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EPIDEMIOLOGICAL INVESTIGATION OF PARASITIC INFESTATION IN SMALL RUMINANTS OF RURAL SETTINGS OF QUETTA, BALOCHISTAN, PAKISTAN

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Abstract

Parasites pose a serious threat to animal husbandry in terms of direct and indirect losses. This study was designed to estimate the prevalence of parasitic infestations in small ruminants in Quetta, Pakistan. Retrospective data were collected from the Livestock & Dairy Development Department, Quetta, regarding animal treatments during field visits, mobile camps, and inside hospitals and dispensaries in and around Quetta during the summers and winters of January to December 2023. A total of sheep 138264(48%) and goats 146139(51%) were treated for parasitic infestation. Among the internal parasites 65208(22%) cases of lungworm, 54249(19%) liver fluke and 56013(19%) wireworm were recorded. Similarly, 78719(27%) cases of ticks and 30214(10%) mange was seen and treated. On a season basis during January-June, 2023, 30900 (10%) sheep were affected by external parasites and 50097 (17%) by internal parasites. Whereas, 44796 (15%) goats had internal parasites and 32714 (11%) had external parasites, respectively. Similarly, July -December 2023, 22909 (8%) sheep were affected by external parasites and 33203 (11%) by internal parasites. However, 22380(7%) goats were affected by external parasites and 38376(13%) by internal parasites during the same period. This study highlights the prevalence of parasitic diseases in small ruminants in the area and draws the attention of policymakers to construct a comprehensive strategy to control parasitic infestation in small ruminants in the area.

Key Words: *Balochistan, Goats, Internal parasites, Prevalence, Sheep*

INTRODUCTION

Livestock is one of the key sectors that determine a nation's economy. It serves as the primary source of meat, milk, fiber (such as wool), and dung (1). However, parasite infestation remains one of the most common factors limiting the productivity of sheep production systems (2).

In Pakistan, parasitism poses a major threat to livestock and constitutes a significant barrier to the development of a profitable sheep industry (3). Parasitic diseases are among the principal problems hindering the growth of commercial livestock operations. The prevailing climatic conditions, coupled with a lack of knowledge among livestock owners, create favorable circumstances for infestation with both ectoparasites and endoparasites. Small ruminants are constantly at risk of various viral, bacterial, fungal, and parasitic diseases (4).

Approximately 90% of the sheep population in Pakistan suffers from some form of parasitic disease (5). Parasites constitute roughly half of all living organisms on Earth. Nearly 90% of Pakistan's small ruminant population is afflicted with parasitic illnesses (6). Among the many parasitic diseases affecting sheep and goats, those that impact vital organs such as the liver and lungs cause significant harm. Acute infections are characterized by rapid onset and high mortality rates, whereas chronic infections are typically subclinical but can result in substantial and often overlooked financial losses. Pakistan's geographic and climatic conditions are highly conducive to parasite growth and proliferation (7).

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Ectoparasites are primarily found on the skin and skin-derived tissues, relying on their hosts for food, shelter, and other necessities for survival. External parasites significantly reduce the productivity of sheep and goats (8). Signs of mange—the pathological degradation of skin condition—include skin inflammation (dermatitis), hair loss, and, in severe cases, fatigue and lethargy (9). Ectoparasites act as a principal obstacle to livestock growth and play a vital role in the transmission of specific pathogens (10). Skin diseases are highly contagious and seriously affect meat quality. These skin lesions typically begin on the anterior part of the body, such as the head and neck (11). Ectoparasites cause mechanical damage, anemia, loss of body condition, irritation, allergic reactions, toxicosis, morbidity, and mortality. Indirect effects of ectoparasites include the transmission of pathogens responsible for babesiosis, theileriosis, anaplasmosis, and other diseases (12).

Among parasitic diseases, fascioliasis (commonly known as liver fluke disease), caused by a worm that inhabits the liver and severely damages it through migration within the organ, has been frequently reported in Pakistan (13).

