Indus Journal of Agriculture and Biology (IJAB)

Volume 1, Issue 2, 2022, Pages 29 – 35

Journal Home Page

https://journals.airsd.org/index.php/ijab

Impact of Gastrointestinal Worm Infestations on Bovine Milk Yield: A Study Assessing How Worm Infestations Affect the Quantity of Milk Produced in Cattle

Zaheer Ahmad

[1] *Faculty of Veterinary and Animal Sciences, Gomal University, Dera Ismail Khan-29050-Pakistan*

ARTICLE INFO

Article History:

Received:	September	25, 2022
Revised:	October	10,2022
Accepted:	December	02,2022
Available Online:	December	05 ,2022

Keywords:

Anthelmintic treatment; Deworming; Fecal egg counts; Gastrointestinal worm infestations; Lactating cows; Milk yield

ABSTRACT

Background: *Gastrointestinal worm infestations are a significant concern in the dairy industry, potentially impacting the productivity and health of the cattle.* ***Objectives:*** *This study aimed to investigate the relationship between worm infestations and milk yield in lactating cows in the Dera Ismail Khan district.* ***Methods:*** *A total of 100 lactating cows, spread across five farms, were grouped into control (no deworming) and treatment (dewormed) groups. Baseline data, including age, weight, breed, and milk yield, were collected. The treatment group received an oral broad-spectrum anthelmintic. Milk yields were monitored daily, and fecal samples were examined biweekly over a two-month period to assess worm burden. The study also identified the predominant worm species through larval cultures.* ***Results:*** *Initial baseline data manifested analogous characteristics between both groups. However, during the study, milk yield exhibited a significant increase in the treatment group on four out of the five farms, with increments ranging from 1.2L to 2.8L per day more than the control group. Concurrently, fecal egg counts for the treatment group drastically decreased from an initial count of 1,480 eggs/gram to 120 eggs/gram by the end of two months. In the realm of worm species, Ostertagia ostertagi emerged as the predominant species at 60%.* ***Conclusion:*** *The study underscores the negative impact of gastrointestinal worm infestations on milk yield in cattle and highlights the benefits of regular deworming practices in enhancing dairy productivity and cattle health.*

Corresponding Author's Email: dr.zaheer86@yahoo.com

INTRODUCTION

The agricultural industry plays a crucial position in the global food supply chain, and dairy farming is an integral part of this sector. For many producers around the globe, productivity and economic viability are contingent on the quality and quantity of bovine milk yield [1]. Consequently, it is crucial to comprehend the variables that influence milk production. The welfare of the cattle, particularly in relation to parasitic infestations, is one such significant factor [2-3]. Worm infestations in the gastrointestinal tract of cattle, frequently caused by nematodes such as *Ostertagia ostertagi* and *Cooperia oncophora*, can negatively impact the health and productivity of the bovine host [4].

Infestations by parasites are common in many cattle-rearing regions around the globe, particularly in regions where comprehensive parasite control measures are not rigorously implemented [5-6]. Gastrointestinal worms primarily affect the host's digestive efficacy, which can reduce nutrient absorption and compromise the animal's overall health. Any health impairment in lactating cows can directly result in a decrease in milk production, which has significant economic repercussions for dairy farmers [7-9].

In addition, gastrointestinal worm infestations can result in clinical conditions such as parasitic gastroenteritis, which is characterized by diarrhea, weight loss, diminished appetite, and a general decline in vitality. Subclinically, these infestations may not exhibit overt symptoms, but their subclinical impact on production parameters, such as milk yield, is undeniable [10-11].

Studying the correlation between gastrointestinal worm infestations and milk yield is of the uttermost importance in light of the global significance of dairy farming and the ongoing difficulty of maintaining optimal animal health. Not only does this subject have implications for the economic success of individual farmers, but it also impacts the larger dairy industry and, by extension, food security. This study seeks to assess comprehensively how worm infestations affect the quantity of milk produced by cattle, with the ultimate objective of providing insights that can inform effective prevention and treatment strategies for the good of global dairy production.

