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Analysing Gastrointestinal Helminth Infection Epidemiology and Effects in Dairy Animal Health

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Abstract

Infections with gastrointestinal helminths are a significant threat to the health of dairy animals, affecting their general well-being and production.Gastrointestinal helminth infections can happen to dairy cows, which can have adverse effects on their public health, reduced milk production, and weight loss. There needs to be more knowledge about the frequency, distribution, and results of helminth infections on dairy animal populations despite the dairy industry's importance to the region's agriculture.The aim of this study is to examine the epidemiology of gastrointestinal helminth infections in dairy animals and evaluate their implications on overall health. Through the identification of common helminth species, comprehension of seasonal fluctuations, and assessment of the effects on various dairy animals, our objective is to offer significant perspectives for focused intervention and management strategies.On dairy farms in a predetermined region, 183 animalslike 90 cows, 15 buffaloes, 28 sheep, and 50 goats were used in a cross-sectionedresearch. To identify the percentage of nematodes, protozoa, trematodes, and cestodes, they gathered and examined samples. Seasonal data collection was performed to monitor fluctuations in rates of infection.The outcomes were examined using statistical approach. The nematodes are the most prevalent gastrointestinal helminth infection in domestic ruminants, with a modest the rate globally. To preserve the welfare of the area herd and dairy production, they emphasized the need for preventative measures and cures.

Keywords: Dairy Animal, Health, Gastrointestinal Helminth Infection, Season

INTRODUCTION

The health of society and the milk produced of dairy animals are at risk from intestinal helminth infection (1). In a dairy farming environment, these parasitic worms, which include trematodes, cestodes and nematodes, can affect both individual cows and the group as a whole by developing health problems in the digestive system of animals (2).

Health Effects of Dairy Products on Animals

In dairy cows, helminth infections can result in symptoms such as anemia, diarrhea, decreased appetite and malaise. They can result in preclinical illnesses that lack any apparent indications. There could be an effect on the defences of the host, increasing their susceptibility for more diseases (3). To understand the entire health implications of these conditions, research on their immunology and sickness was important.

Impact of the Economy on Dairy Farming

Dairy farmers suffer substantial losses in money as a result of reduced milk production, slower development rates and higher veterinary expenses caused by gastrointestinal helminth infections (GIH) in animals (4). Health issues for animals and economic growth are exacerbated by the possibility of anthelmintic medication resistance.

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The Value of Animal Health in Dairy

The dairy farming industry was essential for the production of milk and dairy production, but the amount and calibre of these products are heavily affected by animal health, which has an influence on the ability of the business to remain economically viable (5). Unregulated GIH can have an impact on the health of dairy animals, enhancing their vulnerability to many issues and resulting in decreased milk output and impaired reproduction,

Integrated One Health

By combining the health of animals, people, and the environment, the One Health approach seeks to treat gastrointestinal helminth infections. Collaboration between veterinary professionals, academics, and public health experts is required (6).

Gastrointestinal Helminth Infection Prevalence

It was necessary to understand the prevalence of GIH to identify the best method of treatment (7). These diseases, which are common around the world, are impacted by characteristics including climate, eating habits, and livestock management. Fluctuations in rates of prevalence provide issues for farmers, therefore evaluating the existing environment were essential in setting focused strategies for management into place.This research aims to analyse the prevalence of GIH in dairy animals in a particular region, with a focus on cows, buffaloes, sheep, and goats.

The epidemiological study (8) which involved 495 cattle, determined the prevalence and contributing factors of Strongylida and Eimeria infections in the context of intensive dairy farms in northern Italy. The management measures score (MMS) and the productive categories were related to the occurrence of strongylida. The dominant species was Eimeria spp., and MMS had an impact on oocyst counts, especially in calves. The results underscore the importance of appropriate management approaches in reducing parasite infections and enhancing herd production; nevertheless, several limitations exist, such as the use of self-reported data and regional specificity.The European-wide study (9) evaluated the effects on ruminant livestock's bottom line of gastrointestinal nematodes, Fasciola hepatica, and Dictyocaulus viviparus. A deterministic model was used to predict the yearly cost, which was €1.8 billion across 18 nations, 81% of which was ascribed to lost productivity. Resistance to anthelmintics added €38 million. Data gaps and dependability on expert judgments are limitations that highlight the need.