Lungworm parasites are extremely common in small ruminants. They cause a disease characterized by respiratory distress known as verminous bronchitis or verminous pneumonia (14). Dictyocaulus filaria is one of the most pathogenic lungworms of sheep and goats. It resides in the lumen of the bronchial tree and is commonly associated with chronic bronchitis and localized bronchial occlusion with atelectasis (15). This study was designed to evaluate the epidemiology of internal and external parasites in sheep and goat populations treated during field visits, mobile camps, and indoor hospital settings in and around Quetta, Pakistan.

MATERIALS AND METHODS

STUDY AREA

Retrospective data were collected from January to December 2023 from the Livestock and Dairy Development Department, Quetta. A pre-designed questionnaire regarding ectoparasites and endoparasites was used during field visits and mobile camps conducted under the supervision of hospitals and dispensaries in and around Quetta, Balochistan. Quetta district has a diverse livestock population, consisting primarily of sheep and goats. The climate and geography of the area support various livestock farming practices, thereby contributing to the local economy and food security.

STUDY DESIGN

This study was designed to evaluate the epidemiology of internal and external parasites in small ruminants (sheep and goats) in District Quetta, Balochistan, during both winter and summer seasons. The collected data comprised animals treated for internal and external parasites in hospitals, during mobile camps, and during field visits conducted by veterinary experts.

RESULTS

In small ruminants, several parasites infestation were treated through different healthcare approaches including hospitals, dispensaries, field visits, and mobile veterinary camps. Endoparasites and ectoparasites infestation were observed in winter and summer seasons.

Table I. Treatment against different ecto and endoparasites infection in small ruminants in hospitals and dispensaries in peri-urban area of Quetta, Pakistan

Small ruminants	Lung warm	Wire worm	Liverfluke	Mange	Ticks	Total
Sheep	21027 (11%)	21222 (11%)	19399 (10%)	10220 (5%)	24207 (13%)	96075 (52%)
Goats	20130 (22%)	18119 (9%)	16500 (8%)	9495 (5%)	23381 (12%)	87625 (47%)
Total	41157 (22%)	39341 (21%)	35899(19%)	19715 (10%)	47588 (25%)	183700

The small ruminants were treated in hospitals and dispensaries for endo and ectoparasites infestations. Among all parasites tick infestation emerged as the most frequently treated condition, with a

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total of 47,588(25%) cases 24,207(13%) sheep and 23,381(12%) goats. Wireworm infections also accounted for a considerable number of cases 39,341(21%) in total, slightly higher in sheep 21,222 (11%) than goats 18,119(9%). Lungworm and liverfluke infestations both caused by internal parasites were also prevalent though to a slightly lesser than ticks and wireworm infestations. The liverfluke total of 35,899(19%) cases highlights the persistent problem of fascioliasis in small ruminants. In Sheep 19399(10%) cases and in goats 16500(8%) cases were treated. Lungworm infestations in small ruminants 41,157(22%) total cases recorded. In sheep 21027(11%) and in goats 20130(22%) cases found. Mange was the least reported condition among those infections, with 19,715(10%) cases in total. Mange cases were also more prevalent in sheep than goats. In sheep 10220(5%) in goats the cases were 9495(5%). possibly due to differences in wool coverage, hygiene, and housing condition (Table I).

The small ruminants treated for five distinct parasites during field visits by animal health specialists. The sheep and goats total 71148 treatments were given. There were 34608(48%) parasites overall in sheep and 36540(51%) parasites overall in goats were found and treated, among all parasites ticks were the most prevalent in sheep and goats with a total of 19,694(27%) treatments. Both sheep and goats had similar parasites prevalence but goats slightly more affected by ticks. The total number of lungworms infestation in sheep and goats were 16656(23%). In sheep 8280(11%) positive cases and in goats 8376(11%) positive cases were recorded. In goats more cases were found for ticks 11295(15%), mange 4971 (6%) and lung worm 8376(11%) compare to sheep. Total 12177(17%) positive cases of wireworm were recorded in sheep and goats. The positive cases in sheep 6334(8%) and goats 5843(8%) were found. The total cases of liver fluke in sheep and goats were 12991(18%) and in goats 6055(8%) cases were and in sheep 6936(9%) cases treated. Sheep had significantly more treatments for wireworm 6334(8%) and liver fluke 6936(9%) than goats. Both sheep and goats faced similar health issues and problems. But the number of treatments varied slightly (Table II).

