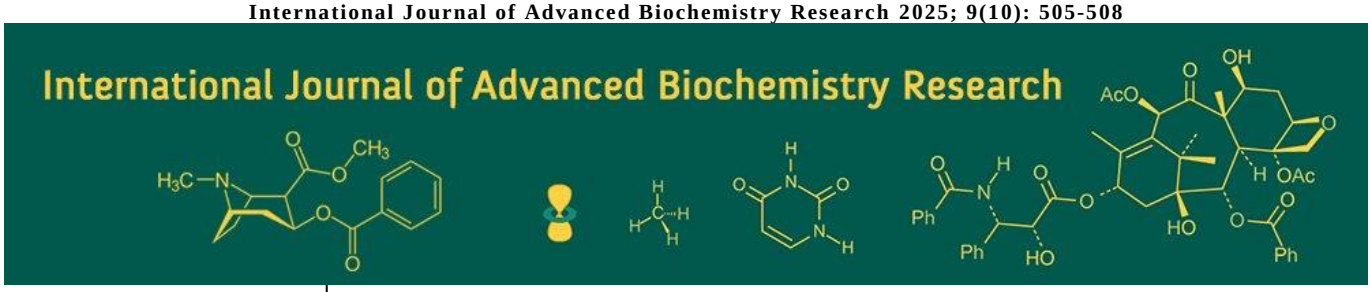

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Prevalence and Pathomorphology of *Haemonchus contortus* infection in small ruminants of Warangal, Telangana state

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Abstract
Haemonchus contortus, a highly pathogenic gastrointestinal nematode of small ruminants, continues to cause significant economic and production losses in tropical and subtropical regions. This study was conducted at the Department of Veterinary Pathology, College of Veterinary Science, Mamnoor, Telangana, from January 2022 to December 2024 to determine the prevalence and pathological changes associated with *H. contortus* infection in sheep and goats. A total of 121 post-mortem cases were examined; 19 animals were positive, indicating an overall prevalence of 15.7%. Gross findings included poor body condition, pale mucous membranes, submandibular and abdominal edema, abomasal mucosal pallor, catarrh, and hemorrhages with firmly attached parasites. Histopathological lesions varied with severity, ranging from mucosal edema and hyperplasia to degeneration, necrosis, eosinophilic infiltration, and cirrhotic changes in severe cases. Morphological identification confirmed the distinct "barber's pole" pattern in female worms. The study highlights the continued prevalence, characteristic pathological lesions, and potential role of *H. contortus* in causing anaemia, hypoproteinemia, and immunosuppression in small ruminants. Increasing anthelmintic resistance further complicates control measures, emphasizing the need for integrated management strategies.

Keywords: *H. contortus*, small ruminants, pathology, prevalence

Introduction
Small ruminants, including sheep and goats, form the foundation of the rural economy in many developing nations. In India, these animals play a particularly vital role, contributing substantially to the livelihood and economic stability of marginal and small-scale farmers. They serve as a readily available source of meat, milk, fibre, and manure, helping sustain agricultural operations even in areas where crop or dairy farming is not economically feasible. The adaptability of small ruminants to diverse climatic conditions and their ability to thrive on limited resources make them the livestock of choice in arid and semi-arid regions [1, 22]. According to the 20th Livestock Census, India possesses about 148.88 million goats and 74.26 million sheep, representing a major share of the nation's total livestock population. Telangana stands out as a leading state in both sheep population and mutton production, contributing nearly 8.94% of the total meat output in the country [18].

