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Assessment of Anthelmintic Resistance in Goats in Echague, Isabela, Philippines

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Abstract:
Goat farming plays an important part in global livestock production, being adaptable to different environments, including arid and marginal areas; known to provide meat, milk, fiber, and manure that support the food supply and income of millions of rural families. In the Philippines, goat production remains to be smallholder farming; raised alongside crops to maximize household resources. However, it is threatened by animal health problem, particularly parasitic infections, leading to low productivity. The present study was conducted to evaluate anthelmintic resistance in goat raised in different smallhold farms in Echague, Isabela, Philippines using Fecal Egg Count Reduction Test (FECRT). The study was carried-out using 150 heads of mature goats, naturally infected with parasites, were been dewormed within 4 months, and raised in six (6) different study sites. The most prevalent gastro-intestinal nematode was identified before and after deworming using Albendazole®.
Results of the laboratory evaluation shows that *Haemonchus* spp. is the most prevalent gastrointestinal parasite, present in all animals under study. On the other hand, 82% of the population show resistance to dewormer. Therefore, anthelmintic resistance has already developed across the study sites. *Haemonchus* spp. can no longer be effectively controlled by Albendazole treatment.

Keywords: Anthelmintic resistance, Gastrointestinal nematodes, Farm management

Introduction

Goat farming continues to play an important part in global livestock production. Goats are adaptable animals that can live in different environments, including arid and marginal areas. They provide meat, milk, fiber, and manure that support the food supply and income of millions of rural families (Manalili et al., 2020). In the Philippines, goat production remains a central part of backyard and smallholder farming. Most farmers raise goats alongside crops to maximize household resources (Rosario et al., 2023). In Central Luzon, many farmers depend on open grazing and locally available feeds with limited access to veterinary care. Even though productivity remains low, goats continue to provide a steady source of food and income. Yet, animal health problems, particularly parasitic infections, continue to threaten productivity and profitability. The Philippine Statistics Authority (2025) reports that goat populations are rising as more farmers see their value, but productivity remains below potential because of disease burdens—especially those caused by gastrointestinal nematodes.

Gastrointestinal nematodes (GINs) are among the most harmful parasites in goats. These worms feed on blood and nutrients, causing anemia, diarrhea, weight loss, and reduced milk and meat yield (Khan et al., 2023). They are especially dangerous for young, lactating, and undernourished animals. Studies show that these parasites thrive in tropical and humid climates where temperature and rainfall support larval development and pasture contamination (Dey et al., 2020). Beyond visible symptoms, GIN infections decrease feed efficiency, weaken immune function, and reduce fertility. Severe infestations often lead to death, creating large economic losses for small-scale farmers.

Rising temperatures and irregular rainfall extend the survival period of infective larvae in the environment, increasing the exposure risk for grazing goats (Jas et al., 2022). Such conditions make disease control more difficult since goats continually encounter contaminated pastures. Bricarello et al. (2023) point out that understanding the interaction between animals, forage plants, and parasites is key to designing effective control methods. Without better strategies, GINs will continue to hinder goat health and production.

Farmers have long depended on commercial anthelmintic drugs to manage these infections. These products were once highly effective, improving animal growth and performance. However, years of improper use have led to the rise of drug-resistant parasites (Vanhoy, 2023). Resistance has been recorded even in areas once thought unaffected (Bosco et al., 2020), and some nematode populations now show multi-drug resistance that weakens treatment results (Kruken et al., 2024). WAAVP guidelines released in 2023 highlighted the need for regular monitoring because resistance now appears even in small herds without veterinary guidance (Kaplan et al., 2023).

Scientific assessment of resistance helps farmers understand the effectiveness of the products they use. The Fecal Egg Count Reduction Test (FECRT) remains the most widely recommended field method. This test compares fecal egg counts before and after treatment with a commercial anthelmintic. A low reduction indicates that nematodes survived treatment, which signals resistance. International standards identify FECRT as a practical method because it requires basic laboratory materials and works under smallholder farm conditions (WAAVP, 2022; Kaplan et al., 2023). The test also reflects actual drug performance in real farm environments, which makes it useful for backyard goat raisers.

This study examines the resistance levels against dewormer among goats raised in smallholder goat farms in Echague, Isabela, Philippines.

Materials and Methods

Collection of Fecal Samples

The collection of fecal samples was conducted early in the morning, approximately between 5:00 and 7:00 am. Fecal samples were at least 10 grams which was collected directly from the rectum using clean gloves and sterile containers, labeled with animal identification, date, and treatment code, and transported in insulated containers with ice packs to maintain a temperature. Laboratory analysis was done immediately after collection.