Table II. Treatment profile of internal and external parasites infestation in small ruminants during field visits in rural area of Quetta Pakistan

Small ruminants	Lung worm	Wireworm	Liver fluke	Mange	Ticks	Total
Sheep	8280 (11%)	6334 (8%)	6936 (9%)	4659 (6%)	8399 (11%)	34608 (48%)
Goats	8376 (11%)	5843 (8%)	6055 (8%)	4971 (6%)	11295 (15%)	36540 (51%)
Total	16656 (23%)	12177 (17%)	12991 (18%)	9630 (13%)	19694 (27%)	71148

The parasites infestations were widespread among small ruminants with over 29555 cases recorded during mobile veterinary camp. Among the endo and Ectoparasites ticks infestation emerged as the most frequently treated condition with a total of 11437(38%) cases were recorded in small ruminants in sheep 6018(20%) and in goats 5419(18%) cases were treated. In sheep and goats the lungworm cases 7395 (25%) were recorded which was slightly higher in goats 3812(12%) than sheep 3583(12%). The third no of parasites infestation was liverfluke in small ruminants. The liverfluke infestation cases were 5359 (18%) in small ruminants which was slightly higher in sheep 3115(10%) than goats 2244(7%). The internal parasites wireworm infestation also accounted for a considerable number of cases 4495(15%) recorded in total which was slightly higher in sheep 2404(8%) than goats 2091(6%) cases treated. Mange was the least reported condition with 869(2%) cases in total. Goats were more cases of mange than sheep. 533(1%) affected goats were treated and 336(1%) sheep were treated during mobile camp. In Sheep overall parasites infestation cases were 15456(52%) recorded which was slightly higher than goats. In goats the parasitic infestation cases were 14099 (47). Ticks (20%), lungworm (12%), and liver fluke (10%) were dominated in sheep. Mange was least common in goats. Like sheep, ticks (18%) and lungworm (12%) were the main problems in goats (Table III).

Table III. Endo and ectoparasites cases in sheep and goats treated at mobile camp in rural settings of Quetta Pakistan

Small ruminants	Lungworm	Wireworm	Liver fluke	Mange	Ticks	Total
Sheep	3583 (12%)	2404 (8%)	3115 (10%)	336 (1%)	6018 (20%)	15456 (52%)
Goats	3812 (12%)	2091 (6%)	2244 (7%)	533(1%)	5419 (18%)	14099 (47%)
Total	7395 (25%)	4495 (15%)	5359 (18%)	869 (2%)	11437 (38%)	29555

Fig. 1 (a) highlights the impacts of seasons January–June (seasons 1) and July–December (seasons 2) on external parasites and internal parasites in small ruminants. During the January - June in sheep the total

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80997(28%) parasite cases were recorded, out of total 30900(11%) external parasites and 50097 (18%) internal parasites cases were found. During the July-December in sheep the total parasites were 65142(23%) out of total 22939 (8%) external parasites cases were recorded and internal parasites were 42203 (15%). During the January-June in goats the total parasites were 77510(27%) out of total 32714(12%) external parasites cases were recorded and internal parasites were 44796 (16%). During the July - December in goats the total parasites were 60756(21%) out of total 22380 (8%) external parasites cases were recorded and internal parasites were 38376 (13%). parasites were much more prevalent in the first half of the year (January-June) compared to July-December. internal parasites increased more than External parasites in (season 1) (Junary-June). In sheep the total parasites (internal parasites and external parasites) in January-June (season 1) was higher than July–December (season 2). In goats the total parasites internal parasites and external parasites) in January-June (season1) was higher than July–December (season 2). Sheep carried a heavier parasites burden than goats in both seasons, January-June compared to July-December internal parasites were found more than external parasites.

