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Anthelmintic Resistance in Cattle Raised in Echague, Isabela, Philippines

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Abstract:
This study was conducted to evaluate anthelmintic resistance (AR) in gastrointestinal nematodes of cattle raised in selected communities in Echague, Isabela, Philippines. The development of AR was evaluated using Fecal Egg Count Reduction Test (FECRT) and the prevalence of parasite before and after dewormer administration of 90 heads of cattle. Results show that *Haemonchus* spp. was the most prevalent gastrointestinal parasite, occurring in 100% of cattle before and after treatment, while *Trichostrongylus* spp., *Moniezia* spp., and *Trichuris* spp. were eliminated following deworming. Although fecal egg counts significantly decreased after treatment (mean reduction = 43.03 EPG; p = 0.000), FECRT results indicated that overall fecal egg count reduction was below the recommended 95% threshold. Moreover, 78.9% of the cattle were classified as resistant, confirming the presence of widespread anthelmintic resistance in the study area. The study concludes that anthelmintic resistance is already prevalent among cattle in Echague, Isabela.

Keywords: Anthelmintic Resistance, Gastrointestinal Nematodes, Fecal Egg Count Reduction Test

INTRODUCTION

Cattle production continues to support the food supply and income of rural households in many developing countries. Smallholder farmers raise cattle for meat, milk, draft power, and emergency cash needs. The Food and Agriculture Organization (FAO) reported that cattle serve as a key asset for families with limited resources. These animals adapt well to different environments and grow under low-input conditions (FAO, 2022; Banda & Tanganyika, 2021). The Philippine Statistics Authority (PSA) records showed that as of January 2024, almost 80% of the national cattle inventory came from small farms, which highlights the steady dependence on household-level production (PSA, 2025). Regions with active mixed-crop and livestock systems, such as Cagayan Valley, continue to record increases in cattle numbers and carcass output. Cattle production forms part of the livestock output of Cagayan Valley, which posted a 4.3% increase in total livestock volume in 2023 (PSA, 2023). The steady livestock increase reflects continuous farm activity and the ongoing demand for meat products in Cagayan Valley.

Despite this steady growth, cattle health problems continue to limit productivity. Gastrointestinal nematodes (GINs) remain among the most common causes of poor performance in grazing cattle (Khan et al., 2023). These parasites impair animal growth, feed efficiency, and overall condition. Studies in tropical and semi-tropical countries showed that infections with *Haemonchus* sp., *Cooperia* sp., and *Oesophagostomum* sp. often led to weight loss, anemia, and lower milk yield (Charlier et al., 2023). Recent research in Southeast Asia revealed high GIN prevalence in cattle raised under open grazing systems, especially during warm and humid seasons (Chan et al., 2025; Bautista-Garfias et al., 2022). These findings match the situation in Philippine backyard herds, where farmers report recurring digestive problems, poor growth, and delayed maturity in infected animals (Balbin et al., 2025). Heavy worm loads weaken animals and reduce farm income due to higher treatment needs and slow recovery.

A growing concern in cattle production is the decline in the effectiveness of common dewormers. Many farmers rely on benzimidazoles, macrocyclic lactones, and imidazothiazoles to control parasite infection. These products once produced consistent results, but recent studies recorded an increase in anthelmintic resistance in several countries. Research in Indonesia and Vietnam recorded resistance in cattle GINs exposed to long-term ivermectin and albendazole use (Duc et al., 2024; Kobylinski et al., 2024). WAAVP's updated guidelines in 2023 stressed the importance of regular monitoring because resistance now appears in areas with limited veterinary supervision (Kaplan et al., 2023). Philippine reports remain limited, yet field observations from local livestock technicians indicate declining treatment responses in backyard cattle, especially in herds that use the same product for several years without dose checking.

Scientific evaluation of anthelmintic resistance helps communities understand the effectiveness of the products they rely on. One widely accepted method is the Fecal Egg Count Reduction Test (FECRT). The FECRT compares fecal egg counts before and after treatment with a commercial anthelmintic. A low reduction rate signals that worms survived treatment, which indicates resistance. International guidelines recognize FECRT as a practical field tool because it works with naturally infected animals and requires only basic laboratory procedures (WOAH, 2022; Kaplan et al., 2023). FECRT results also reflect actual farm conditions, making it appropriate for backyard cattle systems. This study was conducted to assess the development of AR in the backyard- level cattle production in selected backyard cattle raisers in Echague, Isabela, Philippines.

