greater nuisance.
- The incidence of blood spots in egg is more.
- Problem of cage layer fatigue. (It is a condition, in which laying birds in cages develop lameness. It may be due to Ca and P deficiency but the exact reason is not known)
- In case of broilers, incidence of breast blisters is more, especially when the broilers weight is more than 1.5 kg.


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Popular Article

Pregnancy detection in cats

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Introduction

Cat keeping is very much popular now these days because of its faithfulness and excellent hunting qualities. Cats used to be considered the choice of pets for old ladies who live alone. These days, however, more people are discovering how sweet felines can be, and they are becoming a more popular choice for pets. Cats are lovable companions that bring happiness and joy to the lives of many pet parents. Keeping in views of the importance of cat husbandry, fertility and diagnosis of pregnancy at the right time is of paramount importance. The average gestation length in the bitch is 63-64 days but the interval from first mating to whelping can vary from 56 to 71 days whereas queens have the average gestation length of 63-65 days but is reported to be varying between 59 and 70 days. The domestic queen is classified as seasonal polyestrous and a long day breeder. They are induced ovulators. Queens' estrous cycle repeats 2-3 times during breeding season, which leads to either pregnancy or pseudopregnancy. The seasonality is also depended on light duration, because the cat is positive photoperiodic. In the temperate zone non-pregnant females usually exhibit estrous cycles from January or February until the following September and the female is usually in anestrus from late September until late January. There are mainly the three methods by which pregnancy is diagnosed in cat and dog viz. Abdominal Palpation, Radiography and Ultrasonography.

General characteristics of estrous cycle

Queens normally have their first estrous cycle between 4 and 12 months, with the average age around 6 months. They have 2 to 4 estrous periods every year, lasting 13 to 15 days in length. If the cat is bred, estrus seldom lasts more than 4 days. In presence of male cat, estrous lasts 3 to 6 days or an average of 4 days. If successful mating does not occur, a heat cycle may last for 7 to 10 days and reoccur at 2 to 3 days intervals. This cycle is repeated 2 to 3 times. An unmated female can cycle every 3-4 weeks indefinitely. Cats also exhibit lactational anestrus for 4-6 weeks while nursing and come back into estrum about 2 weeks after weaning their litter.

The time for first estrous in cats is influenced by following factors:

- **Breed:** Many shorthair breeds reach puberty earlier than longhair breeds.
- **Season:** Depends on the length of daylight. It has been observed that under 12 hours of natural light without seasonal variations, queens seem to cycle continually.
- **Body condition:** The average body weight at puberty is 2.3 to 3.2 kg (or 80% of adult body weight) average body weight 2.5 kg.

Phases of estrous cycle:

- **Proestrus:** It lasts for 2-3 days. There is no bleeding from vulva observed but vulvar swelling is present. Feed intake of queen become irregular.
- **Estrous:** Following proestrus comes estrous. It lasts for 4-6 days in presence of male and 8-10 days in absence of males. If mating is successful then gestation period starts but if male is not present, the queen again shows signs of estrous for 8-10 days at the interval of 2-3 days. The estrous is repeated 2-3 times until successful mating. Even if now the male is not present, the queen enters into diestrum.

Signs of estrous:

1. Tail deflection,
2. Spinal flexion,
3. Rubbing or rolling,
4. Vaginal discharge,
5. Vocalization (cry),
6. Treading of the hind legs,
7. Body or tail tremor and rigidity,
8. Blows or scratches and discomfort on manipulation

- **Diestrum:** Increase of successful mating, queen become pregnant and carries on gestation period which lasts for 54 to 60 days. But in case of unsuccessful or sterile mating the queen become pseudo pregnant. The pseudopregnancy lasts for 30 to 40 days. Hence, diestrum is shorter in length as compared to pregnancy. In diestrum corpus luteum dies due to ageing gradually till 4^{th} week of unsuccessful or sterile mating. After the end of diestrum, queen directly enters into proestrus. There is no anestrus within the breeding season. Pseudopregnancy is uncommon in non-ovulated queens.
- **Anestrus:** Anestrus is the period of sexual rest that occurs between October and January in most free-roaming queens. Anestrus queens are sexually no inviting and nonreceptive. They may hiss or strike out at toms making sexual advances.

Breeding behavior

Courtship usually occurs at night. Receptive queens sit at a distance from competing males and crouch, roll, and tread in place. Fighting may occur between males as they mark out territories surrounding females. Vocalization is not limited to fighting and is more often associated with courtship and mating. Queens utter low monotone howls known as heat cries, while males caterwaul in response, signaling their readiness to mate. A male may approach a receptive female and rub chins and faces with her before mating. Courtship lasts from 10 seconds to 5 minutes, and the duration decreases with repeated breedings. Mating is accomplished as the tom grasps the female by the neck with his teeth, grips her forequarters with his front legs, and straddles her with his hindlimbs. Intromission and ejaculation occur within a few seconds. After the tom releases his grip, he rapidly retreats as the female displays a postcoital after-reaction, which lasts up to several minutes. The after-reaction is characterized by loud scream (the copulatory scream), followed immediately by vigorous rubbing and rolling on the ground or floor and licking of the vulva. During this time, the queen is unreceptive to the male and if he approaches, she will strike out at him. Additional matings, with the same or different tomcats, usually resume within 20 to 30 minutes.1 Several matings (10 to 30) commonly occur during the next 24 hours and continue over several days with the interval between matings becoming increasingly longer.1 Coital contact does not shorten the queen's period of receptivity. An after-reaction may occur in some estrual queens following mechanical stimulation, such as petting down the back or scratching the dorsal rump. Owners can be quite alarmed by this behavior, often confusing it with a seizure. Similarly, owners may not recognize normal estrous behaviors and may mistake excessive lordosis and treading for seizure activity in their cats.

