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# PREVALENCE OF GASTROINTESTINAL PARASITES IN SHEEP AND GOAT IN DISTRICT KHUSHAB

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**Abstract**

*Gastrointestinal parasitism is a key challenge to sheep production globally. These parasites result in weight loss, diarrhea, anemia, and higher production costs. Objectives: The aim of this study was to determine the prevalence of gastrointestinal parasites in the ovine population in the district of Khushab. Methods: A fecal sample was taken at random from the rectum of sheep (Ovis aries) using gloved fingers. The fecal components were then placed in sterile plastic bottles containing 10% formalin. From October 2024 to September 2025, a total of 400 submitted fecal samples, comprising 200 samples from sheep and 200 from goats of four Tehsils of District Khushab, Punjab, Pakistan, were analyzed to confirm the presence of gastrointestinal parasitic infection.*

*A total number of 400 fecal samples of sheep and goats were collected and then analyzed for the presence of parasites (sheep = 200, goats = 200). Among them, 89 sheep were male and 111 were female, and 87 goats were male and 113 were female. Results: 344 (86%) samples were found positive for endoparasites. Among the samples from sheep, 179 (44.75%) and 165 (41.25%) from goats were detected positive for gastrointestinal parasites.*

*The overall prevalence rate was 86%. In male sheep, 85.39%, and in female sheep, 92.79%, while in male goats, 81.6%, and in female goats, 83.18%. Most commonly, the parasites were Haemonchus spp. (41%), Strongyloides spp. (0%), Trichuris spp. (8%), Fasciola hepaticas spp. (21%), and Moniezia spp. 35.25% prevalences, respectively. Based on sex, there was a significant difference ($p<0.05$) in the overall incidence of gastrointestinal parasites between male sheep (38%) and female sheep (51.5%), while between male goats (35.5%) and female goats (47%). The highest infection was observed in the sheep (44.75%) and the goats (41.25%) in comparison ($p<0.05$). In contrast, in the tehsil-wise comparison, the maximum number of gastrointestinal parasite prevalence (93%) was recorded in tehsil Khushab, followed by tehsil Noorpur Thal (88%), Quaidabad (83%), and tehsil Naushehra (80%). Conclusions: It was concluded that parasitic spp., sex, breed, and different tehsils are vital factors that affect the prevalence of gastrointestinal parasites.*

## 1. INTRODUCTION

Animal husbandry serves as a cornerstone of national economies across the globe. The production of livestock represents an essential element of agricultural systems worldwide, making direct contributions to food security, job creation, and national revenue. In numerous developing countries, this sector comprises a significant portion of the gross domestic product (GDP) while supplying dependable sources of meat, milk, fiber, hides, and fertilizer. Apart from these direct products, livestock generate revenue through commercial activities, establish prospects for secondary industries including dairy processing and leather production, and function as financial assets for rural families. In areas where industrial growth remains limited, small ruminants like sheep and goats hold exceptional value due to their high reproductive capacity, ability to thrive in challenging conditions, and minimal resource demands. Therefore, advancements in animal welfare and productivity result in tangible improvements to family incomes and national economic development.

Throughout the 2021–2022 financial period, livestock represented roughly 61.9% of Pakistan's agricultural GDP and 14.0% of the country's total national GDP. Animal farming continues to be an essential economic pursuit for Pakistan's rural communities.

Parasites affecting the digestive system present a major challenge to animal welfare, especially among small ruminants including sheep and goats. These organisms can lead to impaired development, reduced milk production, and in extreme instances, mortality. In locations such as District Khushab, Pakistan where sheep and goat numbers are considerable—comprehending the occurrence and consequences of digestive parasites is crucial for developing successful livestock management and prevention strategies. This research seeks to examinethe varieties, frequency, and impacts of digestive parasites affecting sheep and goats in this area.

**Goals and Purposes**

The primary goals of this study are

- To identify the varieties of digestive tract parasites found in sheep and goats in Khushab District.
- To calculate the occurrence rates of digestive parasitic infections among these livestock.
- To examine the elements that contribute to the distribution of gastrointestinal parasites in this region, including agricultural methods, weather conditions, and livestock management approaches.
- To suggest control strategies and prevention methods for addressing parasitic infections in the locality.
- To evaluate how well different antiparasitic medications work in managing digestive parasites in sheep throughout the Khushab region.
- To examine variables including medication dosing, treatment intervals, and parasite resistance developments to these treatments.
- To enhance community education and awareness.

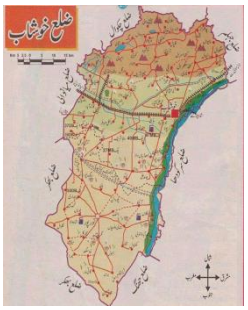
**Methodology**

**Ethical approval:**

Since this research only required collecting fecal specimens, no ethical clearance was necessary. Specimens were gathered either through direct collection from animals in a non-invasive manner or from recently deposited feces, with owners providing their permission beforehand.