MATERIALS AND METHODS

Study Site

The study was conducted in selected cattle-producing areas in Echague, Isabela, where gastrointestinal nematode infections are commonly encountered under field conditions. The study includes 30 cattle farms with at least 3 cattle or more, either cow or bull, who engaged in cattle farming for at least 1 year was included in the FECRT.

Collection of Fecal Samples

Fresh fecal samples were collected around 5 to 7 in the morning and it was excreted by the animals on pre-treatment and post-treatment (day 14). The fecal samples collected were at least 15 grams and store in a clean and sterile containers. The containers were carried the animal's identification, the sampling date, and the assigned treatment code. Samples were placed in insulated boxes with ice packs to maintain a cool temperature until they reach the laboratory. All sample processing and fecal egg count procedures were completed at the College of Agriculture, Isabela State University–Echague Campus.

Preparation of Floating Solution

A salt-sugar solution with a specific gravity of approximately1.18 to 1.20 were prepared by gradually dissolving 400g sodium chloride and 500g sugar in 1000 mL of distilled water with continuous stirring until saturation was achieved.

Interpretation of Worm Egg Count (WEC)

Table 1. Interpretation of Worm Egg Count (WEC) Obtained from animals

Worm Egg Count	Interpretation	Action
50-300 EPG	Light Infection	Treatment not necessary
400-600 EPG	Moderate Infection	Anthelmintic treatment may be beneficial
650-1000+ EPG	Heavy Infection	Anthelmintic treatment necessary

Source: World Association for the Advancement of Veterinary Parasitology (WAAVP) Guidelines

Fecal Egg Count Reduction Test (FECRT)

Samples collected on Day 0 were used as the baseline pre-treatment fecal egg counts and the samples collected 14 days (post-treatment) after deworming to assess the reduction in fecal egg shedding and determine the effectiveness of the treatment. The Modified McMaster Technique was determined the number of eggs per gram (EPG). Each sample was mixed with a saturated salt-sugar solution at a 1:15 ratio, filtered, loaded into McMaster chambers, and examined under a microscope at 10× magnification. The FECRT helped detect drug performance under the actual conditions of cattle farms and was computed using the formula:

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

Identification of prevalent parasite and worm egg count (WEC)

Fecal samples collected from cattle will be examined using the modified McMaster counting chamber to determine the worm egg count (WEC). To identify the prevalent gastro-intestinal parasite in cattle, floatation was used in the study, and identification is based on morphological characteristics. Weighing approximately 4 grams of feces using a digital balance and place it in a beaker. It was mix in a 50 mL floatation solution to achieve proper dilution. The fecal suspension was strain through a sieve into another container to remove large debris. The filtrate was stir using Pasteur and Pipette. A glass slide was placed on top of the test tube, and allowed to settle for 5 minutes before examining under a microscope using 10x magnification. The total number of eggs from both chambers were summed and multiplied by 50 to calculate the eggs per gram (EPG) of feces. On the other hand, the parasites' egg present will be identified using the morphological characterization.

Statistical Analysis

The FECR% was calculated for each sampled animal and then averaged at the farm level. A farm with a mean FECR of 95% or higher was classified as having no evidence of resistance. Values below this threshold indicates possible resistance, consistent with the current WAAVP guideline. All analyses were used SPSS or STAR software. Results were reported as mean standard deviation, together with resistance interpretation per farm.

RESULT AND DISCUSSION

Gastro-Intestinal Parasites Observed. The results revealed that there are four gastrointestinal parasites detected in the cattle population before treatment, namely *Haemonchus* spp. (100%), *Trichostrongylus* spp. (11.11%), *Moniezia* spp. (3.33%), and *Trichuris* spp. (3.33%). These parasites were identified as most prevalent in Sothern Isabela, Philippines (Balbin et al., 2025). On the other hand, following deworming, *Haemonchus* spp. remained present in all examined cattle.

The disappearance of *Trichostrongylus, Moniezia*, and *Trichuris* after treatment suggests that these parasites were susceptible to the administered dewormer. The anthelmintic effectively killed the adult parasites, preventing further egg production and interrupting their life cycles. Their relatively low prevalence before treatment may also have facilitated complete elimination. Based on published researches, *Trichuris* sp. is known to be less common in adult cattle but can be problematic in calves. Although *Trichostrongylus* spp. is observed in cattle, it is primarily known as a threat in small ruminants. resistance in *Moniezia* tapeworms in cattle is rare. Because these parasites are generally non-pathogenic in mature animals, tapeworm treatments are rarely needed, hence, standard dewormers remain highly effective (Kapo et al., 2025).