Pregnancy diagnosis

Behavioral and physical changes may aid in pregnancy diagnosis, but such changes are typically subtle during the first two trimesters. Many queens become increasingly docile during this period and exhibit pinking of the nipples (the nipples become pinker and more erect). Ironically, in the author's experience, cats in the early stages of pregnancy, when physical signs of their condition are lacking, are frequently offered for adoption by humane shelters because of their docile, friendly temperaments. By the third trimester, behavioral and physical changes are obvious and include abdominal distention, enlargement of the mammary glands, excessive grooming of the mammary and perineal areas, and nesting behavior. Relaxin is the only pregnancy-specific hormone in cats. Pregnancy gonadotropins are not known to exist, and serum progesterone concentrations are not helpful in diagnosing pregnancy because they do not significantly differ in pregnant and pseudopregnant queens. Plasma relaxin assays may be used to diagnose pregnancy in dogs after day 22 to 24 of pregnancy. and may become available for use in cats.

Plasma relaxin concentrations increase from days 20 to 30 after mating and remain elevated throughout pregnancy and for the first few days after birth. The luteotropic effects of relaxin help to maintain pregnancy and result in relaxation or softening of the connective tissues of the pelvis.

Abdominal palpation is the most common method for diagnosing pregnancy in queens. Fetuses may first be palpated at day 17 (2.5 weeks of gestation) as discrete, firm, spherical nodules that are 2 to 2.5 cm in diameter. By day 25 (3.5 weeks of gestation), fetuses are no longer discretely palpable. Instead, generalized uteromegaly is evident and remains palpable through parturition. By week 7 of gestation, fetal heads can be palpated. With experience, palpation is very reliable for detecting pregnancy and is the most economical and practical method. Imaging methods used for pregnancy diagnosis include radiography and ultrasonography. Calcification of the fetal skeletons may occur as early as day 38 of gestation but is not a reliable finding until day 43. Therefore, to ensure diagnostic results, radiography should be performed after day 43 of gestation. Uteromegaly may be seen before this time but cannot be distinguished from pyometra or other inflammatory uterine diseases. Abdominal radiographs are most useful for evaluating litter size before parturition. Ultrasonography is rapid, safe, and reliable for pregnancy detection in cats. Ultrasonographic evidence of pregnancy may be seen as early as 11 to 14 days, and fetal heartbeats can be recognized at 3.5 to 4 weeks of gestation.

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Popular Article

Anesthetics used in aquaculture

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Introduction

The anesthetics most commonly used in aquaculture are clove oil, etomidate, quinaldine, quinaldine sulphate, tricaine methane sulphonate (MS-222), and 2-phenoxyethanol. The most common anesthetic drugs used in fish are MS-222 (Tricaine), benzocaine, isoeugenol, metomidate, 2-phenoxyethanol, and quinaldine.

Why anesthetics are used in transportation of ornamental fish?

Conversely, anesthesia reduces metabolic rate, need for oxygen, activity, and response to stress enabling fish to be transferred in higher densities more efficiently.

Stages of anesthesia in fish

Stage	Condition	Behaviour/Response
L	Sedation	Motion & breathing reduced
II	Anaesthesia	Partial loss of equilibrium Reactive to touch stimuli
III	Surgical anaesthesia	Total loss of equilibrium No reaction to touch stimuli
IV	Death	Breathing & heart beat stop Overdose - eventual death

The stage achieved usually depends on the dose and the length of exposure. When an aesthetic is first administered (induction) fish may become hyperactive for a few seconds.

Methods of anaesthetizing fish and shellfish

- Immersion (Waterborne or Inhalant) Drugs
- Injectable Anesthetics

The stage achieved usually depends on the dose and the length of exposure. When an aesthetic is first administered (induction) fish may become hyperactive for a few seconds.

Methods of anaesthetizing fish and shellfish

- Immersion (Waterborne or Inhalant) Drugs
- Injectable Anaesthetics

Fish are usually anesthetized by immersing them in an aesthetic bath containing a suitable concentration of drug so that the drug is absorbed through the gills and rapidly enters the blood stream.

Figure: - 1 Immersion (Waterborne or Inhalant) Drugs

TricaineMethanesulfonate (MS-222)
Clove Oil, Eugenol, Isoeugenol, and Aqui-S
Benzocaine
Metomidate
2-Phenoxyethanol
Quinaldine and Quinaldine Sulphate
Isoflurane and Halothane

Oxygen

Oxygen is a sedative for some elasmobranch species. Oxygenated water is flushed across the gills by bubbling 100% oxygen in the flow of water directed into the animal's mouth. But prolonged exposure to elevated oxygen depresses ventilation and produces hypercapnia and potentially life-threatening acidaemia (Spotte 1992).

Injectable Anaesthetics

Ketamine Hydrochloride

Medetomidine

Xylazine

Propofol

Alfaxalone/Alfadolone

Factor effecting Anaesthetic

Many factors influence anaesthetic efficacy in fish. These are classified as biological and environmental variables. The rate at which anaesthetic medications become effective is frequently related to the gill area to body weight ratio, which varies greatly amongst fish species. Aquatic species also have varying metabolic rates, which influence how quickly drugs are absorbed and anaesthesia is established. Cold-water species, for example, appear to respond to lower anaesthetic concentrations than warm-water ones. There are also elements that can influence anaesthesia within a species. Larger people often require a higher concentration of anaesthesia than smaller people. It has also been noted that larger, more active fish in a group are anaesthetized faster than smaller fish.

