

## Epidemiological observation of Cryptosporidiosis in adult beetal goats: First comprehensive study in Sub-Himalayan region

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Cryptosporidiosis is a highly infectious zoonotic waterborne disease caused by the species *Cryptosporidium* that poses a public health risk. Sheep and goats are intermediate hosts for *Cryptosporidium*. Cryptosporidiosis has such a severe impact on the farm economy, owing to high morbidity and, at times, high death of farm animals (Casemore *et al.*, 1985). *Cryptosporidium* sp. is a pathogen that causes gastrointestinal problems in domestic animals (cattle, buffalo, sheep, goat, pig, dog, cat, and horses), birds, fish, amphibians, reptiles, and humans, which is transmitted by faeco-oral route (Fayer *et al.*, 2000; Ahamed *et al.*, 2015). Infected animals shed a huge number of oocysts (108–109/g), which serve as a contamination reservoir for other animals and humans (Romero-Salas *et al.*, 2001).

In India, though cryptosporidiosis has been documented in does and goat kids, but no comprehensive epidemiological investigations incorporating tribal flocks have been described, with the exception of Jammu and Kashmir (J&K). Keeping in view the paucity of information available in India about *Cryptosporidium* oocyst rise in goats, this study was conducted to know the bio-load of cryptosporidiosis amongst milch breed (Beetal) reared in Jammu region (Sub-Himalayan Region). To our knowledge this is the first large scale comprehensive study conducted in the Jammu Region targeting female beetal does; a milch breed reared by socio-economically weaker sections.

### Sampling

This epidemiological study was conducted in and around Jammu division of J&K UT in the period of October, 2021 to December, 2021 (winter period) from the goat flock unit; sponsored by Sheep Husbandry Department, J&K (Beetal breed; Fig. 1) of socio-economically weaker sections. A total of 384 faecal

samples were collected directly from the rectum with random-effects model from age group 1-2 years, 2.-3 years and > 3 years old does reared in organised and unorganised management pattern which had history of poor and hunted growth over a long period despite being taken for browsing timely and timely dewormed mostly against nematodes and trematodes.

### Ethical clearance

The sampling procedures were approved by Faculty of Veterinary and Animal Science, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, Jammu and Kashmir, India (Institutional Animal Ethics Committee; approval. No: 07/IAEC-20/2021).

### Screening of samples for *Cryptosporidium* spp. Oocysts

Faecal samples of animals were collected directly from the rectum and thick faecal smears were prepared and air-dried. The faecal smears were stained by Acid-Fast staining (Henricksen and Pohlenz, 1981). After air drying the stained smears were observed under 100X magnification using oil immersion.

### Identification of *Cryptosporidium* oocysts

The *Cryptosporidium* sp. oocysts were identified as bright red spherical bodies against a blue background in the faecal smears, and infection was evaluated as positive or negative depending on the presence or absence of the oocysts (+1 as per OIE, 2008). A sample was considered positive if an oocyst with the right morphology was found.

Using Zeihl-Neelsen technique additional findings of *cryptosporidium* oocysts (Fig. 2) were identified with overall percentage of 42.9 per cent (165 out of 384) in organized and unorganized goat farms. Out of 165 animals positive for cryptosporidiosis only 10 animals were having diarrhoeic faeces and poor growth of age 1 year, rest of the animals were asymptomatic and all

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positive animals were reared in unorganised management system.

In organized farms overall percentage of cryptosporidium oocysts in faecal samples was found 35.1 per cent (19 out of 54) and in unorganized farms overall percentage of cryptosporidium oocysts in faecal samples was found 44.2 percent (146 out of 330). Overall age wise percentage of shedders were 28.1 per cent, 14.06 per cent and 0.78 per cent in age group 1-2 years, 2-3 years, >3 years respectively (Fig. 4.21). Age wise percentage of cryptosporidium oocyst shedders in two management systems includes 29.3 per cent and 14.8 per cent unorganized flocks of age group 1-2 years, 2-3 years while as in organized management system percentage shedders include 20.3 per cent, 9.2 per cent and 6 per cent of age group 1-2 years, 2-3 years, >3years respectively.

Cryptosporidiosis is a widespread intestinal protozoan disease in many agro-ecological zones across the world, posing a substantial threat to the global livestock sector. It is the most significant limitation to global livestock production (Akinkuotu and Fagbemi, 2014; Paul *et al.*, 2014). Our investigation is in agreement with the findings of Khan *et al.*, (2021) who also reported increased over all prevalence of cryptosporidiosis in age group 1-2-year-old group as compared to 2-3 years' group or above. Though in organised group showed increased incidence in >2-year-old group which can be attributed to the differences in hygienic conditions, environmental factors such as heavy rain fall, high relative humidity, high temperature, immune status of animal, feeding and watering management conditions. In our findings the

overall prevalence was 42.9 per cent which is in close agreement with Khan *et al.* (2021) who also reported 47.5 per cent prevalence in does. However, the overall prevalence of cryptosporidiosis in India is lower as compared to our findings and but Ahmad (2012) also reported 40.41% prevalence in goats of Jammu region using acid-fast staining technique. The geographical distribution with in one agro-climatic plane can vary as mentioned by Majewska *et al.* (2000) Veracruz has higher prevalence of cryptosporidiosis as compared to found in goats in Spain. In contrary to our findings Utaaker *et al.* (2017) reported very low prevalence of cryptosporidiosis in adult goats in northern region of India. As the Jammu region falls under the intermediate climatic region the difference in the values can be attributed to the difference in the agro-climatic conditions in the region as compared to the study by Utaaker *et al.* (2017), the parasite often survives cold environment conditions as mentioned Fayer *et al.* (2000) and Jenkins *et al.* (2003) who observed that *Cryptosporidium* oocysts can remain viable and infective for 4–5 months at 5–20°C. However, comparing the prevalence of *Cryptosporidium* infection in animals between locations should be done with caution because matching for animal traits and raising conditions is difficult.