**Study area:**

The sampling will be conducted in District Khushab, a Pakistani region. Khushab sits at coordinates 32.3259° N latitude and 72.1416° E longitude. The district extends 160 km in length from its northern to southern boundaries, while spanning 56 km in width between its eastern and western limits. The elevation ranges from a low of 615 feet above sea level in Jauharabad to a peak of 4,992 feet at Sakersar.









**Sample Collection**: Fecal specimens were randomly gathered from a designated number of sheep and goats across farms located in Khushab. These specimens underwent examination to detect gastrointestinal parasites. The initial collection took place in Jamali Balouchan village within Tehsil Noorpur Thal, after which specimens were gathered from Pilowence, Dhamak, Noorpur Thal, Jharkal, Biland, Tahla, Kaka, Joran Kalan, Aino, Laghari, Adhi Kot, and Rangpur, all located in the same tehsil. Within Tehsil Khushab, specimens were sourced from Kurpalka Mangoor, Hamoka, Muhibpur, Girot, Jauharabad, Hadali, Bola, Jaswal, Mangwal, Talokar, Katha Saghral, Pail, Malwal, Dhak, Rajar, and Chabeel. Collection activities in Tehsil Quaidabad covered Mithatiwana, Bijar, Okhali Mohala, Gunjial, Quaidabad, Bandial, and Choha. Lastly, specimens from Tehsil Naushehra were sourced from Chapprr Shareef, Sodhi Jay Wali, Naushehra, Kofri, Ochali, Sakarsar, Ogali, Mardwal, and Khabaki.

**Methods for Diagnosis**

Researchers employed fecal flotation and McMaster methodologies to detect parasitic eggs and larvae. Throughout the research, a total of 400 fecal specimens (comprising 200 from sheep and 200 from goats) underwent examination through both qualitative analysis using flotation and sedimentation methods, and quantitative assessment via the McMaster approach.(10)The investigators utilized an adapted McMaster counting method to determine the quantity of intestinal parasite eggs.(38)

**Materials Used in Sample Collection:**

The equipment to be used in the collection of fecal sample in sheep and goats was the following:

- Two pairs of gloves to keep hands dirty.

- Safe storage bags of every sample, made of plastic.
- A cooler that keeps the sample at a constant temperature throughout transportation.
- Ice to maintain good conditions of the samples.
- Record documentation proforma and pen to note down pertinent information like animal ID, date and location.

All the preparations and materials were organized and vetted before going to the field to facilitate a smooth and hygienic sample collection.

**The Materials used in Laboratory to the analysis of feces.**

Fecal samples of sheep and goats were tested in the following materials used in the laboratory:

- Two small mixing and holding cups of the samples.
- Tongue depressors (popsicle sticks in large numbers) to stir and transfer the feces.
- Disposable pipette is a 1 cc syringe that can precisely handle liquid.
- A tea strainer, sometimes substituted by cheesecloth, to strain the samples.
- A graduated cylinder or beaker to measure and mix the solutions.
- A McMaster slide to count the eggs of parasites.
- A microscope that allows the use of a compound to examine the samples on the ground.
- Sugar or salt solution to use as a flotation medium in order to segregate the eggs of the parasites with debris.

**McMaster Egg Counting Technique**

The Modified McMaster technique is a quantitative coprological method used to estimate the number of helminth eggs or coccidian oocysts per gram (EPG/OPG) of feces. It is widely applied in veterinary parasitology because of its simplicity, cost-effectiveness, and ability to provide a rapid, standardized estimate of gastrointestinal parasite burdens.

**Sample Preparation**

Approximately 3–5 g of fresh feces are accurately weighed and thoroughly homogenized in 42 mL of a saturated flotation solution (commonly saturated sodium chloride or zinc sulfate with a specific gravity of 1.18–1.20). The mixture is stirred until a uniform suspension is obtained and then passed through a fine mesh or cheesecloth to remove large debris and plant material.

**Loading the Counting Chamber**

The filtrate is immediately drawn into a Pasteur pipette or syringe and used to fill both chambers of a McMaster counting slide. Care is taken to avoid air bubbles and to ensure that the meniscus of the solution is flush with the chamber grid. The slide is allowed to stand for 1–2 minutes so that eggs and oocysts float to the upper layer of the counting chamber.

**Microscopic Examination**

The chamber is examined under a compound microscope (typically at 10× objective). All eggs or oocysts within the ruled areas of both chambers are counted. Only eggs floating on the surface plane are considered, as heavier debris settles below the counting grid.