Despite their economic value, small ruminants face several challenges that limit productivity, with parasitic infections being among the most serious. Gastrointestinal nematodes, particularly *Haemonchus contortus*—commonly known as the "barber's pole worm"—represent one of the most pathogenic threats to sheep and goats worldwide [24]. This parasite is a blood-sucking nematode that primarily inhabits the abomasum, the fourth stomach compartment of ruminants. Under warm and moist environmental conditions, which are typical of tropical and subtropical regions, the free-living larval stages of *H. contortus* multiply rapidly, leading to heavy pasture contamination and recurring infections [1, 10]. The parasite feeds on host blood, causing significant blood loss—estimated at 0.03 millilitres per worm per day—resulting in haemorrhagic anaemia, hypoproteinemia, and general weakness [3]. Further, the infection is known to cause significant changes in haematological parameters like Hb, PCV and TEC and result in anaemia in 3 infected animals [10, 16, 24].

Infected animals often exhibit clinical signs such as submandibular edema (bottle jaw), pale mucous membranes, weight loss, reduced feed intake, and poor growth performance. Severe infestations may even result in death, particularly in lambs and lactating ewes, which have underdeveloped or suppressed immune responses. Beyond its direct physiological impact, *H. contortus* infection exerts a major economic toll by reducing productivity through decreased growth rates, milk yield, reproductive performance, and carcass quality [10]. Moreover, recurrent infections increase veterinary expenses and undermine farmer profitability, especially in low-input production systems where access to effective management practices is limited [1, 10].

The disease, known as haemonchosis, remains a major obstacle to sustainable sheep and goat farming in tropical and subtropical countries [4]. Its widespread prevalence and high pathogenicity make it one of the most challenging parasitic problems in small ruminant management [1, 2].

Emerging challenges involve the rapid spread of multidrug resistance, diminishing effectiveness of conventional therapies, and the occurrence of subclinical infections that reduce productivity in the absence of obvious clinical signs, making prompt diagnosis and effective control more difficult [27].

This study is conducted to know the prevalence and pathology *H. contortus* in this particular area which helps in understanding the disease and is essential to improve diagnostic approaches and inform prevention strategies against this highly resistant parasitic infection.

Materials and Methods

For the present study, samples were collected from the small ruminants brought to the post-mortem examination for diagnosis of the disease during January 2022 to December 2024. These cases were examined at the Department of Veterinary Pathology, College of Veterinary Science, Mamnoor, Telangana. Before conducting post-mortem the history was collected and animals were thoroughly examined for body condition. The lesions on post-mortem examination were recorded. The abomasal content was collected and examined under microscope for the demonstration of parasitic eggs and parasites lodged in the abomasum were macroscopically examined for identification. The abomasums of affected animals were dissected with the help of surgical scissors, and the abomasal contents were taken in a dissection tray. After washing in tap water, both the abomasums and its contents were examined thoroughly for the presence of *H. contortus*. The worms were manually picked up by forceps and collected in normal saline solution. *H. contortus* were identified morphologically using the key characteristics [24]. Tissue sections for histopathological examination were prepared following the standard method described by Lillie and Fullmer [17]. The tissue blocks were paraffin-embedded in accordance with standard procedure. Thin sections (4-5) were cut with a rotary microtome and stained with the standard Harris Haematoxylin and Eosin stain [19].

Results, Discussion and Conclusion

A total of 121 animals were examined during the study period to detect the prevalence of *Haemonchus contortus*. About 19 animals were found to be infected, indicating the overall prevalence of *H. contortus* was 15.7%. *H. contortus* was a predominant gastrointestinal nematode in small ruminants across multiple states of India, with prevalence rates varying regionally. In Uttar Pradesh, Singh *et al.* (2013) [23] reported 32% prevalence in goats and 32% in sheep (16/50 positive) in Mathura. In West Bengal, Ghosh *et al.* (2011) [12] found 70.17% prevalence in Garole sheep under field conditions, Jas *et al.* (2008) [13] recorded 68% prevalence in sheep. In Andhra Pradesh, Chiranjeevi *et al.* (2021) [5] documented 15.55% prevalence in sheep and goats from Prakasam district. In Chhattisgarh, Varadharajan *et al.* (2015) [26] reported 61.5% overall prevalence from 1,356 sheep and goat samples. In Tamil Nadu, Jeyathilakan *et al.* (2015) [14] documented 45.7% prevalence in sheep and 41.3% in goats, while Prakash *et al.* (2018) [21] recorded a 39% prevalence from 6,785 abomasal samples of small ruminants in Chennai. These findings highlight the extensive distribution and varying prevalence of H. contortus across Indian states and its continued impact on small ruminant health and productivity.