Cattle, sheep, buffaloes and goats are frequently raised together in Jammu region, and this interaction along with poor hygienic sanitary conditions in the agroecosystems where they are raised might account for transmission of *Cryptosporidium* infection among animal species. Therefore, apprehensions are needed for

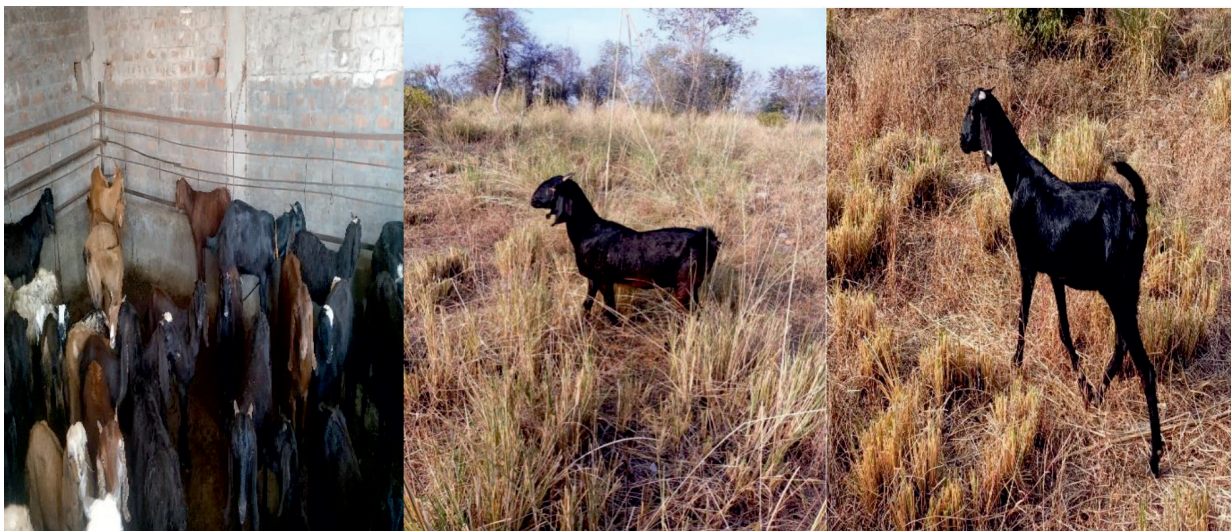
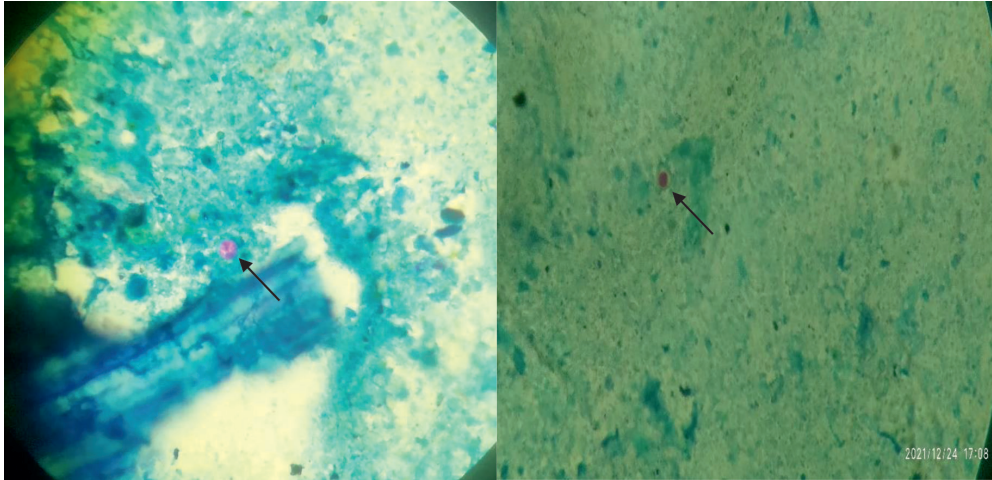


Fig. 1. Picture of Beetal Goat does reared by economic weaker sections in Jammu



**Fig. 2.** Picture of *Cryptosporidium* parasite oocyst in faecal smear of Beetal breed reared in Jammu region

the risk factors of transmission which lead to economic losses as well as reduced welfare of the flock.

The study is the first comprehensive report on *Cryptosporidium* sp. infection in goats reared by socio-economically weaker sections of Jammu region. Presence of *Cryptosporidium* sp. infection in goat population not only adversely affects per animal productivity but is also potential threat to other livestock, wild-life and human population. Further work is needed to determine the molecular epidemiology of MAP, risk factors and its impact on livestock of the region and devise preventive measures accordingly.

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