Furthermore, sick or weaker animals are far more vulnerable to anaesthetic treatment. Environmental conditions can also have a significant impact on the efficacy of certain anaesthetics. Ectotherms organisms such as aquatic invertebrates and fish, where their body temperature closely matches that of their surroundings environment. As a consequence, the drug's physicochemical transit into the fish is likewise temperature dependent. MS-222, benzocaine, and 2-phenoxyethanol require higher doses or longer exposure times at lower water temperatures, presumably because the absorption rate reduces at lower temperatures. The pH of an anaesthetic solution can also alter its efficacy, possibly by influencing the charged-to-uncharged molecule ratio. This is especially noticeable with quinaldine, which loses potency in low pH solutions.

Conclusion

Anaesthetics are physical / chemical agents that relax animals and gradually lead them to lose mobility, equilibrium, consciousness, and, finally, reflex action. Anaesthetics are useful in fisheries and aquaculture for relieving stress caused by handling and shipping. Many factors can influence the efficacy of anaesthetic treatments; consequently, experimental dosages should be performed on a small sample of non-critical animals before performing large-scale anaesthetics.

Government agencies regulate the manufacturing, marketing, and use of chemicals for environmental and human safety reasons. The FDA controls the use of chemicals on food fish in the United States. MS-222 is the only chemical anaesthetic currently approved by the FDA for use on food fish; it needs a 21-day withdrawal period. These regulations are subject to change, and users should be aware of above criteria.

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Popular Article

MALDI – TOF: A Modern Technique for Identification of Microorganism

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What is MALDI-TOF MS?

Mass spectrometry has been commonly used by research laboratories and it is regarded as a promising technique as to the rapid identification of microorganisms. Mass spectrometry applied to the identification of micro- organism. MS is another method that may be of great help to microbiological diagnosis. Furthermore, it has been widely used as a research tool, mainly in proteomic and lipid analyses. Several techniques based on ionization and subsequent biomolecular detection have been developed and the matrix assisted laser desorption/ionization-time of flight (MALDI-TOF) has been one of the mostly applied.

Matrix-assisted laser desorption ionization–time of flight mass spectrometry (MALDI-TOF MS) has emerged as a rapid, highly accurate, and cost-effective method for routine identification of a wide range of microorganisms. Mass spectrometry is an analytical technique in which chemical compounds are ionized into charged molecules and ratio of their mass to charge(m/z) is measured. Fresh colonies (< 24h) are preferentially selected for performing bacterial identification by MALDI-TOF MS.

How Does MALDI-TOF MS Work?

In clinical microbiology, direct colony testing, is not as user friendly for clinical microbiology applications and thus is generally reserved for processing hazardous or difficult-to-lyse organisms. Direct colony processing is easiest, fastest, and least expensive. A colony is “picked” from a culture plate to a “spot” on a MALDI-TOF–MS target plate. The addition of a formic acid solution to the MALDI plate may be used to improve the quality of the generated mass spectrum, which may be particularly helpful for certain types of organisms, such as yeasts. After drying, the target plate is placed in the mass spectrometer’s ionization chamber. In MALDI (matrix-assisted laser desorption ionization), a matrix (e.g., alpha-cyano-4-hydroxycinnamic acid dissolved in 50% acetonitrile and 2.5% trifluoroacetic acid) assists in the desorption and ionization of microbial analytes through the energy of a laser. The matrix isolates analyzed molecules and protects them from fragmentation by the laser. As a result of being “shot” by the laser, microbial and matrix molecules are desorbed, with the majority of energy being absorbed by the matrix, converting it to an ionized state.

Through random collision in the gas phase, charge is transferred from matrix to microbial molecules. The ionized microbial molecules are accelerated, based on mass-to-charge ratio, into a TOF (time-of-flight) mass analyser, a tube under vacuum. Ion's travel toward an ion detector, with smaller analytes reaching the detector first, followed by progressively larger analytes. A mass spectrum is generated, representing the number of ions of a given mass impacting the ion detector over time

How Does the Analysis Work?

For clinical microbiology applications, highly abundant microbial proteins such as ribosomal proteins are the main contributors to the generated mass spectrum, although specific proteins are not identified and their mass and abundance are merely profiled. In general, mass spectra are unique to individual organism-types, with peaks specific to genera, species, and strains. The mass spectrum of the test isolate is compared to a database of reference spectra or deconvoluted spectra to determine relatedness to spectra in the database; the most closely related organisms are identified with a value provided as to the level of confidence in identification. Depending on how high the value is, the organism may be identified at the family, genus, or species level.

Applications in Microbial Diagnosis

MALDI-TOF MS in Bacteriology: Clinical microbiology laboratories require rapid, reliable, and cost-effective methods for identification of potential pathogens in clinical samples so that appropriate antimicrobial therapy maybe initiated early. A number of researchers have shown that MALDI-TOF MS can be used for early identification of bacteria in blood cultures, urinary tract infections (UTIs), cerebrospinal fluids, respiratory tract infections, stool samples etc.

Food-and Water-Borne Bacteria: Rapid identification of pathogenic microorganisms is important to ensure safety and quality of water and food products. MALDI TOF MS has been shown to be useful for early detection of bacterial hazards which might contaminate drinking water.

Environmental Bacteriology: Tests based on biochemical traits usually fail to identify microbes isolated from environmental samples, as the diversity of microbes in these habitats is enormous. Various studies have shown that whole cell MALDI-TOF MS can be used as an efficient tool to identify and characterize isolates which originate from specific ecosystems.

