

Goat health

and sustainable goat farming in eastern India

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Goat farming has been a source of income for the resource-poor. It has vast potential as a startup and entrepreneurship with value addition and organic milk. The importance of goat milk has caught attention with recent outbreaks of dengue fever and the COVID-19 pandemic. Goat is a hardy animal with minimal investment for taking up goatary. Understanding health and management problems and their remedial measures can further sustain goat farming and enhance income. Farmers should be aware of important health management related to diseases like PPR (Peste des petits ruminants), ORF (Contagious ecthyma), endoparasitism, urinary stones, etc. commonly challenged in goat herds. However, these challenges can be easily overcome if suitable measures and understanding are attained.

Keywords: Entrepreneurship, Farming, Health, Profitable

Goat rearing plays a vital role in the socio-economic development of rural households. Goat is rightly referred to as 'Poor man's Cow', 'ATM' owing to their multi-dimensional use as meat, milch and wool/fiber animal and instant market for cash sales. Goat rearing is mainly restricted to marginal and small farmers except for a few scattered startups as commercial goat farms. Goat can survive on multiple unwanted shrubs and trees in challenging environments and unproductive lands. Apart from this, goats are considered to be among the most efficient domestic animals in water use efficiency nearing camels. It is also heat stress tolerant compared to other domestic species. Therefore, goats are never considered competitive for human food, unlike poultry and other domesticated and pet animals. Many breeds of goats have the potential to multiply extensively owing to their fecundity, such as Black Bengal goats. Goat milk is considered to have medical value due to the characteristic of the milk

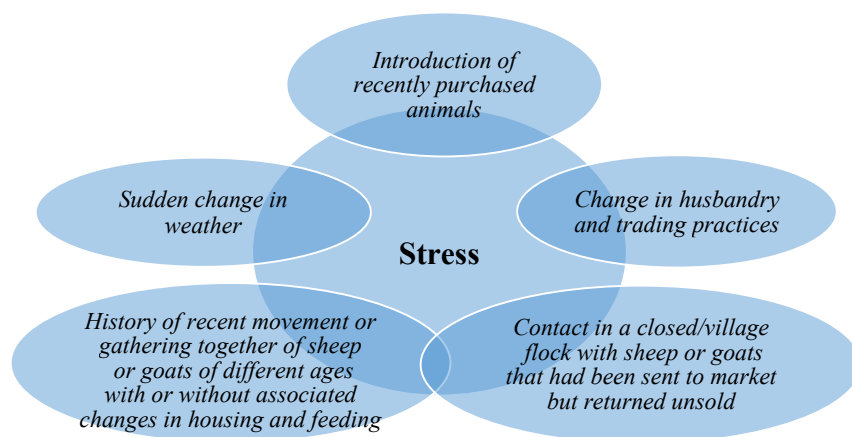
constituents, and few refer to it as grandmother's drug. Recently, goat milk has been used for the treatment of dengue infection and recovery from novel coronavirus disease (COVID-19) infection in humans. Dengue fever's main complications are the deficiency of selenium (Se) and a decrease in platelet count. Goat milk is a rich source of selenium which may benefit the control of Dengue infection. It is also reported to control elevated interleukin-6 levels in viral infection.

Despite these, the goat population in our country declined by 3.82% in the 19th census over the 18th census of livestock. Thankfully, the 20th census showed a positive trend (10.14%), owing to an increase in the female goat population over the last census. The total goat in the country was 148.88 million numbers in 2019. The possible causes of the current trend can be multiple. However, it is assumed that goat health, nutritional and social factors like decreasing agricultural, fallow land, and grazing area; changes in social dynamics; choices in selecting

animal protein as human food, etc. play the most limiting role. The increase in the female population and the decrease in the male population indicate excessive use of male goats for human food. Many of these factors are beyond control at the individual level or farm level. However, health constraints can be targeted and controlled. Among many health problems, goat plague (PPR), ORF, pox, endo-parasitism, and urinary stones are key issues affecting farmers and farms.

Goat plague/PPR

PPR (Peste des petits ruminants) is the most devastating viral disease of goats with heavy mortality (80–90%) and mortality (50–100%) rate and, therefore, is rightly called goat plague. Indirect loss accentuates the situation due to trade restrictions, long-term impact on survivors' health and production, and farmers' lost interest in goat farming. The disease is more severe in young aged and adults with compromised immunity. Recovered animals have lifetime immunity.



Diagrammatic representation of factors responsible for stress related to PPR promoting its transmission

Transmission: Close contact and confinement favour spread. The virus is discharged from infected goats for all body secretions (ocular, nasal and oral) and faecal discharges. There is no known carrier state. Fine infective droplets are released into the air from these secretions, and the excretions of infected animals are the transmission sources. Stress is considered an important factor in perpetuating clinical symptoms.