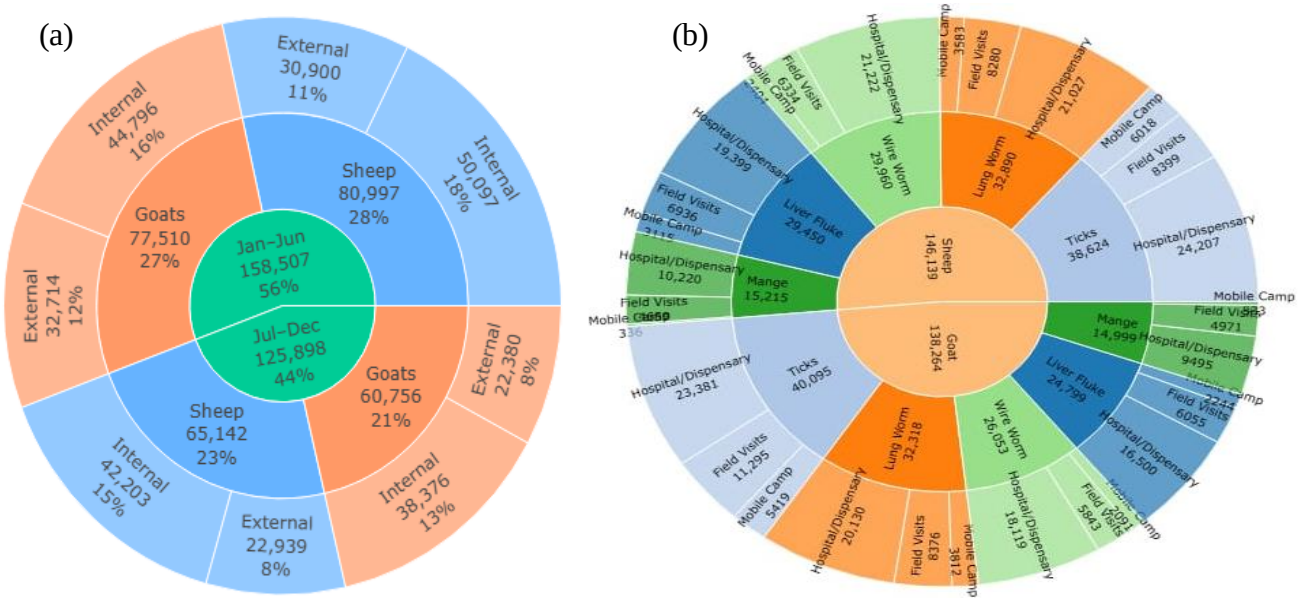

Fig. 1 (a). Graphical presentation of comparison of internal and external parasitic prevalence between two seasons in sheep and goats in peri-urban area of Quetta, Pakistan; **(b).** Graphical presentation of treatment records of parasitic infestation in small ruminants in different veterinary health care approaches

In small ruminants, several parasites infestation were treated through different healthcare approaches including hospitals and dispensaries, field visits, and mobile veterinary camps the present study revealed that 284403 samples were infected by parasites, Among the submitted samples 138264(48%) cases found in sheep while for goat 146139(51%) positive Cases of endoparasites and ectoparasites infestation were observed (Fig. 1b).

In sheep 32890(11%) samples were infected by lungworm among these samples 21027(7%) were treated in hospitals and dispensaries, 8280(2%) were treated during field visits and 3583 (1%) were treated during mobile camps. In sheep 29450(10%) samples were infected by liver fluke among these samples 19399(6%) were treated in hospitals and dispensaries, 6936(2%) were treated during field visits and 3115(1%) were treated during mobiles camps. The infestation of wireworm was 29960(10%) and the treatment in side hospitals and dispensaries were 21222(7%) treatment in during field visits 6334(2%) and treatment during mobile camps was 2404(0.8%). The total treatments of mange infected samples were 15215(5%) out of these 10220 (3%) were treatment in hospitals and dispensaries, 4659(1%) treated during field visits and 336 (0.1%) during mobile camp. Total 38,624(13%) tick infestation samples were treated out of these 24207(8%) cases in hospitals, 8,399(2%) during field visits, and 6,018(2%) in mobile camps were treated (Fig. 1b).