The research (10) determined the frequency of gastrointestinal helminths in dairy cows throughout the year in the Luni basin of Rajasthan. The total helminth prevalence of 625 fecal samples was 66.88%, with strongyle preponderance. The rainy season had the highest number of illnesses, and native cattle showed greater vulnerability. The district of Sirohi had the most significant frequency. Larvae of Haemonchus, Oesophagostomum, Trichostrongylus, Bunostomum, and Strongyloides were detected by coprolculture. Constraints encompass a limited geographic reach and an inattention to specific variables impacting the incidence of helminth infections.The research (11) in Bangalore evaluated the effects of social and ecological factors on disorders by *Eimeria spp.*andgastrointestinal nematodes (GIN) in dairy animals along a gradient between urban and rural areas. The stratification index had a substantial impact on *Eimeria spp.* Infections and coinfection rates were more significant in rural regions. Results indicated that increasing urbanization has a variety of effects on endoparasite dynamics in the farming of dairy cattle. Two drawbacks are the cross-sectional design and the focus on a particular location.

Cross-sectional research (12) examined gastrointestinal helminths in 117 goats and 157 cattle in the Kanchanaburi Province, Thailand, finding infection rates of 88% and 35.7%, respectively. In goats, strongyle nematodes were 100% prevalent in the herd. The risk study emphasized the distinctions between animals raised for meat and dairy. Numerous strongyle genera were discovered using DNA sequencing, highlighting the significance of coinfection factors. The regional emphasis and possible sample limitations related to molecular techniques are among its rules.To support sustainable agricultural growth, the study (13) attempts to evaluate the

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effects of helminthic infections, in particular flukes, on livestock production and health. They examined existing practices such as the use of anthelmintic drugs, pasture management, and illness diagnostics. It emphasizes the need for more effective, integrated approaches to control parasitic infections in cattle while highlighting persisting obstacles.

The article (14) determined risk factors and the incidence of gastrointestinal parasite infections in water buffaloes in southern Iraq's marshlands: the two most prevalent parasites, *Fasciola spp.* (23%) and *Eimeria spp.* (19%) had an overall prevalence of 82%. The Marshlands require immediate and effective control measures, as demonstrated by the results. The cross-sectional nature of the study and its geographical emphasis are among its limitations.The extensive research (15) focused on helminthic, protozoan, and fungal parasite infections in dairy calves, as well as their frequency, effects, and diagnostic techniques. They stressed the need to take preventive action, emphasized the difficulties making a correct diagnosis, and emphasized the necessity for continued research to advance knowledge and create practical management plans for these illnesses in dairy calves.

Examining the distribution and prevalence of gastrointestinal parasites in bovine over, large-, medium- and small-scale farms, as well as their link to farm management approaches (16) conducted in Bangladesh's Chattogram area. Higher levels of parasitosis were found on small-scale farms, which may be related to inadequate management. They highlighted the necessity of efficient deworming techniques to control anthelmintic resistance and avoid infections. They offered insightful information that will help the area's livestock production be sustainable.To evaluate the incidence and risk variables of gastrointestinal parasites in cattle, the research (17) in Hossana town and the surrounding areas found a significant infection rate of 67.2%. Strongyle, Paramphistomum, and Fasciola were the most common parasites, highlighting the financial burden on cow producers. For the elimination of parasites, strategic deworming and efficient management techniques are essential.

The research (18) highlighted the risk of anthelmintic resistance (AR) and tackled the out-of-date data on helminth infections in small ruminants in Italy. To address integrated control measures, which include targeted therapies and non-traditional ways, the analysis presents prevalence and distribution data and promotes sustainable treatment solutions. They offered a valuable model for dealing with comparable issues in Mediterranean nations.The article (19) used a desktop technique and secondary data from published literature, examines the negative consequences of parasites and parasitic illnesses on animal health and production. Suggestions for responsible parasite management practices in cattle production are prompted by the findings, which show strong negative associations with key indicators and are consistent with immunopathology and resource competition theories.The study (20) intended to investigate the complex interaction that exists between gastrointestinal helminth infections in cattle and nutritional elements (prebiotics, probiotics, and phytonutrients), with a focus on these components affect the gut microbiota. The resultshighlighted reciprocal effects and provided insight into possible approaches for long-term helminth control and improved animal yield. Some limitations involve the need for more study to understand specific processes and their applicability in different contexts.