Floatation Solution Preparation

A flotation solution was prepared for use in the fecal egg count reduction test following standard parasitological procedures. A saturated sodium chloride solution was prepared by gradually dissolving approximately 400 g of sodium chloride in one liter of warm distilled water with continuous stirring until no more salt dissolved. The solution was allowed to cool to room temperature and then filtered to remove undissolved particles. The specific gravity of the solution was adjusted and maintained between 1.18 and 1.20 using a hydrometer to ensure effective flotation of gastrointestinal nematode eggs. The prepared flotation solution was store in a clean, airtight container and mix thoroughly before use in the modified McMaster technique for determination of fecal egg counts before and after anthelmintic treatment.

Interpretation of Worm Egg Count (WEC)

Table 1. Interpretation of the Worm Egg Count (WEC) for Adult Goats

Worm Egg Count	Interpretation	Action
0-200 EPG	Light Infection	Treatment not necessary
200-500 EPG	Moderate Infection	Anthelmintic treatment may be beneficial
500-1000 EPG	Heavy Infection	Anthelmintic treatment necessary

Source: World Association for the Advancement of Veterinary Parasitology Guidelines

Fecal Egg Count Reduction Test (FECRT)

Fecal samples were collected before and after treatment. The Day 0 samples was served as the pre-treatment baseline fecal egg count. Post-treatment fecal samples were collected after 14 days of deworming and used to evaluate the reduction in fecal egg output. Fecal egg count analysis was conducted using the Modified McMaster Technique. Each fecal sample was homogenized with a saturated sodium chloride flotation solution at a 1:15 ratio, filtered, and examined under a microscope at 10× magnification. Egg counts were multiplied by the McMaster correction factor to obtain EPG values. The Fecal Egg Count Reduction Percentage (FECR%) were calculated by comparing pre-treatment and post-treatment fecal egg counts using the formula:

$$\text{FECR\%} = \left(\frac{FEC_{before} - FEC_{after}}{FEC_{before}} \right) \times 100$$

Identification of most prevalent gastro-intestinal nematode

Fecal samples that were collected from goats will first examine using the modified McMaster technique to determine fecal egg counts.

To identify the prevalent gastro-intestinal parasite, floatation was used in the study. In preparing the samples, 50 ml of floatation solution was added to 4 g of fecal sample. Thoroughly mix the feces and solution until dissolved. The filtrate was stirred using Pasteur and Pipette. The sample filtrate was placed immediately to fill the first and second chamber of McMaster chamber. It allowed the slide to stand undisturbed for 5 minutes before examining under a microscope using 10x magnification. The total number of eggs from both chambers was summed and multiplied by 50 to calculate the eggs per gram (EPG) of feces. The eggs of the parasites were served as the basis for identification.

Statistical Analysis

Fecal egg count data from each farm were analyzed using descriptive statistics, including mean, standard deviation, and percent reduction in egg counts. Fecal Egg Count Reduction (FECR%) was computed per goat and averaged per farm to determine resistance status. Based on WAAVP guidelines, farms with mean FECR% above 95% were classified as having no evidence of anthelmintic resistance, while values below 95% indicated possible resistance. All analyses were conducted using SPSS or STAR software, and results were presented as mean ± standard deviation with corresponding resistance interpretation per farm, following standard procedures for field-based anthelmintic resistance studies in small ruminants.

RESULTS AND DISCUSSION

Gastro-Intestinal Parasites Observed. Table 2 presents the prevalence of GIN before and after deworming as well as the efficacy of dewormer against different gastrointestinal parasites. Prior to treatment, the most prevalent parasite identified was *Haemonchus* (100%), *Trichostrongylus* (4%), *Coccidia* (8%), *Dictyocaulus* (1.33%), *Moniezia* (2%), and *Trichuris* (1.33%) were present before the dewormer administration. These parasites were established as prevalent in backyard farms of Southern, Isabela (Balbin et al., 2025). After the treatment, only *Haemonchus s*pp. was observed in the fecal samples.

The absence of *Trichostrongylus*, *Coccidia*, *Dictyocaulus*, *Moniezia*, and *Trichuris* in the post-treatment samples suggests that the deworming treatment was effective in eliminating these infections. Their low prevalence before treatment may have also contributed to their complete disappearance after deworming. Additionally, reduced egg shedding following treatment and limited reinfection during the observation period may explain why these parasites were no longer detected (Taylor et al., 2016; Bowman, 2021).

Table 2. Distribution of Gastrointestinal Nematodes in Goat Before and After Treatment

Gastrointestinal Nematode	Pre-Treatment		Post Treatment	
	Frequency	Percent	Frequency	Percent
Haemonchus	150	100	150	100
Trichostrongylus	6	4	0	0
Coccidia	12	8	0	0
Dictyocaulus	2	1.33	0	0
Monieza	3	2	0	0
Trichuris	2	1.33	0	0

Fecal Egg Count at Pre vs. Post Treatment. The result of fecalysis conducted before (pre) and after (post) deworming administration is presented in Table 3. The results show a significant reduction in fecal egg counts across all barangays after treatment.