In goats 32318(11%) samples were infected by lungworm among these samples 20130(7%) were treated in hospitals and dispensaries, 8376(2%) were treated during field visits and 3812(1%) were treated during mobile camps.24799(8%) samples were infected by liver fluke among these samples 16500(5%) were treated in hospitals and dispensaries ,6055(2%) were treated during field visits and 2244(0.7%) were treated

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during mobile camp. The infestation of wireworm were 26053(9%) and the Treatment in side hospitals and dispensaries were 18119(6%), treatment in during field visit 5853(2%) and treatment during mobile camps were 2091(0.7%). The total treatments of mange infected samples were 14999(5%)out of these 9495(3%) were treated in hospitals and dispensires,4971(1.7%) treated during field visits and 533(0.1%) during mobile camps. 40095(14%) tick infestation samples were treated among these 23381(8%) cases were treated in hospitals and dispensaries ,11295(3%) during field visits, and 5419(1%) in mobile camps were treated.

DISCUSSION

Parasitic infestations in small ruminants significantly impact livestock health and productivity. This evidence-based approach can guide the development of strategies aimed at reducing parasites burdens, improving animal welfare, and promoting sustainable livestock production in Quetta, Balochistan. Tick is the most prevalent infestation sheep and Goats had a higher burden of external parasites among all parasites, Total 38,624 (13%)tick infestation samples find out in Sheep and these samples were treated out of 24,207 (8%) cases in hospitals, 8,399(2%) during field visits, and 6,018(2%) in mobile camps were treated. In goats 40095 (14%) tick infestation samples were treated among these 23381 (8%) cases were treated in hospitals and dispensaries ,11295 (3%)(during field visits, and 11295(3%) in mobile camps were treated our results corroborate with (16) the ectoparasites of small ruminants in three selected agro-ecological sites of Tigray Region, Ethiopia disclosed an overall prevalence of 55.5% and 58% in each examined 750 sheep and goats, respectively. In the sheep population, *Melophagus ovinus* (19.1%), tick infestations (*ovis* (15.3%), *Linognathus africanus* (11.5%), and *Ctenocephalides felis* (9%) were the major ectoparasites. The major ectoparasites identified in goats were tick infestations (29.7%), *L. africanus* (27.9%), *Sarcoptes scabiei* var. *caprae* (12.5%), *C. felis* (11.1%),

Mange infestation was the most common issue of small ruminants. In sheep total treatments of mange infected samples were 15215 (5%) out of these 10220 (3%)were treatment in hospitals and dispensaries ,4659 (1%) treated during field visits and 336(0.1%) during mobile camp. In goats the total treatments of mange infected samples were 14999(15%) out of these 9495(3%) were treated in hospitals n dispensires,4970(1.7%) treated during field visits and 533(0.18%) during mobile camp our result corroborate with (17) .Small ruminant mange mites were the subject of an epidemiological investigation in three specific agro-ecological zones in Wolaita, Southern Ethiopia., 352 sheep and 376 goats were tested 7 (1.98%) and 22 (5.85%) sheep and goats tested positive, respectively. The study detected two genera of mange mites: *Sarcoptes* (2.61%) and *Demodex* (1.23%). Of these,. Goats were far more likely than sheep to have mange mites. Lung worm is the most common internal parasites of sheep and goats. In Sheep 32890(11%) samples were infected by lungworm among these samples 21027(7%) were treated in hospitals and dispensaries, 8280(2%) were treated during field visits and 3583 (1%) were treated during mobile camps. In goats 32318(11%) samples were infected by lungworm among these samples 20130 (7%)were treated in hospitals and dispensaries ,8376 (2%)were treated during field visits and 3812(1%) were treated during mobile camps. our results corroborate with (18) cross-sectional studies carried out between 2000 and 2016 in four administrative states of Ethiopia. In this review the calculated pooled prevalence estimate of lungworm infection in small ruminants in Ethiopia was 40.8%. However, only 15.5% of the true heterogeneity was explained by the final model in meta-regression. Diagnostic test and administrative states were the only two predictor