Researchers have reported the use of MALDI-TOF MS in identification of microbes isolated from sewage sludge.

Biological Warfare: Fast and reliable identification of microbes which pose threats as agents of bioterrorism is required, not only to combat biological-warfare attacks, but also to prevent natural out breaks caused by these organisms. Recently various researchers reported MALDI-TOF MS as a simple, rapid and reliable approach to identify highly pathogenic organisms like Brucella spp., Coxiella burnetti, Bacillus anthracis, Francisella tularensis, and Y. pestis.

Detection of Antibiotic Resistance in Bacteria: MALDI-TOF MS has been shown to generate PMF capable of discriminating line ages of methicillin-resistant S. aureus strains Similarly, MALDI-TOF MS has been shown to be of great use in identifying vancomycin resistant enterococci.

Bacterial Strain Typing and Taxonomy: MALDI-TOF MS for rapid characterization of pathogen. They also determined strain-specific differences and it was a powerful tool for the identification of clinical isolates. MALDI-TOF MS was used for rapid identification often different species, when the results of species identification obtained by MALDI TOF MS were compared with the phenotypic/genotypic identification systems, a 100% consonance was achieved.


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Monograph

Nitrate Poisoning in Farm Animals

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Introduction:

Nitrate poisoning is a rare but important cause of poisoning in cattle. It can occur as the result of eating crops such as Brassicas, green cereals or sweet clover that contain high levels of nitrate. However, the most common source is inorganic nitrate fertilizer, either directly (straight from an open bag), via grazing an over-fertilized field, or via water run-off from heavily fertilized fields. Spring is the most common season for nitrate poisoning.

(Source:https://agsolutions.com.au/2020/02/06/nitratepoisoning/)

Sources:

a. **Fertilizers:** Nitrogen fertilizer, Manure increases soil nitrate concentration, application of urea to the crops, on a subsequent day if animals are grazed on such crops are succumbed due to nitrate poisoning, not due to urea poisoning

b. **Plants:** Zeamaize, cabbage, Barley, linseed, lucerne, maize, millet, oats, rape, Johnson grass (Sorghum variety), soybean, subterranean clover, Tama ryegrass, wheat. In unfavourable conditions like a sudden change in the weather, low soil pH, low soil temperature, and soil deficient in minerals are contributing to nitrate accumulation in the leaves, and lower parts of crops such as wheat, barley and oats. Mostly lower parts of plants have the highest nitrate content like stem>roots>leaves>seeds.

c. **Industrial effluent:** Effluent from dairy, meat industry and other organic industries may accumulate nitrate in their leaves and stems. Due to its high mobility, nitrate also can leach into groundwater. If people or animals drink water high in nitrate, it may cause methemoglobinemia, an illness found especially in infants (Self and Waskom, 1992).

a. **Water:** Nitrate (NO3) is a naturally occurring form of nitrogen found in soil. Nitrogen is essential to all life. Most crop plants require large quantities to sustain high yields. The formation of nitrates is an integral part of the nitrogen cycle in our environment. In moderate amounts, nitrate is a harmless constituent of food and water. Plants use nitrates from the soil to satisfy nutrient requirements and may accumulate nitrate in their leaves and stems. Due to its high mobility, nitrate also can leach into groundwater. If people or animals drink water high in nitrate, it may cause methemoglobinemia, an illness found especially in infants (Self and Waskom, 1992).
b. Dynamites explosion contains ammonium nitrate

Factors affecting nitrite poisoning:

a) **Species:** Ruminants are highly susceptible due to the rumen bacterial nitro reductase enzyme which converts nitrate to nitrite. In Horses nitrite conversion takes place in the caecum, in the swine some extend in the small intestine. Monogastric-like pigs are less likely to affect by nitrate as no conversion of nitrite and the pigs drink drainage water that has become heavily contaminated. Sometimes nitrate causes irritation to gastric mucosa leads to vomiting, diarrhea, abdominal pain
b) **Age of the plant:** mature plants contain fewer nitrates than growing plants. In mature plants, nitrate is used for protein synthesis and has less chance of toxicity while in growing plants, nitrate is being used for roots and shoots and contains more nitrate likely to cause more toxicity. Plant stressors, such as drought, are associated with increased levels of nitrate in plants. Soils high in nitrogen readily supply nitrate to plants. Additionally, factors such as acidic soils, sulphur or phosphorus deficiencies, low molybdenum and low temperatures are known to increase nitrate uptake by plants.
c) **Dose and duration of ingestion:** large quantity intake in a short time more poisoning
e) **Deficiencies:** Deficiency of Vitamin A exaggerated nitrate toxicity
f) **Adaptability:** lack of prior exposure to nitrate
g) **Poor quality f carbohydrate diet:** as an absence of carbon skeleton which hampers ammonia utilization for protein synthesis
h) **Hypovitaminosis:** Nitrate interfere with the utilization of Vitamin A, D and E, and also Iodine
i) **Other health factor:** Presence of anemia or methaemoglobinurea hasten nitrate toxicity

Toxicokinetic:

If an animal's nitrate intake is too high, or if conditions are not right for the conversion of nitrite to ammonia in the rumen, nitrite will accumulate and may be absorbed into the blood. Nitrite may also be absorbed directly from fodder such as hay if it becomes wet or mouldy. Microbes on the fodder convert nitrate to nitrite under these conditions. Nitrite reduces the ability of the blood to transport oxygen throughout the body of the animal. If the nitrite level is high enough, death can occur through oxygen starvation.