In this study, all study sites exhibited reductions in fecal egg counts after Albendazole treatment; however, moderate reduction was observed. Among all study sites, Garit Sur showed the highest reduction in fecal egg count (78.99%) indicating relatively better drug performance compared to other barangays. However, even this level of reduction still does not confirm complete susceptibility, as residual egg shedding was still observed post-treatment.

Table 3. Comparison of Pre-Treatment and Post-Treatment Fecal Egg Counts by Barangay

Community	**N**	**Total Pre FEC**	**Total Post FEC**	**Mean Difference (Pre–Post)**	**% Reduction**
1	50	8,798	1,250	7,548	85.79%
2	15	7,150	2,910	4,240	59.30%
3	20	6,600	1,520	5,080	76.97%
4	10	7,390	3,910	3,480	47.09%
5	20	11,150	2,300	8,850	79.37%
6	35	14,711	3,091	11,620	78.99%

Anthelminthic resistance. The presence of anthelminthic resistance among the animals under study at different farm locations is presented in Table 4. The results show that the majority of goats (82%) are classified as resistant; 18% are classified as susceptible. This indicates that resistance is widely present across all study areas. Among the sites under study, Carulay shows the highest proportion of resistant goats at 100.0% while Gucab records the lowest at 70.0%.

Table 4. Anthelmintic Resistance Status Across Barangays

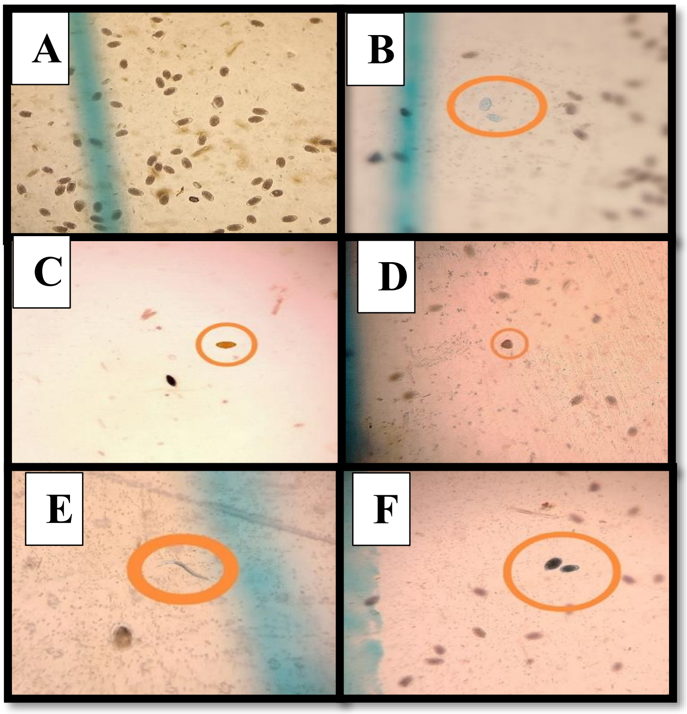
Community	Resistant (n)	Susceptible (n)	Total	% Resistant
1	42	8	50	84.0%
2	13	2	15	86.7%
3	17	3	20	85.0%
4	10	0	10	100.0%
5	14	6	20	70.0%
6	27	8	35	77.1%
Total	123 heads	27 heads	150 heads	82.0%

≥95% = Susceptible *<95% = Resistant*

Fecal egg count reduction test (RECRT). Table 5 presents the variation in fecal egg count reduction (FECR) across barangays. Fecal Egg Count Reduction (FECR%) across barangays ranging from negative reductions to moderate efficacy levels. However, none of the barangays reached the ≥95% FECR threshold, which is the standard indicator of effective anthelmintic performance. This suggests widespread reduced drug efficacy and probable anthelmintic resistance in the goat populations across all study sites.

Table 5. Fecal Egg Count Reduction (FECR) Across Barangays

Community	N	Mean FECR%
1	50	-51.90
2	15	-44.93
3	20	50.55
4	10	26.90
5	20	60.85
6	35	67.23



Identified Parasites
a. Haemonchus sp. b. *Coccidia* c. *Trichuris sp.* d. *Monieza*
e. *Dictyocaulus* f. *Trichostrongylus sp.*

CONCLUSION

It is therefore concluded that anthelminthic resistance has already developed in sites across study, affecting 82% of the herd. *Haemonchus* sp. is the most prevalent gastrointestinal parasite, which can no longer be controlled by the administration of Albendazole.

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