In sheep, the infestation of wireworm was 29960 (10%) and the treatment in side hospitals and dispensaries were 21222 (8%) treatment in during field visits 6334 (2%) and treatment during mobile camps was 2404(0.84%). In goats the infestation of wireworm were 26053 (9%) and the Treatment in side hospitals and dispensaries were 18119 (6%) treatment in during field visits 5853 (2%) and treatment during mobile camps were 2019(0.70%) our research line up with (19) identify the roundworm species infections in cattle, sheep and goats that were slaughtered at Lafia abattoir during the rainy season (April to June, 2016). A total of 70 animals examined, 36 representing 51.4% of the animals were infected with various species of roundworms. Those found in the animals examined included *Haemonchus contortus*, *Bunostomum*

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phlebotomum, Ascaris suum and *Neoascaris vitulorum*. This may disrupt the life cycles of the roundworm species thus, preventing parasites infections from spreading to other animals in the study area.

Fasciola hepatica is the most common liver fluke in sheep and goats, particularly in temperate and cooler areas. All fasciola species cause morbidity and mortality in ruminants. The study highlights treatment of liver fluke across three veterinary service hospitals/dispensaries, field visits, and mobile camps. The total cases of liver fluke in small ruminants were 54249 (19%) among these 29450 Sheep were infected (10%), the sheep treated 19399 (6%) in hospitals and dispensaries, and 24799 (8%) goats infected. Each treatment channel plays a role in managing parasites diseases in livestock. Among these samples 16500 (5%) were treated in hospitals and dispensaries, 6055 (2%) were treated during field visits and 2244(0.7%) were treated during mobile camps our findings line up with Khan *et al*., 2015 (20). Liver fluke infections were found in((30%) of young, adult, and old sheep in Pakistan, with (50%) of young and(10%)of adults having *Fasciola hepatica*. In older sheep, both *Fasciola gigantica* and *Fasciola hepatica* were prevalent, causing liver damage and inflammation. These infections are most common in Pakistan.

The seasonal variation significantly influences parasites population. The number of sheep and goats were affected by external parasites 63614(22%) and internal parasite 94893(33%) between January -June 2023. I*n sheep internal parasite accounted for 50097(18%) cases while external parasites affected 30900(11%). In* Goats external parasites were 32714(12%) and internal parasites were 44796(16%). The data indicates that both sheep and goats are significantly impacted by parasites infestations during this period our result line up (21) worked on Prevalence of parasites diseases of goat at Pirganj upazilla of Bangladesh. According to the findings, there was additionally an overall prevalence of 15.71% for ectoparasites diseases and 60.71% for endoparasites diseases. The study revealed that the incidence of 8 endoparasites disorders was higher during the rainy season and that of ectoparasites infestations during the summer.

Parasites infestations were more common during the July-December 2023 period. In Quetta includes summer July-September followed by autumn and early winter (October-December)**.** The seasonal variation significantly influences parasites populations. *In sheep internal parasites accounted for 42,203(15%) cases, while external parasites affected 22,939(8%). In* Goats external parasites were 38376(13%) and internal parasites are 22380(8%) our result corroborate (22) conducted an experiment on Distribution of ruminant ectoparasites in Tehsil Nikasyal, District Kotli, Azad Jammu and Kashmir. 7.5% was the highest frequency of ectoparasites in July, with 6% in August, 6% in September, 4.5% in October, 1.5% in November, and 0.5% in December. It is stated that in order to lower the quantity of ectoparasites and their influence on ruminant production and health, coordinate control strategies with sustainable veterinary services should be developed.

CONCLUSION

In conclusion, the study showed higher prevalence of worm infestation in small ruminants both in sheep and goat equally. However, more prevalence of ectoparasites and endoparasites was seen in summer than winter. Liver fluke and external ticks were the main problems identified and treated during mobile camps and inside hospitals

Conflict of interest:

The authors declare no conflict of interest.

Authors' contribution:

FA Conducted the study, collected retrospective data; SK Conceptualized, designed the epidemiological investigation and analyzed seasonal prevalence data; MS Supervised the research and finalized the manuscript; FA Performed statistical analysis of internal and external parasite cases; SA, RM & AK Compiled and organized treatment records from field visits, camps, and hospitals.

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