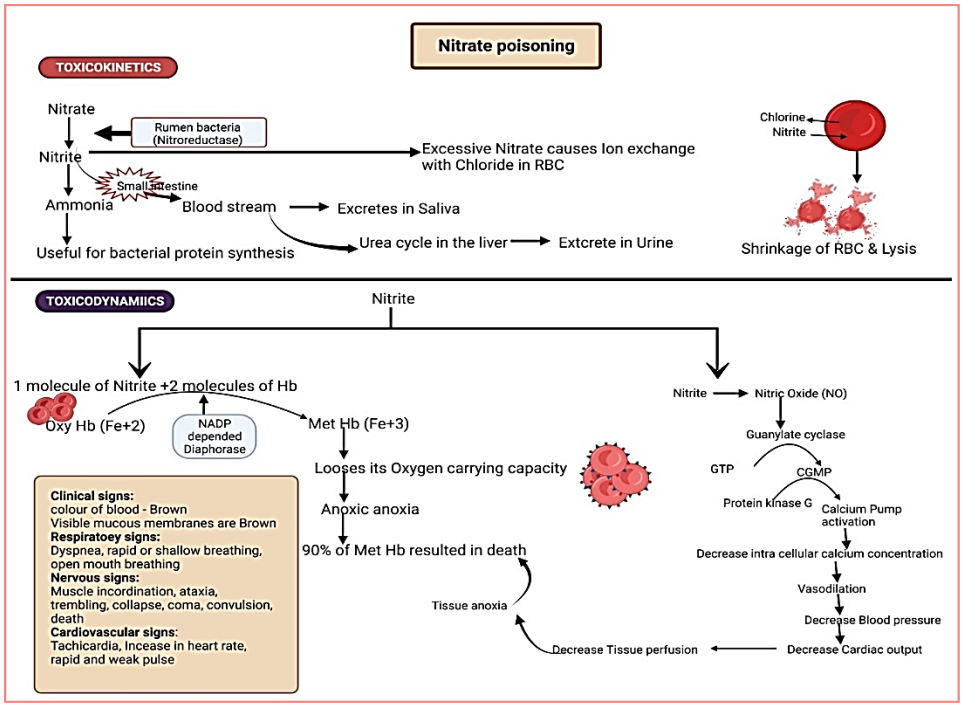
Non-ruminants, such as horses and pigs, have no mechanism for converting nitrate to nitrite in their digestive tracts and so are not in danger of getting nitrite poisoning from an excessive intake of nitrate. However, they are highly susceptible to oral intake of nitrite (for example, in mouldy hay) because they cannot convert the nitrite to ammonia.

Toxicodynamic

Nitrite: effect RBC and vascular endothelial cells after being absorbed in the bloodstream.

a) RBC: nitrite converts oxyHb (Fe+2)to MetHb (Fe+3) by NADP-dependent diaphorase enzyme systems 1 &2 when there is excess nitrite, this enzyme system gets saturated in more concentrated metHb If MetHb % is more than 20 % indicative, not harmful, while 50% and 90% showing signs and death respectively

b) Vascular endothelial cell: Nitrite will convert to NO in the vascular smooth muscle due to the presence of acetylcholine and causes vasodilation through Guanylate cyclase enzyme (Depicted in the picture)



Clinical sings:

1. Acute toxicity:

- GIT effects: Local irritation, vomiting, diarrhea, colic, micturition
- CVS effects: Tachycardia, increase in heart rate, rapid and weak pulse rate
- Respiratory effects: dyspnea, rapid/shallow breathing, open mouth breathing
- Nervous effects: muscle incoordination, ataxia, trembling, collapse, coma, terminal convulsion and death
- Death 12-24 hrs.

2. Chronic toxicity:

- Early abortions, nitrate interfere with implantation of fertile ova, infertility mostly due to less O_2 supply, anorexia, hypothyroidism, hypovitaminosis of A, D and E
- Mucous membrane: cyanotic
- Post mortem findings:
- Mucous membrane – cyanotic
- Dark chocolate brown color blood, tissues and organs due to methaemoglobin
- Pin-point hemorrhages may be present in the heart and trachea along with general congestion of the blood vessels.

Mud coloured mucous membranes

Source : http://www.flockandherd.net.au/cattle/ireader/nitrate-toxicity-cattle.html

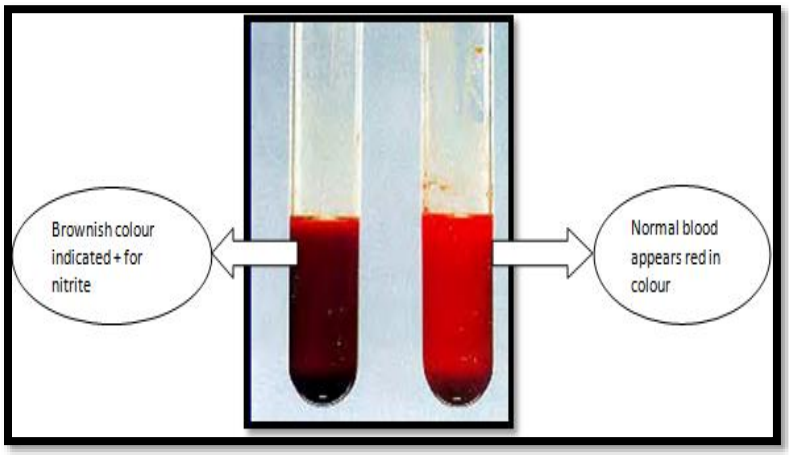
Bloody foamy oozing from nose
Source: Oruc, et al (2010)

Un clotted brown coloured blood
source: Nagarajan et al (2015)