MATERIALS AND METHODS

The purpose of a study carried out in Sirmaur, a district in northern India, from February to July 2019 was to ascertain the incidence of gastrointestinal helminth parasites in household animals.Every month, a random sample of cattle, buffalo, goats, and sheep representing different breeds were studied. Fecal samples were gathered, frozen right away, and then carefully examined using statistical methods such as Student's "t" test and one-way ANOVA to identify infection trends among hosts and seasons.

Study Area

In the northern Indian district of Sirmaur, which is part of the outer Himalayan Shivalik range, research samples were collected from February to July 2019.

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Study Animals Selection

Cattle, buffalo, goats, and sheep were among the animal species that were chosen at random from the sites listed in Table (1). The selected breeds were Rampur bushair and Gaddi sheep, Chegu and Gaddi goats, Murrah buffalo, and Jersey, Sahiwal, and Holstein Friesian cattle. Samples of excrement were gathered.Basic information was requested on a printed questionnaire, which included the animal's age, gender, breed, husbandry techniques, farm size, type of flooring in animal shelters (soil or cement concrete), grazing schedules, cleaning and sanitation procedures, and history of deworming.

Table (1). Description of animals sampling (Source: Author)

Dairy Animals	Gender		Sample size	Positive cases	Infection rates (%)
	Male	Female			
Sheep	10	18	28	26	94.4%
Cow	35	55	90	85	95.3%
Goat	22	28	50	47	93.7%
Buffalo	4	11	15	14	90.9%
Total Samples	-	-	183	172	-

Gathering Fecal Samples

Freshly released feces from the research animals were gathered and placed in sterile disposable 100 mL containers or sterile polyethylene bags. After being correctly labelled, every sample was sent to the lab in a frozen state. On the same day that the samples were collected, they were processed and analyzed. The fecal samples were safely refrigerated at 2 to 4 degrees Celsius until analysis could be performed in cases where an immediate analysis was not possible.

Statistical Analysis

A methodical monthly assessment is carried out to ascertain whether gastrointestinal helminth parasites are present in dairy animals.Analysis and comparison of the gathered data were done in-depth. One-way ANOVA and the Student's "t" test were used in the statistical evaluation to identify crucial differences in infection rates across different hosts and seasons. Meaningful variations in infection prevalence were defined as those with a significance level of $p < 0.05$.

RESULT AND DISCUSSION

Table (1) provides specifics on the prevalence of the gastrointestinal helminth parasite (GIH) in domestic ruminants in the Sirmaur area of northern India. Feces samples from a total of 183 animals were obtained: 90 from cows, 15 from buffaloes, 28 from sheep, and 50 from goats. A total of 94% of these samples had positive results, with 172 of them testing positive.In terms of prevalence per species, cows showed the highest substantial rate of infection (95.3%), subsequently followed by buffaloes (90.6%), sheep (94.4%), and goats (93.7%). When ruminants were split into two groups extensive, which included sheep and cows, and tiny, which comprised buffaloes and goats it emerged that the larger animals had a significantly higher frequency of GIH disease than the smaller group. To determine the significance for variation in prevalence of infections across different hosts, a range of statistical techniques was used, such as single-way testing and the't' test. The results revealed significant variations ($p < 0.05$) at a 5% probability rate. It was demonstrated that the prevalence differences between small and large ruminant species were statistically important.Figure (1) illustrates the

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incidence of GIH identified in fecal samples taken from ruminants. Based on the statistics, nematodes had the most major rate of infection (42.5%), which was followed by trematodes (24.3%), protozoa (12.2%), and the cestodes (5.6%).