In faecal examinations eggs appear as thin-shelled and elliptical in shape (Fig.1) as mentioned by previous studies and differentiated from other strongylid nematodes [6, 9].

Grossly carcass showing poor body condition, pale mucosa of the eyes (Fig.2) in moderate infections, and in severe infections there is edema of submandibular and abdominal regions. On cut open the carcass findings include pallor of carcass tissues, fluid accumulation in the abdominal cavity. These gross lesions primarily manifests as anemia due to the blood-feeding activity of parasite. The larval stage (L4) initiates blood consumption and adult worms continue feeding in the abomasum, leading to clinical anemia within 10-12 days post-infection [3]. The severity of the disease depends on number of worms, immunity of host and host response to the haematopoiesis. Affected animals exhibit profound mucosal paleness, weakness and edema, progressive anemia, weight loss, submandibular edema, hypoproteinemia and in chronic (long-standing) haemonchosis it may lead to immunosuppression [16]. The prolonged exposure to smaller worm burdens may cause anthelmintic resistance [10]. The abomasal mucosa exhibits edema, catarrah and petechial to echimotic hemorrhagic lesions with firmly attached parasites (Fig.3). These results of gross pathological changes were similar to the previous studies. Hemonchus worms are identified by the distinctive spiral-striped “barber’s pole” pattern seen in females and the reddish coloration characteristic of males [7, 24].

Histopathological lesions in abomasum showing varied lesions based on the severity of infection. In mild infections, abomasal edema is observed along with thickening of the mucosa caused by hyperplasia of mucous cells (Fig.4); these findings have also been reported by Saminathan *et al.* (2015) [22] and Mannan *et al.* (2017) [20].

In moderate infections, abomasal glandular structures appeared degenerated and with a few areas of desquamation. The epithelial cells within the glands exhibited marked eosinophilia and necrosis. Gastric pits were occasionally filled with debris. Remnants of parasite tissue were detected on the surface tips of the mucosa. Oedema was observed in the deeper glandular layers, accompanied by infiltration of polymorphonuclear cells around necrotic regions. The mucosa muscularis showed mild proliferative changes, and both blood and lymphatic vessels were slightly dilated. These results were in line with the previous studies where they noticed degenerated glands with esinophilic

infiltrations [8, 20, 22].

In severe cases, mucosal lesions included oedema, desquamation, necrosis, and heavy polymorphonuclear infiltration (Fig.5). Cirrhotic changes were prominent, with most gastric glands replaced by cellular infiltration, while remaining glands appeared hyperactive and elongated towards the lumen. Mild proliferative activity was also noted in the submucosa, and the muscularis mucosa showed signs of hyperplasia, with clearly visible elastic fibres. The blood and lymphatic vessels were dilated, and large masses of adipose tissue were observed in the submucosa. Remnants of parasites were found within the mucosal layer (Fig .4). Similar histopathological lesions were been noticed by previous authors [1, 8, 20, 22].

Several researchers worldwide have documented similar lesions in *H. contortus* infections the abomasal tissue exhibited degeneration of mucosal glands, oedema, necrosis, and marked infiltration of inflammatory cells, particularly eosinophils [8, 20, 25]. Gastrointestinal nematodes release substances that promote the infiltration and movement of eosinophils, and in cases of haemonchosis, these cells are regarded as a key element of the host's cellular immune response against *H. contortus* [25]. Inflammation and infiltration of cells resulting into leakage of protein molecules leading to hypoproteinemia, which might be responsible for oedematic changes [9].