Clinical signs: The clinical signs of PPR in goats are often fulminating and fatal, although apparent infection occurs in endemic areas. In the acute form, there is a sudden onset of fever with an elevated rectal temperature of 40–41°C. The affected goats show dullness, sneezing and serous discharge from the eyes and nose. During this stage, farmers often think that the animal has developed cold exposure and may attempt to protect from it. In the process, goats may be congregated and it may accentuate the viral transmission. In 2–3 days, discrete lesions develop in the mouth and extend over the entire oral mucosa, forming diphtheric plaques. During

this stage, profound halitosis (foul smell) is easily appreciable and the animal cannot eat. Diarrhoea develops 3–4 days after the fever and is profuse and faeces may be mucoid or bloody depending upon the damage. Dyspnoea and coughing occur later due to secondary pneumonia. Death occurs within one week of the onset of the illness.

Control: Lesions around the eyes, nostrils and mouth should be cleaned twice daily with a sterile cotton swab. Our experience indicates that fluid therapy and anti-microbial such as Enrofloxacin or Ceftiofur on recommended doses along with mouthwash with 5% Boroglycerine can be of benefit in reducing mortality. Immediate isolation of affected goats from clinically healthy goats is recommended. Provide a soft, moist, palatable diet to the affected goats. If possible, parenteral energy infusion in anorectic goats along with appetizers may be useful.

Immediate biosecurity measures should be taken for notification of disease to the nearest government

veterinary hospital. Vaccination is the most effective way to control PPR. The vaccine can protect small ruminants against PPR for at least 3 years (Table 1). It is important to note that farmers should avoid providing any stress such as transportation, inclement weather, etc. to the goat for at least 3 weeks post-vaccination.

Table 1. Vaccination schedule of goat for disease prevention

Disease vaccine	Dose and method	Time schedule
PPR (Raksha PPR®)	1 ml and subcutaneously	Age of 4 months and annually
Brucella* (Rev. 1 strain vaccine)	1 × 10 ⁹ CFU and Subcutaneously	Age of 3–5 months (Female)
Enterotoxemia (ET vaccine)	2 ml and subcutaneously	Age of 4 month, and revaccinate 8 weeks later and annually
Goat Pox* (Raksha Goat Pox®)	1 ml and subcutaneously	Age of 3–4 months and annually

*Not in general use in field conditions in India.

Contagious ecthyma/ORF

ORF is primarily a disease of goats caused by a parapoxvirus with zoonotic potential. It is a highly contagious viral skin disease affecting the mouth, udder and coronet of the hoof. The disease is characterized clinically by the appearance of papules, pustules and scabs of the skin commonly in the mucocutaneous junctions at the commissures of the mouth and nose. It can also predispose these immunocompromised goats to other infections like mastitis, PPR, etc. Similar to PPR, stress plays a role in susceptibility to this disease.

Control is possible by avoiding the mixing goat and sheep populations; and isolation of infected goats from the herd. Though vaccines are available, vaccination is not practiced in the field situation. Recovery from clinical disease or vaccination provides only partial immunity for up to 3 months. Recurrence is common but is usually less severe. Treatment is supportive to keep the animal feeding and heal the lesions faster using 5% boro-



PPR affected goats with discharge from nose



Post mortem finding of lungs showing pneumonia of antero-ventral part, atelectasis in PPR



ORF affected goats with scabs at the mouth commissures



ORF affected goats with pustules on teats indicated with arrow marks

glycerine solution, antiseptic and fly repellents.

Endo-parasitism

Infection with endo-parasites remains an important problem goat farmers face in our country. Goats that graze are always exposed to parasites and are thus constantly re-infected even after routine deworming. These parasites cause losses to farmers in many ways. Goats with worm load tend to have poor growth rate, weak, diarrhoeic, neurological problems, anaemic and poor feed utilization. Parasitism can also cause decreased fertility, abortion, unthriftiness, increased susceptibility to disease and death. The most important intestinal parasites affecting goat health are the gastrointestinal trichostrongyles (Barber pole worm or *Haemonchus contortus*) in a commercial goat herd. In field conditions, goats kept on grazing often suffer from cyst formation (metacystode stage) due to cestode parasite primarily *Echinococcus* (unilocular hydatid cyst), *Taenia* (Gid, Coenurus cyst), etc. Goat acts as intermediate host which acquires eggs while grazing, released in faeces of canids. Effective control of this parasite will significantly contribute to the goat's health and reduce loss due to mortality.

Barber pole worm: Barber pole worm commonly referred to as *Haemonchus contortus*, is a major problem for goats specially if managed under a semi-intensive and intensive system of farming. It is copper-coloured worm. Adult male and female worms feed on blood and produce eggs. Adult females may deposit as many

as 5000 to 10000 eggs per day. Clinically characterised by anaemia, low packed cell volume (PCV), diarrhoea, dehydration, peripheral, and internal fluid accumulation. Recently it has become a significant problem limiting the productivity of goat farming. Indiscriminate and frequent use of anthelmintic and development of resistance, overstocking of goats, climate change such as high temperature and moisture and many other undetermined causes.