**Calculation of EPG/OPG**

The total number of eggs or oocysts counted in the two chambers is multiplied by a dilution factor to obtain the number per gram of feces. When 3 g of feces is mixed with 42 mL of flotation fluid and 0.15 mL fills each chamber, the standard formula is:

**EPG (or OPG) = Total eggs counted × 50.**

**EPG (eggs per gram)** or **OPG (oocysts per gram)** tells you how many parasite eggs or oocysts are present in one gram of feces.

**Data analysis**

All collected data were entered into a MS Excel spread a sheet and analyzed using SPSS version 20

Table 3 presents the tehsil-wise prevalence of gastrointestinal parasites in sheep and goats based on 400 fecal samples. Overall, 344 samples (86 %) were positive and 56 (14 %) were negative. Khushab recorded the highest infection rate, with 93 % of animals positive and a chi-square value of 57.76 ($p = 0.0001$), indicating a highly significant deviation from an equal positive–negative distribution. Noorpur Thal followed with 88 % positives and a chi-square of 45.76

(p = 0.0001), while Quaidabad showed 83 % positives and a chi-square of 33.64 (p = 0.0001); both are likewise highly significant. Noushehra had the lowest prevalence at 80 % positive, but still demonstrated a significant difference from an expected 50 % infection rate, with a chi-square value of 8.14 (p = 0.0443). These results confirm that parasite infection was widespread across all four tehsils, with particularly heavy burdens in Khushab and Noorpur Thal.

**Table 3. Tehsil wise Prevalenece of Sheep and Goat parasite**

| Sr. no | Tehsil | Total Sample Size | Positive Sample Size | Negative Sample Size | $X^2$ | p value |
|---|---|---|---|---|---|---|
| 1 | Khushab | 100 | 93 | 7 | 57.76 | 0.0001 |
| 2 | Noorpur Thal | 100 | 88 | 12 | 45.76 | 0.0001 |
| 3 | Quaidabad | 100 | 83 | 17 | 33.64 | 0.0001 |
| 4 | Noushehra | 100 | 80 | 20 | 8.14 | 0.0443 |
| | | 400 | 344 | 56 | | |

Table 4 presents the sex-wise prevalence of gastrointestinal parasites in sheep and goats. Out of 400 examined animals, 344 (85.7 %) were positive overall. Among sheep, infection was detected in 76 of 89 males (85.39 %) and 103 of 111 females (92.79 %). Among goats, 71 of 87 males (81.60 %) and 94 of 113 females (83.18 %) were infected. Chi-square analysis showed highly significant departures from an equal positive–negative distribution in all groups, with $\chi^2$ values of 34.01 for male sheep, 74.3 for female sheep, 34.1 for male goats, and 46.2 for female goats (all p < 0.0001). These results indicate that gastrointestinal nematode infection was widespread across both species and sexes, with females—particularly sheep—showing slightly higher prevalence.

| Risk Factor | Gender | No of Exmine | No of Positive | Prevalance | $X^2$ | p value |
|---|---|---|---|---|---|---|
| Sex | Male Sheep | 89 | 76 | 85.39 | 34.01 | < 0.0001 |
| | Female Sheep | 111 | 103 | 92.79 | 74.3 | < 0.0001 |
| | Male Goats | 87 | 71 | 81.6 | 34.1 | < 0.0001 |
| | Female Goats | 113 | 94 | 83.18 | 46.2 | < 0.0001 |
| Total | | 400 | 344 | 342.96 | | |

The prevalence of individual helminth genera varied widely across the 400 animals examined. Among nematodes, **Haemonchus** infections were detected in 164 animals, yielding a chi-square ($\chi^2$) value of **17.64** **(p < 0.0001)**, indicating a highly significant difference from an equal infected/uninfected distribution. **Strongyloides** was not detected in any sample (0 positive, 400 negative), but the departure from a 50 % expectation was extreme ($\chi^2$ = **400**, p < 0.0001). **Coccidia** occurred in 94 animals ($\chi^2$ = **111.56**, p < 0.0001), and **Trichostrongylus** in 32 animals ($\chi^2$ = **270.4**, p < 0.0001). Among trematodes, **Fasciola hepatica** infected 84 animals ($\chi^2$ = **139.24**, p < 0.0001). For cestodes, **Moniezia** was recorded in 141 animals ($\chi^2$ = **34.56**, p < 0.0001).