The study confirms that *H. contortus* remains a major cause of morbidity and production loss in small ruminants of Telangana with a15.7% prevalence, the parasite induces characteristic gross and histopathological lesions associated with anaemia and hypoproteinemia. The findings highlight the need for regular surveillance, strategic deworming, and integrated parasite control measures to sustain the productivity and health of sheep and goats.

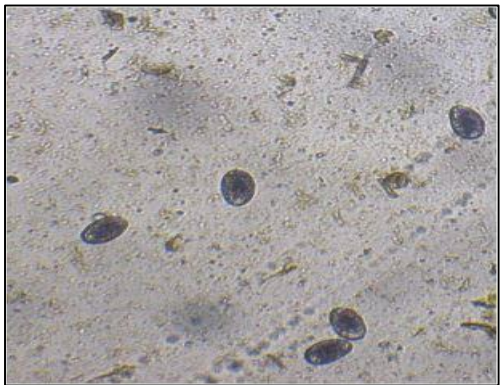

Fig 1: *Haemonchus contortus* egg in faecal **sample 100x**

Fig 2: Sheep showing pale mucous membranes

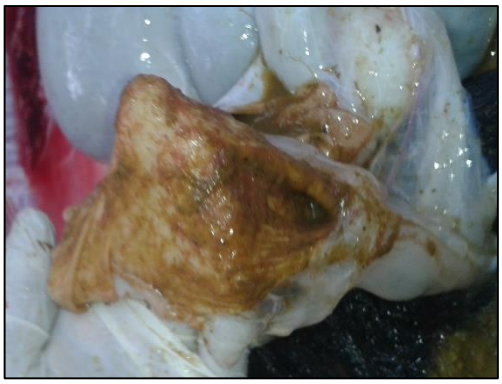

Fig 3: The abomasal mucosa showing edema and firmly attached parasites

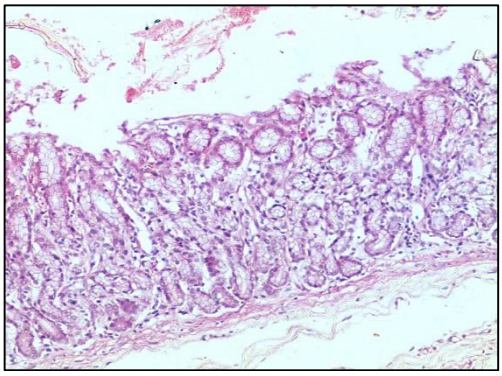

Fig 4: Abomasal edema and hyperplasia of mucous cells 200x

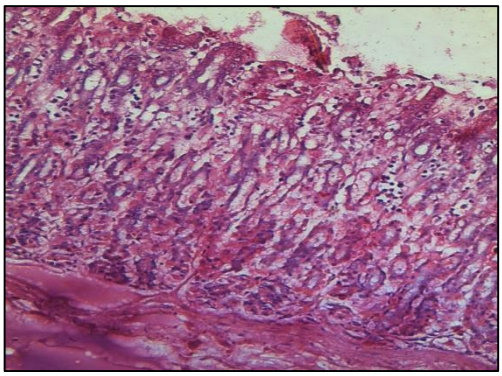

Fig 5: The abomasal mucosa showing oedema, desquamation, necrosis, and heavy polymorphonuclear infiltration 200x

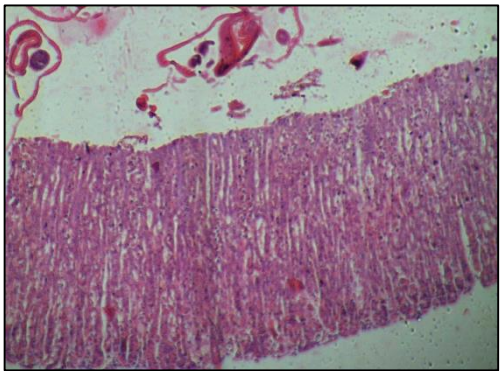

Fig 6: The abomasal mucosa showing edema and firmly attached parasites 100x

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