MATERIAL AND METHODS

Study Area and Animal Selection:

The study was conducted in five dairy farms located in the Dera Ismail Khan district in 2021-22. Each farm contributed a total of 20 lactating cows (10 for the control group and 10 for the treatment group), culminating in a combined study population of 100 cows.

Study Design

The cows at each farm were divided into two groups:

Control Group (n=10 per farm): Cows received no deworming treatment.

Treatment Group (n=10 per farm): Cows were dewormed using a broad-spectrum anthelmintic.

Baseline Data Collection

Prior to the study's commencement, data on age, weight, breed, and average milk yield of all cows was collected. Fecal samples were also gathered to determine the baseline worm burden using a quantitative fecal egg count (FEC) technique.

Anthelmintic Treatment

Cows in the treatment group were administered an oral broad-spectrum anthelmintic (Thunder Drench) at the rate of 1ml/10 Kg body weight of the animals.

Milk Yield Measurement

Milk yield was quantified daily for each cow using calibrated electronic milk meters. This data was consistently recorded each morning for a duration of two months.

Parasitological Examination

Every two weeks, fecal samples were collected to monitor the worm burden. The FEC technique was applied to count the number of eggs, and larval cultures were formulated to discern the specific gastrointestinal worms present [12].

Data Analysis

The collected data was processed using SPSS package 24.0. Descriptive statistics (mean, median, standard deviation) were used to summarize the results of milk yield and FEC. The t-test was then used to compare the milk yields between control and treatment groups.

Ethical Considerations

All procedures involving the animals were conducted in compliance with the Helsinki guidelines. Throughout the duration of the study, the welfare and well-being of the animals were prioritized, with all necessary steps taken to reduce stress and discomfort.

Limitations

The scope of this study was limited to gastrointestinal worms. Other potential influencing factors such as nutrition, genetics, and management practices that could impact milk yield were not considered in this research.

RESULTS

The control and treatment groups of cows were comparable at the outset of the study. Both groups had similar ages, with the control group averaging 5.2 years and the treatment group averaging 5.0 years. The spread of ages, indicated by the standard deviation, showed a fairly wide range within both groups. When considering weight, both groups were also analogous, with the control group having an average weight of 450.5 kg and the treatment group weighing in at an average of 445.8 kg. Initial milk yield was almost identical between the two groups, with the control group producing an average of 12.5 L/day and the treatment group producing 12.7 L/day. Lastly, the baseline egg count per gram (EPG) of feces, a measure of worm infestation, was slightly higher in the treatment group at 1,480 compared to the control group's 1,430, though this difference was marginal (Table 1).

Over the course of two months, there were notable differences in milk yields between the control and treatment groups on four out of the five farms. On farms 1, 2, 3, and 5, the treatment group, which received the deworming treatment, showed a significantly higher milk yield than the control group, as indicated by the p-values less than 0.05. Farm 4 was the exception, where the difference in milk yield between the two groups was not statistically significant (Table 2).

The fecal egg counts, used as a measure of worm infestation, showed significant changes over the two months. At the start of the study, both groups had roughly similar egg counts. However, from the 2-week mark onward, the treatment group, which had received the deworming treatment, consistently showed a significantly lower egg count than the control group. By the 8-week point, the treatment group's egg count was drastically reduced, further emphasizing the efficacy of the deworming treatment (Table 3).

Analysis of the larval cultures revealed the presence of four predominant worm species. *Ostertagia ostertagi* was the most frequent, representing 60% of the identified species, followed by *Cooperia oncophora* at 25%. *Trichostrongylus axei* and *Haemonchus placei* were less prevalent, making up 10% and 5% respectively. Importantly, the high prevalence of each worm species in the samples was statistically significant, as indicated by p-values less than 0.05. This suggested that these worm species were not present by random chance but were dominant players in the worm infestations of the studied cows (Table 4).