Diagnosis:

a) Based on history

b) Based on clinical signs: cyanotic mucous membrane, presence of chocolate brown color blood (McKenzie et al, 2004; Latimer, 2011)



c) Laboratory diagnosis: estimation of blood concentration of nitrate and nitrite levels. If the nitrate and nitrite levels more than 20 ppm and 0.75 ppm respectively indicated positive

d) Rumen contents can be analyzed for nitrite levels

e) Estimation of percentage of methemoglobin (more than 70% indicated for death)

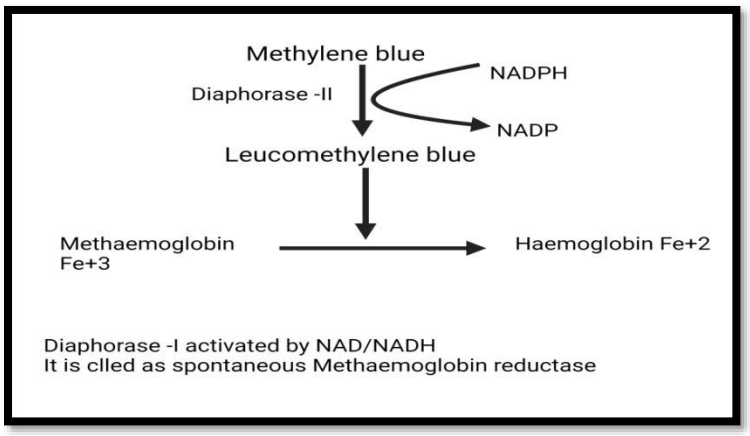
f) Eyeball and aqueous humor under refrigerated conditions which do not undergo bacterial decomposition in dead animals, more than 30 ppm of nitrite in ocular fluid indicative of its poisoning. Also, analysis of the aqueous humor using a Merck quant Strip test which is a field test for veterinarians (Ensley and Rumbeiha, 2012).). after the death of suspected animals with nitrite poisoning the collection of rumen content, urine, serum, plasma is not useful because of bacterial decomposition. Diphenylamine blue test for estimation of nitrate content in plants materials

Differential Diagnosis:

1. **Cyanide poisoning:** death is rapid 1-4 hrs., venous blood color appears as bright red or cherry red (Hemoglobin carries oxygen but is not utilized by the tissue and cherry red colored due to oxyhemoglobin), the bitter almond smell of gastric content.
2. **Hydrogen sulphide (H2S) poisoning:** the color of blood seems to be dark due to sulphides, and stomach content will be dark with rotten egg smell.
3. **Carbon monoxide (CO) poisoning:** the color of blood seems to be bright red in arteries and cyanotic in venous (carboxy hemoglobin formation as CO is 200 times more affinity for hemoglobin than O_2)

Treatment:

1. Animals can be treated by intravenous injections of methylene blue. Commercial preparations intended for the treatment of prussic acid poisoning only should not be used to treat nitrate poisoning. Methylene blue is not approved by the Food and Drug Administration for use in food-producing animals. Methylene blue (Isotonic solution 1%in distilled water) @8.8mg/kg for ruminates IV route 4.4 mg/kg in other animals' species. Methylene blue is a reducing agent and converts methemoglobin to hemoglobin and restores normal oxygen transport by the red blood cells. The half-life of methylene blue is about 2 hours, meaning that small doses can be given repeatedly every few minutes until the animal is not exhibiting severe respiratory distress.



2. Ascorbic acid@5-10mg/kg BW
3. Supportive therapy:

a. Adrenaline infusion 0.05 µg/kg/min
b. Blood transfusion
c. Saline purgative ex: magnesium sulfate (cattle, 250–500 g; horses, 30–100 g; pigs, 25–125 g; dogs, 5–25 g; cats, 2–5 g), sodium sulfate (cattle, 500–750 g; horses, 250–375 g; pigs, 30–60 g; dogs, 5–25 g; cats, 2–5 g), sugar alcohols (mannitol and sorbitol), lactulose (dogs, 5–15 mL, t.i.d., per os).
d. Mineral oil or demulcent to soothe GIT like glycerine, liquid paraffin, egg white, honey gruels administration n(mineral oil or liquid paraffin cattle, 250–500 mL; horses, 250–1000 mL; pigs, 25–300 mL; dogs, 5–30 mL; cats, 2–6 m)
e. Vitamin supplementation
f. Administration of broad spectrum antibiotics in cold water to suppress microflora chlortetracycline @30mg/kg BW for 5 days

Prevention:

✓ Prevent access to nitrate sources. In particular, prevent cattle getting into fertiliser stores. Ensiling high nitrate pastures will usually reduce the nitrate levels to safe levels (as will allowing the pasture to set seed).

- ✓ Feeding a high grain diet alongside high nitrate forage has a protective effect because carbohydrates enhance the conversion process from nitrate to microbial protein.
- ✓ When grazing, feed a dry roughage first to reduce the amount of affected plants ingested by hungry animals.
- ✓ Harvested forages that are high in nitrate often can be fed safely by mixing them with other feeds to reduce the total dietary intake of nitrate.
- ✓ Ruminants can tolerate fairly high levels of nitrate in their diet if the intake is spread over the whole of the feeding day their diet is also high in readily available carbohydrate, which is needed to fuel the microbial activity in the rumen, if these conditions are not met, the nitrate can accumulate, resulting in poisoning.