Control can be attempted by changes in the management and grazing, use of commercial anthelmintic, use of herbal plants, etc. When maintained in a good hygienic environment, goats can resist or tolerate internal parasites. A lack of cobalt promotes parasitism since animals use cobalt to synthesize vitamin B12. Forages that contain condensed tannins, like *Leucaena*, *Acacia*, allow goats to fight parasites better. Generally, shrub and tree foliage is likely higher in tannins than pasture plants and leguminous forages. Grazing land requires three year rest period for the complete cleaning of grazing land. The use of common salt, liming, and acidification with copper sulfate

are appropriate methods to reduce the burden in the grazing area. Composting is a good way to clean manure as the larvae and eggs of the parasite are destroyed. Mustard can be grown on grazing land as it is an excellent nematicide plant.

Effective broad-spectrum anthelmintics against adult barber pole worms are several benzimidazoles, levamisole, and macrocyclic lactones (doramectin, ivermectin, moxidectin). Few narrow-spectrum anthelmintics such as closantel and morantel are effective against adult worms.

Cestodes of goat: The most common tapeworm of the goat is *Moniezia expansa*. Adult tapeworms live in the gastrointestinal tract and are shed with faeces. Treatment is effective if praziquantel is provided. Metacystode infection in the goat is related to the stray dog population and its faeces as a source of infection in goats. They have zoonotic significance and therefore require stringent control measures and awareness among goat farmers about stray dogs and their role in disease transmission to goats and its consequence on human health. *Taenia multiceps* cause Coenurosis, an intestinal parasite of canids, and goat acts as an intermediate host. It can increase intracranial pressure and goat develop symptoms of head pressing or rotation depending upon the location of the cyst in the brain referred to as Gid. Similarly, echinococcosis is caused by *Echinococcus granulosus*, which is a primary parasite of canids, and goats act as an intermediate host.

Treatment and prevention depend on controlling stray canid populations and giving praziquantel at regular intervals.



Adult tape worm



Metacystode stage (cyst) in the subcutaneous region of abdomen

Urinary calculi

Urinary calculi (uroliths) is an important problem of intact and castrated male goats due to anatomical attributes (sigmoid flexure and urethral process), though it can occur in either sex. It results from mineral deposition in the urinary tract but is more problematic when in the urethra (urethroliths). Affected animals with partial obstruction have difficult and painful urination, such as straining and slow urination (dribbling). Sometimes with complete obstruction, the pain is exhibited as stomping of feet and/or kicking at the area of the penis. If interventions are not instituted immediately, the urinary bladder may rupture, resulting in a water belly and causing death. This nutritional problem is common in areas with high soil phosphorus or flocks fed on a high cereal grain diet with low calcium and phosphorus (>1:1) or those with access to graze and consume forages with high silica content.

Treatment depends on the severity, if a complete obstruction is found, surgical intervention is required to drain the urine and

dislodge the uroliths apart from fluid and electrolyte resolution. If a partial obstruction is suspected, a conservative approach of providing anti-spasmodic drugs and tranquilizers but is often not valuable for goats. Affected goats may respond well to oral supplementation of nausadar (Ammonium chloride) @10–15 g daily for 3–5 days along with vitamin A and E injections.

Control measures in such a herd should focus on increasing the calcium-to-phosphorus ratio (2:1), prophylactic supplementation of Ammonium chloride, and increasing the salt (NaCl) up to 4% in the animal ration.

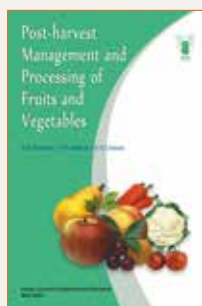
SUMMARY

Goat rearing is preferred by the poor and marginal farmers because of its easy handling, broader adaptation to diverse vegetation and climatic condition, high prolificacy in some breeds, smaller generation interval, economical in rearing, infrastructure and housing need as compared to other animals and ability to instant cash return because of high market demand. However, they suffer from many health

issues. Few, like pox and brucella may have zoonotic implications. Therefore, understanding goat diseases and ways and means to prevent or control them is very important for sustainable goat farming. Limitations related to animal health can be managed by raising awareness among goat farmers, especially those associated with significant health problems of economic importance. Prophylactic vaccines and control measures can prevent major infectious diseases like goat plague, contagious ecthyma, and pox. Parasitic infection, both eco and endo parasitism, needs regular screening, judicious use of effective drugs and herbal medicines, and scientific management strategies. Herbal medicine, especially those that are the natural food of goats, seems prospective. It is also vital for planners and implementing bodies to understand that resource-poor farmers keep goats. Control measures are available and effective. However, implementation on the part of the individual farmers and government needs greener shade.

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Post-harvest management technology offers promising option for increasing production of vegetables and fruits quantity-wise and also in maintaining quality of the products. It involves all the activities that occur after production or harvesting of commodities, including procurement, removal of field heat, sorting, grading, packaging, storage, transportation, primary and secondary processing and marketing of agricultural products from farm-gate to distributors. This book is an effort to document vast available knowledge on the various aspects of post-harvest management and processing, and it will prove worthy for teachers, students and extension workers for understanding post-harvest management and processing of fruits and vegetables. It has 16 chapters covering storage, packaging, advanced preservation technology and value-addition of fruits and vegetables.

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