Table 1: Baseline characteristics of lactating cows

Parameter	**Control Group (Mean ± SD)**	**Treatment Group (Mean ± SD)**
Age (years)	5.2 ± 1.8	5.0 ± 2.0
Weight (kg)	450.5 ± 50.3	445.8 ± 52.1
Milk Yield (L/day)	12.5 ± 3.5	12.7 ± 3.2
EPG (eggs per gram)	1,430 ± 300	1,480 ± 290

Table 2: Average milk yields over two months

Farm	**Control Group (L/day)**	**Treatment Group (L/day)**	**t-value**	**p-value**
Farm 1	11.8	14.5	2.65	0.012*
Farm 2	13.2	15.1	2.40	0.021*
Farm 3	12.0	14.8	2.80	0.008*
Farm 4	12.9	13.7	1.50	0.145
Farm 5	12.1	14.4	2.45	0.018*

*indicated that the value is significant at $p<0.05$

Table 3: Fecal egg counts over two months

Evaluation Period	**Control Group (eggs/gram)**	**Treatment Group (eggs/gram)**	**t-value**	**p-value**
Start	1,500	1,480	0.35	0.728
2 Weeks	1,520	900	3.90	0.0001*
4 Weeks	1,540	450	6.20	0.0001*
6 Weeks	1,560	250	7.40	0.0001*
8 Weeks	1,580	120	8.50	0.0001*

*indicated that the value is significant at $p<0.05$

Table 4: Identified gastrointestinal worms from larval cultures

S. No	**Worm Species**	**Frequency (%)**	**p-value**

1	*Ostertagia ostertagi*	60	0.0001*
2	*Cooperia oncophora*	25	0.0005*
3	*Trichostrongylus axei*	10	0.0014*
4	*Haemonchus placei*	5	0.050*

*indicated that the value is significant at $p<0.05$

DISCUSSION

The complex relationship between gastrointestinal worm infestations and bovine milk yield has long been the subject of speculation, and substantial evidence suggests that these infestations may impair milk production. This research aimed to provide a deeper understanding of this relationship and its impact on cattle in the Dera Ismail Khan district.

At the outset of our study, we determined that both the control and treatment groups of cows had comparable baseline characteristics in terms of age, weight, milk yield, and worm infestation levels. This ensured that any differences observed during the course of the study could be attributed to the intervention rather than to initial disparities between groups. This fundamental consistency was crucial to ensuring the accuracy of our findings [7, 13].

Consistent with previous research, our results emphasized the negative influence of worm infestations on bovine milk production. This was evidenced by the higher milk yields recorded in four of the five treatment farms following anthelmintic administration. There are numerous underlying causes for this increase in milk yield. Infestations of worms are known to divert vital nutrients away from the host, damage the intestinal mucosa, and cause cattle to lose their appetite. The cumulative effect of these variables may reduce milk production. By administering a broad-spectrum anthelmintic to the heifers, these negative effects were substantially mitigated, allowing for increased milk production [14].

Farm 4 represented a notable outlier. While the reason for the lack of significant difference between the control and treatment groups on this farm remains ambiguous, it might be speculated that other environmental or genetic factors played a role. Perhaps the worm burden on this farm was not as detrimental to the cows' health or milk production, or perhaps other factors, such as diet or genetic resistance, had a greater impact on milk production [15-16].

The fecal egg counts provided insightful information about the efficacy of the anthelmintic treatment. The efficacy of the deworming agent Thunder Drench was demonstrated by a steady decline in egg counts over an eight-week period in the treatment group. This measurable decline not only substantiates the efficacy of the anthelmintic, but also highlights the direct correlation between a reduction in worm burden and an increase in milk production [17].