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Review Article

First – Aid in Veterinary: A Review

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Introduction:

In veterinary practice first-aid is very important for saving the life of animals. First-aid is the initial treatment given to the animal till we are approaching to a veterinarian or a veterinary hospital for appropriate treatment. It can also define that "The initial administration of care of an injured animal until more thorough veterinary attention can be sought." There are number of reasons and emergency conditions for which the first – aid provided to the animals. However, there are some emergencies in which first – aid is required to the pets or other animals. Few of the emergencies which may threaten the life of our pets or other domestic animals, are listed here.

- Dyspnea
- Automobile Accident
- Fracture
- Hemorrhages
- Cardiac Arrest
- Shock
- Seizures
- Toxicity or poisons
- Heat stroke
- Burn

Points to be consider in emergencies

- First of all, we should not be panic from the prevailing or existing situation.
- Then we have to call our veterinarian.
- Till the arrival of our veterinarian, we people have to do certain things.
- The name, mobile no and address of veterinarian should be kept at ready hand.

- There is an emergency first – aid kit, which may have different things that include –
    - Adhesive tapes
    - Blankets
    - Blunt end scissors
    - Wound wash
    - Antiseptic solution
    - Cotton bandage

Now we will discuss that what things, we have to do in different types of emergencies -

Dyspnea

Dyspnea means difficulty in breathing. This may be due to cardiopulmonary arrest. When there is cardiopulmonary arrest, we people have to perform cardiopulmonary resuscitation (CPR). There is ABC of CPR.

A stand for patent airways

B stands for breathing &

C stands for circulation

First of all, we must have to see that, the respiratory tract should be clear. There should not be any type of obstruction in the respiratory tract. When the animal is of cooperative nature then we can remove the foreign bodies with the help of tweezer or plier easily. The tongue of the animal is gently pulled forward to locate the foreign body in the mouth. If the foreign body is lodged in the mouth or trachea or esophagus forceful attempt to remove it should be avoided because it may aggravate the condition. We can provide rescue breathing. In that the mouth of the animal closed and by making funnel of our both hands on the nostril of the suffering animal, we have to blow air on the nostril so that the respiration can be normally started. Antibiotics and bronchodilators such as theophylline can be used immediately if available to prevent bronchospasm (Wong, 2006 and Zhu, 2015).

Automobile Accident

If you come across an animal that has met with road accident, here are some initial things that you could do to keep the animal comfortable and free from stress.

- Place the animal in a cool, well-ventilated place or a shaded area under the tree.
- Give small amounts of cold-water containing glucose or sugar frequently.
- Ice packs should be applied on the head, forehead and all over the body. If you cannot get ice, use cold towel press it on the head and chest of the animal.
- If bleeding is profuse, apply some pressure at that site to minimize blood loss and prevent the animals to go in hypovolemic shock.
- Once first aid has been administered, and the animal is stable, consult a vet.

Fracture

Fracture is one of the most common emergencies in veterinary field, in which first-aid may be required. Most fractures resulting from direct trauma are either comminuted or multiple (Brinker, 1974). At the fractured site first of all hemorrhage must have to be controlled. Then the fractured site should be handled as less as possible, so that there will not be more damages to the tissues in the vicinity of the fracture. Since it is important to immobilize the fracture to prevent reinjure of the trapped nerve or injured blood vessel (Ellsasser, 1975). Moreover, homemade splints can be applied, till the arrival of a veterinarian or we are approaching to the veterinary hospital. It is important to remember that the entire animal may need treatment, as well as the fracture.

Hemorrhage

Hemorrhage is the leading cause of morbidity and mortality in surgery and trauma patients (Nunez, 2009). Hemorrhage may be internal or external. Immediate steps must be taken to check hemorrhage. There are number of techniques or methods, which can be adopted to check the hemorrhage. First of all is the digital pressure. In this method we have to keep pressure of our fingers or palm on the bleeding artery or vein or at the site of hemorrhage. Capillary blood is the most common and is slow due to the blood vessels being under low pressure. Pressure bandaging is also one of the methods for controlling hemorrhage. As far as the first – aid is concerned, we can apply tourniquet above the affected region. But this tourniquet should be kept loose after every 20 minutes for 2-3 seconds.

Cardiac Arrest

If there is stoppage of the heartbeat, then we can massage the heart of the pet or other animal with our hand. But here again we have to kept in mind that there should not be massage of the heart as well as rescue breathing simultaneously. These methods should be performed alternatively one after the other.

Shock

In case of the shock, the primary cause of the shock should be removed. There are number of classes or types of shock. The shock may be hemorrhagic, vasogenic, septic, anaphylactic & neurogenic. Shock is a result of a collapsed circulatory system that can happen due to stress, blood loss, fluid loss, low blood pressure and damaged heart. Many animals which are badly injured show sign of shock like, rapid pulse and breathing, hypothermia, pale / white gums, animals may shiver & birds fluff their feathers, an animal in shock is usually still, quiet and cold. The animal's eyes should

be covered in order to reduce stress. Any visible signs of bleeding should be stopped. Animal should be kept in warm & quiet place. Oral fluid should not be given to animals in shock. Once the animal has warmed up, warm fluid can be given. The fluid therapy should be provided in the shock. When there is electric shock, we people must be assured that there should not be electric or power supplied to the suffering animal.

Seizures

It is also one of the emergencies in which first – aid is required. We must take into consideration that the animal or pet who is suffering from the seizures should not collapse on the furniture or any other object nearby. The seizures or fits will last for 2-3 minutes. Seizures may be due to poisons or ingestion of toxins.

Toxicity

Poisons can be swallowed, inhaled or absorbed through the skin. Poisoning of native animals generally occurs through ingestion of the poison (e.g., rodenticide) or by eating prey that has been poisoned. Insectivorous mammals may be affected by insecticidal poisons. In cases of toxicity or poisons, there may be vomition & diarrhea. We people have to examine the vomitus for presence of any poisonous substances. Vomitus must be packed in a plastic bag or container for bringing the material to the veterinarian along with our patient.