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

Gastrointestinal Nematodes	Pre-Treatment		Post treatment	
	Frequency	Percent	Frequency	Percent
Haemonchus spp.	90	100	90	100
Trichostrongylus spp.	10	11.11	0	0
Moniezia spp.	3	3.33	0	0
Trichuris spp.	3	3.33	0	0

Fecal Egg Count at Pre vs. Post Treatment. The comparison of pre-treatment and post-treatment fecal egg counts (FEC) of cattle from the four barangays included in the study was presented in Table 3. In all barangays, the mean post-treatment FEC was lower than the mean pre-treatment FEC, indicating that the administered anthelmintic treatment reduced the number of gastrointestinal parasite eggs shed by infected cattle.

These results align with the expected effect of anthelmintic treatment, where reduction in fecal egg counts serves as an indicator of decreased parasite activity (Morgan et al., 2022; Nielsen, 2021). However, uneven response across animals and locations remains common under field conditions. Differences in parasite burden, animal condition, and dosing practices influence treatment outcomes. Some animals carry heavier infections and show larger reductions, while others show limited response due to survival of parasites (Kaplan et al., 2023).

The continued presence of eggs in fecal samples after treatment indicates that some nematodes survived exposure to the drug. According to the recommendations of the World Association for the Advancement of Veterinary Parasitology (WAAVP, 2023), effective parasite control should result in a marked reduction in egg output, and any surviving parasite population should be carefully monitored to prevent the establishment of resistant strains.

Table 3. Comparison of Pre-Treatment and Post-Treatment Fecal Egg Counts by Communities Using Paired Samples Test

Community	N	Pre FEC	Post FEC	Mean Difference (Pre–Post)	Interpretation
A	48	4,293.75	2,706.25	1,587.50	Moderate Reduction
B	12	2,425.00	533.33	1,891.67	High Reduction
C	24	6,997.92	3,756.25	3,241.67	Very High Reduction
D	6	5,025.00	2,200.00	2,825.00	High Reduction

Anthelminthic Resistance. The results in Table 4 show that 71 out of 90 cattle (78.9%) were classified as resistant, while only 19 animals (21.1%) remained susceptible to the administered anthelmintic. This indicates a high level of anthelmintic resistance among cattle across the study area. Among the sites, communities be and c recorded the highest resistance rates (83.3%), followed by community a (70.8%) and community d (66.7%). The consistently high resistance levels across all communities suggest that resistance is already widespread and may no longer be confined to isolated farms.

The high prevalence of resistance may be associated with the deworming practices observed among respondents, particularly the frequent use of single drug and routine deworming schedules. Continuous exposure of parasite populations to the same anthelmintic class creates strong selection pressure, allowing resistant parasites to survive treatment and reproduce. According to Kaplan (2023), repeated use of the same anthelmintic without strategic rotation is one of the primary drivers of resistance development in gastrointestinal nematodes of ruminants.

Differences in management conditions across communities also contribute to the results. Grazing practices, exposure to contaminated pasture, and frequency of treatment affect how animals respond. Continuous grazing and shared pasture increase the risk of reinfection after treatment, which reduces the observed difference between pre-treatment and post-treatment values (Bricarello et al., 2023; Ratanapob et al., 2022).

Table 4. Anthelmintic Resistance Status Across Communities

Community	Resistant (n)	Susceptible (n)	Total	% Resistant
A	17	7	24	70.8%
B	10	2	12	83.3%
C	40	8	48	83.3%
D	4	2	6	66.7%
Total	71	19	90	78.9%

≥95% = Susceptible <95% = Resistant

Fecal Egg Count Reduction (FECR) Across Communities. FECR is a widely accepted indicator for evaluating the effectiveness of deworming drugs, wherein higher FECR values indicate greater reduction in parasite egg shedding and better anthelmintic efficacy. Based on the standards established by the World

Association for the Advancement of Veterinary Parasitology, an FECR of 95% or higher is generally considered indicative of a susceptible parasite population, while lower values may suggest reduced efficacy or possible anthelmintic resistance.