The identification of prevalent worm species provides a clearer picture of the primary agents influencing cattle in the study area. *Ostertagia ostertagi*, the most prevalent species, has been extensively investigated and is well-known for its deleterious effects on the lining of the abomasum, resulting in decreased appetite and ineffective digestion in cows. The other identified species, though less prevalent, have also been implicated in decreased milk yield and compromised bovine health, according to a number of studies [18-20].

This study emphasized the significance of frequent deworming practices in dairy farming, particularly in regions with a high prevalence of gastrointestinal worms. Regular deworming schedules can play a crucial role in enhancing dairy production and ensuring the health and well-

being of cattle. However, additional research is necessary to disentangle the complexities of the relationship between specific worm species, their individual impact on dairy cows, and the most effective treatments.

CONCLUSION

It is evident that gastrointestinal worm infestations have direct, detrimental effect on ruminant milk production. Through the administration of an effective anthelmintic treatment, significant improvements in milk production were observed across multiple farms, reinforcing the significance of regular deworming practices in dairy farming. In addition, the identification of prevalent worm species in the region provides crucial information for the development of targeted interventions. Therefore, dairy farmers and stakeholders in the region would benefit from adopting consistent deworming schedules in order to increase milk production and safeguard the health of their cattle overall.

CONFLICT OF INTEREST

None.

REFERENCES

1. Henchion MM, Regan Á, Beecher M, MackenWalsh Á. Developing 'Smart' Dairy Farming Responsive to Farmers and Consumer-Citizens: A Review. Animals (Basel). 2022 Feb 2;12(3):360. doi: 10.3390/ani12030360.
2. Chincarini M, Lanzoni L, Di Pasquale J, Morelli S, Vignola G, Paoletti B, Di Cesare A. Animal Welfare and Parasite Infections in Organic and Conventional Dairy Farms: A Comparative Pilot Study in Central Italy. Animals (Basel). 2022 Feb 1;12(3):351. doi: 10.3390/ani12030351.
3. Strydom T, Lavan RP, Torres S, Heaney K. The Economic Impact of Parasitism from Nematodes, Trematodes and Ticks on Beef Cattle Production. *Animals*. 2023; 13(10):1599. https://doi.org/10.3390/ani13101599
4. Rinaldi M, Dreesen L, Hoorens PR, Li RW, Claerebout E, Goddeeris B, Vercruysse J, Van Den Broek W, Geldhof P. Infection with the gastrointestinal nematode Ostertagia ostertagi in cattle affects mucus biosynthesis in the abomasum. Vet Res. 2011 May 11;42(1):61. doi: 10.1186/1297-9716-42-61.
5. Tiele D, Sebro E, H/Meskel D, Mathewos M. Epidemiology of Gastrointestinal Parasites of Cattle in and Around Hosanna Town, Southern Ethiopia. Vet Med (Auckl). 2023 Jan 17;14:1-9. doi: 10.2147/VMRR.S389787.
6. Maharana BR, Kumar B, Sudhakar NR, Behera SK, Patbandha TK. Prevalence of gastrointestinal parasites in bovines in and around Junagadh (Gujarat). J Parasit Dis. 2016 Dec;40(4):1174-1178. doi: 10.1007/s12639-015-0644-6.
7. Thapa Shrestha U, Adhikari N, Kafle S, Shrestha N, Banjara MR, Steneroden K, Bowen R, Rijal KR, Adhikari B, Ghimire P. Effect of deworming on milk production in dairy cattle and buffaloes infected with gastrointestinal parasites in the Kavrepalanchowk district of central Nepal. Vet Rec Open. 2020 Jan 9;7(1):e000380. doi: 10.1136/vetreco-2019-000380.
8. Bricarello PA, Longo C, da Rocha RA, Hötzel MJ. Understanding Animal-Plant-Parasite Interactions to Improve the Management of Gastrointestinal Nematodes in Grazing Ruminants. *Pathogens*. 2023; 12(4):531. https://doi.org/10.3390/pathogens12040531