Bee or venom bites or sting

Bites and stings can be dangerous to an animal, if they are allergic to the venom injected. Signs of bites or stings can include drooling of saliva, vomiting, muscle weakness, difficulty breathing and convulsions. Pressure immobilization is used for snake & spider bites. Cold compress can be applied to other bites and stings. There are also chances of bee or wasp sting to our pet or animals. The sting of bee is acidic in nature, so it can be neutralized by applying baking soda. However, the wasp sting is alkaline in nature, which can be neutralized by applying vinegar or lemon juice on the site. Antihistamine cream is also applied on the region.

Heat stroke

Summer hyperthermia (heat intolerance syndrome) is one of the commonly encountered clinical conditions of exotic and crossbred dairy cows during summer months in India (Chhabra, 2008). There are number of signs exhibited by the animal suffering from heat stroke. There may be panting, polypnoea, seizures etc. Immediately the suffering animal is to be brought at cool and shaded place. Animal should be cooled by hose water or pipe. Here we again like to emphasis that the suffered

animal should not be bath with extremely chilled water, which will create another problem like going animal in shock further. Wet towel should be wrapped around the animal body.

Burn

Animals with burn require veterinary attention unless the burn is very mild. An animal with burns to over 50% of their body has no positive prognosis & euthanasia is recommended. The treatment adopted should be multidimensional. These include restoration of fluid and electrolyte loss, protection against mechanical injury, prevention of bacterial invasion and infection, maintenance of body temperature and removal of non-viable tissue while leaving viable germinal tissue for healing (Geiser and Walker, 1984).

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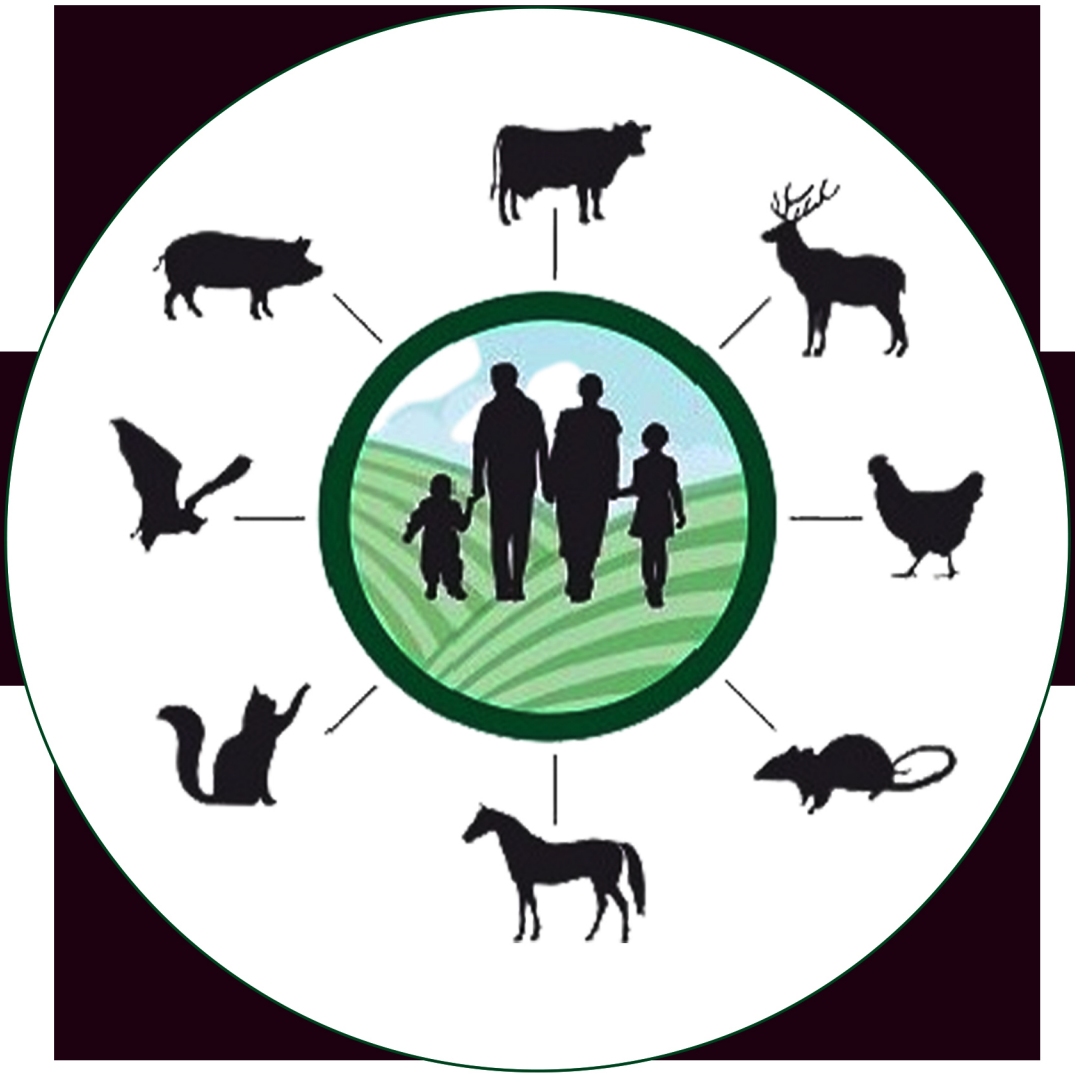

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