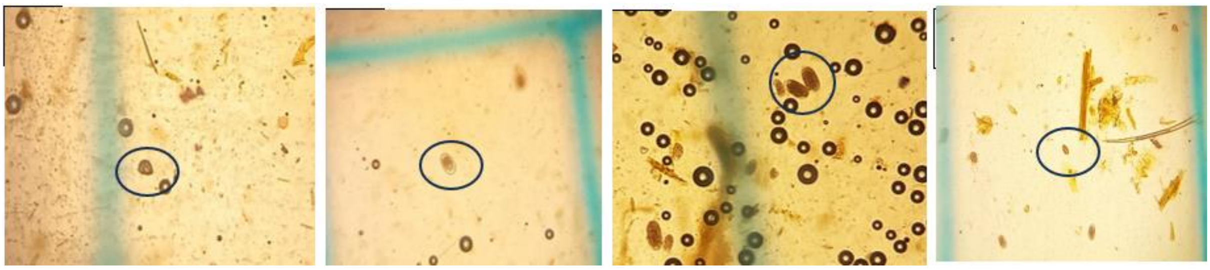
The mean FECR across all communities was 44.70%, indicating that the treatment achieved only a moderate reduction in gastrointestinal nematode egg counts. Since all FECR values were below the recommended efficacy threshold, the findings suggest the possible occurrence of anthelmintic resistance among the nematode populations infecting cattle in the study sites.

The FECR results indicate that none of the communities achieved the level of efficacy expected from a fully effective anthelmintic treatment. While community b showed comparatively better performance, all mean FECR values remained below the accepted susceptibility threshold. The particularly low FECR values observed in community c and d suggest a greater likelihood of established anthelmintic resistance, highlighting the need for improved parasite control strategies and routine monitoring of drug efficacy in cattle herds.

The result of the study confirms the developed anthelminthic resistance among the cattle herd raised in the selected communities. The result also confirms the common practices on deworming to control parasites in livestock has led to high levels of anthelmintic resistance (AR) in grazing ruminants is not only in the Philippines, but worldwide (Morgan et al., 2022). In the Philippines, AR is also documented among buffaloes, which is generally linked to the utilization of albendazole and levamisole (Junatas and Molina, 2021).

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

Community	N	Mean FECR
A	24	46.32
B	12	78.01
C	48	36.97
D	6	56.22
Total	90	44.70



Identified Parasites

a. Moniezia spp. b. Trichostrongylus spp. c. Haemonchus spp. d. Trichuris spp.

CONCLUSION

Based on the results presented, it is therefore concluded that resistance in cattle to anthelmintic treatment has already developed. Severity of resistance is observed across all communities under study with 78.9% of the experimental animals are confirmed to be resistant against Albendazole, and still affected by

Haemonchus sp. Shared grazing area, repeated use of the same drug, improper dosing, and poorly timed treatments are among the farm management and deworming practices directly associated to the resistance development.

REFERENCES:

1. Balbin, A.J.M., Nayga, N.J., Bacton, J., Bautista, J., Catalonia, H.M.D., dela Cruz, K., Fajardo, M.A.D.; Ignacio, A.D.; Quiming, L.; Sapaden, J. Gastrointestinal Parasitic Infections of Ruminants in Backyard Farms of Southern Isabela, Philippines. Environ. Sustain. Anim. Ind. 2025, 191, 1–9.
2. Banda, L. J., & Tanganyika, J. (2021). *Livestock provide more than food in smallholder production systems of developing countries*. *Animal Frontiers, 11*(2), 7–14. https://doi.org/10.1093/af/vfab001
3. Bautista-Garfias, C. R., Castañeda-Ramírez, G. S., Estrada-Reyes, Z. M., Soares, F. E. D. F., Ventura-Cordero, J., González-Pech, P. G., ... & Aguilar-Marcelino, L. (2022). A review of the impact of climate change on the epidemiology of gastrointestinal nematode infections in small ruminants and wildlife in tropical conditions. *Pathogens, 11*(2), 148.
4. Bricarello, P. A., Longo, C., da Rocha, R. A., & Hötzel, M. J. (2023). Understanding animal-plant-parasite interactions to improve the management of gastrointestinal nematodes in grazing ruminants. *Pathogens, 12*(4), 531. https://doi.org/10.3390/pathogens12040531
5. Chan, A. H. E., Kaenkaew, C., Pakdee, W., Sungpradit, S., & Thaenkham, U. (2025). Emergence of dual drug-resistant strongylids in goats: First phenotypic and genotypic evidence from Ratchaburi Province, central Thailand. *BMC Veterinary Research, 21*(1), 245.
6. Charlier, J., Williams, D. J., Ravinet, N., & Claerebout, E. (2023). To treat or not to treat: Diagnostic thresholds in subclinical helminth infections of cattle. Trends in Parasitology, 39(2), 139–151.
7. Duc, H. M., Hoa, T. T. K., Thang, N. V., & Son, H. M. (2024). First report on the occurrence and antibiotic resistance profile of colistin-resistant Escherichia coli in raw beef and cow feces in Vietnam. Microorganisms, 12(7), 1305.
8. Food and Agriculture Organization. (2022). The state of food and agriculture 2022: Leveraging automation in agriculture for transforming agrifood systems. https://www.fao.org/3/cc2211en/cc2211en.pdf
9. Junatas, K. L., & Molina, E. C. (2021). Anthelmintic resistance of gastro-intestinal nematodes to albendazole, levamisole and ivermectin in Murrah buffaloes. *Journal of Agricultural Research, Development, Extension and Technology, 3*(1), 55–59. https://doi.org/10.5281/zenodo.8296453
10. Kaplan, R. M., Vidyashankar, A. N., & Howell, S. B. (2023). WAAVP guidelines for assessing anthelmintic efficacy in ruminants: 2023 update. Veterinary Parasitology, 311, 109955.
11. Kapo, N., Softić, A., Goletić, T., Goletić, Š., Cvetkovikj, A., & Omeragić, J. (2025). Anthelmintic resistance in livestock farming: Challenges and perceptions of farmers and veterinarians. *Pathogens, 14*(7), 649. https://doi.org/10.3390/pathogens14070649
12. Khan, A., Jamil, M., Ullah, S., Ramzan, F., Khan, H., Ullah, N., ... & Amber, R. (2023). The prevalence of gastrointestinal nematodes in livestock and their health hazards: A review. World's Veterinary Journal, 13(1), 57–64.

13. Kobylinski, K. C., Satoto, T. B., Nurcahyo, W., Nugraheni, Y. R., Testamenti, V. A., Winata, I. P. B., ... & Bøgh, C. (2024). Impact of standard and long-lasting ivermectin formulations in cattle and buffalo on wild *Anopheles* survival in Indonesia. *Scientific Reports, 14*, 29770.
14. Morgan, E. R., Lanusse, C., Rinaldi, L., Charlier, J., & Vercruysse, J. (2022). Confounding factors affecting faecal egg count reduction as a measure of anthelmintic efficacy. *Parasite, 29*, 20. https://doi.org/10.1051/parasite/2022017
15. Nielsen, M. (2021). What makes a good fecal egg count technique? https://doi.org/10.1016/j.vetpar.2021.109509
16. Philippine Statistics Authority. (2023). *Cagayan Valley livestock and poultry situation report, 2023*. Philippine Statistics Authority. https://psa.gov.ph
17. Philippine Statistics Authority. (2024). *Livestock and poultry inventory: January 2024.*
18. Philippine Statistics Authority. (2025, February). Livestock and poultry quarterly bulletin: October–December 2024 (Vol. 2, No. 4). https://psa.gov.ph/system/files/technical-notes/Q4%202024%20Livestock%20and%20Poultry%2C%20February%202025.pdf
19. Philippine Statistics Authority – Region II. (2024). *2024 livestock situation report.* https://rsso02.psa.gov.ph/index.php/content/2024-livestock-situation-report
20. Ratanapob, N., Thuamsuwan, N., & Thongyuan, S. (2022). Anthelmintic resistance status of goat gastrointestinal nematodes in Sing Buri Province, Thailand. Veterinary World, 15(1), 83–90.
21. World Association for the Advancement of Veterinary parasitology (WAAVP). (2023). Guideline for diagnosing anthelmintic resistance using the fecal egg count reduction test in ruminants, horses and swine. *Veterinary Parasitology,* 318, 109936
22. World Organisation for Animal Health (WOAH). (2022). Manual of diagnostic tests and vaccines for terrestrial animals. WOAH. https://www.woah.org/en/what-we-do/standards/codes-and-manuals/terrestrial-manual/