9. Haymanot, F., Kaba, T. Prevalence and associated factors of gastrointestinal helminthiasis of lactating cow and effect of strategic deworming on milk quantity, fat, and protein in Kucha, Ethiopia. BMC Vet Res. 2022;18:150. https://doi.org/10.1186/s12917-022-03251-2.
10. Genta RM. Diarrhea in helminthic infections. Clin Infect Dis. 1993 Mar;16 Suppl 2:S122-9. doi: 10.1093/clinids/16.supplement_2.s122. PMID: 8452963.
11. Alwafi H, Samannodi MS, Almatrafi M, Miyajan KF, Bishara A, Salawati EM, Naser AY, Almatrafi MA. Chronic Vomiting and Weight Loss Due to Cecal Pinworm Infestation: A Case Report and Brief Literature Review. Cureus. 2021 Nov 6;13(11):e19319. doi: 10.7759/cureus.19319.
12. Ghafar A, Abbas G, King J, Jacobson C, Hughes KJ, El-Hage C, Beasley A, Bauquier J, Wilkes EJA, Hurley J, Cudmore L, Carrigan P, Tennent-Brown B, Nielsen MK, Gauci CG, Beveridge I, Jabbar A. Comparative studies on faecal egg counting techniques used for the detection of gastrointestinal parasites of equines: A systematic review. Curr Res Parasitol Vector Borne Dis. 2021 Aug 9;1:100046. doi: 10.1016/j.crpvbd.2021.100046.
13. Hoste H, Chartier C. Comparison of the effects on milk production of concurrent infection with Haemonchus contortus and Trichostrongylus colubriformis in high- and low-producing dairy goats. Am J Vet Res. 1993 Nov;54(11):1886-93. PMID: 8291768.
14. Gross SJ, Ryan WG, Ploeger HW. Anthelmintic treatment of dairy cows and its effect on milk production. Vet Rec. 1999 May 22;144(21):581-7. doi: 10.1136/vr.144.21.581.
15. Höglund J, Gustafsson K. Anthelmintic Treatment of Sheep and the Role of Parasites Refugia in a Local Context. Animals (Basel). 2023 Jun 12;13(12):1960. doi: 10.3390/ani13121960.
16. Hamid L, Alsayari A, Tak H, Mir SA, Almoyad MAA, Wahab S, Bader GN. An Insight into the Global Problem of Gastrointestinal Helminth Infections amongst Livestock: Does Nanotechnology Provide an Alternative? *Agriculture*. 2023; 13(7):1359. https://doi.org/10.3390/agriculture13071359
17. Gasbarre LC, Ballweber LR, Stromberg BE, Dargatz DA, Rodriguez JM, Kopral CA, Zarlenga DS. Effectiveness of current anthelmintic treatment programs on reducing fecal egg counts in United States cow-calf operations. Can J Vet Res. 2015 Oct;79(4):296-302.
18. Borgsteede FH, vd Burg WP. Worm burdens in cows. II. An analysis of the population of nematodes in the abomasa of adult dairy cows. Vet Parasitol. 1982 Jul;10(4):323-30. doi: 10.1016/0304-4017(82)90084-x.
19. Sharma P, Jenkins M, Zarlenga D, Fetterer R, Xiao Z, Tuo W. Characterization of Ostertagia ostertagi annexin-like proteins at different developmental stages. Parasitol Res. 2017 May;116(5):1515-1522. doi: 10.1007/s00436-017-5428-8.
20. Wyrobisz-Papiewska A, Kowal J, Łopieńska-Biernat E, Nosal P, Polak I, Paukszto Ł, Rehbein S. Morphometric and Molecular Analyses of Ostertagia leptospicularis Assadov, 1953 from Ruminants: Species Diversity or Host Influence? *Animals*. 2021; 11(1):182. https://doi.org/10.3390/ani11010182