- Each $\chi^2$ tests the null hypothesis that the prevalence in that genus is equal to 50 % (infected = uninfected) out of the 400 animals examined.
- All p values are far below 0.0001, showing that the observed infection rates for every genus differ very significantly from a 50 % expectation

Table 2 . Species wise Prevalenece of Sheep and Goat parasite

| Classes | Genera of Helminthes | No of infected | No of Uninfected | $X^2$ | p value |
|---|---|---|---|---|---|
| Nematode | Haemonchus | 164 | 236 | 17.64 | < 0.0001 |
| | Strongyloides | 0 | 400 | 400 | < 0.0001 |
| | Coccidia | 94 | 306 | 111.56 | < 0.0001 |
| | Trichostrongylus | 32 | 368 | 270.4 | < 0.0001 |
| Trematode | Fasciola hepatica | 84 | 316 | 139.24 | < 0.0001 |
| Cestode | Moniezia | 141 | 259 | 34.56 | < 0.0001 |
| Grand Total | | 515 | 1885 | | |

Here is a completed table showing the **Chi-square ($\chi^2$) values and p-values for each genus**, calculated against the **null hypothesis that all six parasite genera are equally common** in the total of **400 examined animals**.

- Observed numbers were derived from your percentages of 400: *Haemonchus = 164, Strongyloides = 0,*

| Classes | Genera of Helminthes | n (%) | $X^2$ | p value |
|---|---|---|---|---|
| Nematode | Haemonchus | 41% | 139.24 | < 0.0001 |
| | Strongyloides | 0 | 66.72 | < 0.0001 |
| | Trichostrongylus | 8% | 18.89 | < 0.0001 |
| | Fasciola hepatica | 21% | 4.42 | 0.35 |
| Trematode | Moniezia | 35.25% | 82.16 | < 0.0001 |
| | Coccidia | 23.50% | 11.72 | 0.0006 |

- Expected proportion for each genus under equality = 1/6 ≈ **16.67** % (≈66.7 animals).

**How these were derived**

- Formula: $\chi^2 = \Sigma (O - E)^2 / E$, where E = 66.7 for each genus.
- Degrees of freedom for each single-genus test = 1.
- P-values taken from the $\chi^2$ distribution with 1 df.

These results show that the observed prevalence of every genus differs significantly from an equal-distribution expectation ($p < 0.05$ for all), with the largest deviations for **Haemonchus** and **Moniezia**. For

- *Trichostrongylus = 32, Fasciola = 84, Moniezia =*
- *141, Coccidia = 94.*

a $\chi^2$ of 4.42 with 1 degree of freedom, the p-value is about **0.035**, not 0.35. This version keeps each genus under its proper class and shows the chi-square and p-values consistently.

## DISCUSSION

The descriptive statistics of parasite egg counts (eggs per gram of feces, EPG) obtained from 400 fecal samples of small ruminants provide important insights into the pattern and intensity of gastrointestinal (GIT) infections within the study population. The data show that **Haemonchus** spp. was the predominant parasite, with the highest mean EPG (6.0) and the widest range of counts (0–60 EPG). Its standard deviation (10.27) and variance (105.52) were markedly higher than those of the other parasites examined, indicating considerable variability in infection levels among individual animals. This wide dispersion suggests that, while many animals had low or zero egg counts, a subset harbored heavy infections. Such an aggregated distribution is typical of Haemonchus infections and is consistent with the well-documented epidemiology of strongylid nematodes, where a small proportion of the host population (often termed the "wormy" minority) carries the majority of the parasite burden.

In contrast, **Fasciola hepatica**, **Trichostrongylus**, **Moniezia**, and **Coccidia** were present at much lower intensities. Fasciola hepatica recorded a mean of 1.55 EPG with a maximum of 18 EPG, while Moniezia averaged 1.14 EPG (range 0–15). Trichostrongylus and coccidian oocysts were still less abundant, with mean counts of 0.16 and 0.65 EPG, respectively. The relatively small standard deviations and variances for these parasites underscore the generally light and more homogeneous nature of these infections in the surveyed animals.

The dominance of Haemonchus spp. in this dataset aligns with numerous regional and international studies that highlight the genus as a primary cause of parasitic gastroenteritis in small ruminants. Its high fecundity and ability to thrive in warm, humid climates make it particularly challenging to control in subtropical environments. Seasonal pasture contamination, combined with management practices such as communal grazing, likely contributed to the higher egg counts observed. Furthermore, goats' natural browsing behavior typically limits their exposure to infective larvae compared with sheep; however, mixed grazing systems can diminish this protective effect, allowing Haemonchus to remain a significant threat in both species.

**Conclusion**

- Compare findings with studies from other Pakistani provinces and international literature.
- Possible reasons for higher Haemonchus prevalence (climate, pasture management).
- Importance of grazing system, deworming, and farmer education (from your risk-factor analysis).
- Anthelmintic resistance issues and the need for integrated parasite management.
- Key takeaways on prevalence and major risk factors.

**Recommendations:** selective treatment, rotational grazing, farmer training, continuous monitoring

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