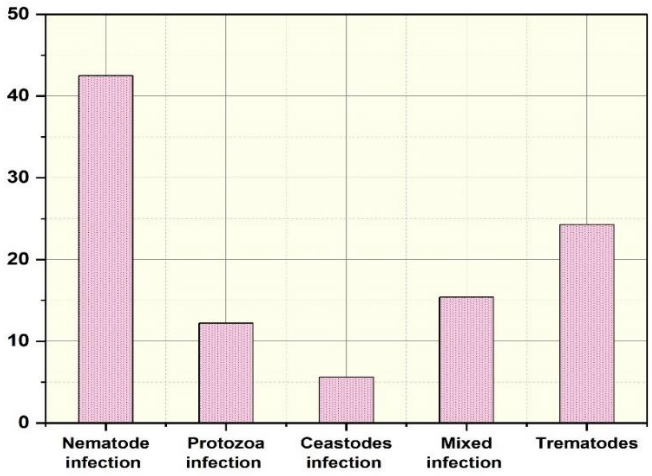

Figure (1). Infection of prevalence in GIH(Source: Author)

Furthermore, 15.4% of individuals had mixed infections found. The fecal samples revealed the presence of eight different helminth parasite species. Three nematode species, Haemonchus, the Strongyle group, and Trichuris, were recognized. Fasciola and Paramphistomum were the two species that represented trematodes. Taeniasaginata and Moniezia spp. were among the cestodes, and Cryptosporidium parvum and Giardia duodenalis were among the protozoa.The examination highlights the wide variety of helminth parasites that impact ruminants, with nematodes being the most common. To focus on efficient control strategies in management, it is essential to identify particular parasite species.Table (2) represents the GIH Prevalence infection in cow, buffalo, goat and sheep.

Table (2). GIH Prevalence infectionin cow, buffalo, goat and sheep (Source: Author)

GIH	Trematodes				Ceastodes				Nematodes				Protozoa			
	Fasciola		Paramphistomum		Moniezia spp.		Taeniasaginatio		Haemonochus		Trichuris		Cryptosporidium		Griardiadroden-alis	
	P (%)	I	P (%)	I	P (%)	I	P (%)	I	P (%)	I	P (%)	I	P (%)	I	P (%)	I
Buffalow (n=14)	7.1	1	21.4	3	7.1	1	7.1	1	7.1	1	7.1	1	7.1	1	7.1	1
Sheep (n=26)	15.4	4	15.4	4	3.8	1	7.7	2	7.7	2	7.7	2	11.5	3	7.7	2
Goat (n=47)	12.8	6	17	8	6.4	3	2.1	1	10.6	5	6.4	3	12.8	6	6.4	3
Cow (n=85)	16.5	14	18.8	16	3.5	3	2.3	2	5.9	5		4	8.2	7	9.4	8

Note: I =Infection, P = Prevalence

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Seasonal Parasite Dynamics

Data on the general prevalence of infection in each season are shown in Table (3) and Figure (2), with summer showing the most excellent rates, followed by winter, autumn, and rainy seasons. There were minor differences in seasonal prevalence amongst the various parasite families. The winter season was protozoa, nematodes, trematodes, and cestodes were most common, and the summer was when mixed illnesses were most common.To analyze the prevalence distribution by host, the winter and fall seasons saw a higher number of positive infection cases in cows and sheep. During the rainy season, the prevalence of infection was more significant in buffalos and goats. A p-value of less than 0.05 was statistically significant.These findings highlight the influence of seasonal fluctuations on the GIH prevalence, with distinct trends found for both parasite species and parasite groups. Comprehending the seasonal dynamics is imperative to execute focused management approaches and enhance the well-being of animals at various points throughout the year.

Table (3). Values of Seasonal infection of dairy animals (Source: Author)

GIH		Rainy (N=77)				Autumn (N=43)				Summer (N=34)				Winter (N=18)			
		Bf	Sh	Gt	Cw	Bf	Sh	Gt	Cw	Bf	Sh	Gt	Cw	Bf	Sh	Gt	Cw
Trematodes	I	5	6	3	2	2	4	1	1	2	2	2	2	1	0	1	2
	P (%)	6.4	7.7	3.8	2.5	4.6	9.3	2.3	2.3	5.8	5.8	5.8	5.8	5.5	-	5.5	11.1
Ceatodes	I	1	3	1	2	1	1	1	1	1	1	1	1	1	0	0	1
	P (%)	1.2	3.8	1.2	2.5	2.3	2.3	2.3	2.3	2.9	2.9	2.9	2.9	5.5	-	-	5.5
Nematodes	I	12	8	6	4	2	6	7	5	2	3	3	2	2	1	1	1
	P (%)	15.5	10.3	7.7	5.1	4.6	13.9	16.2	11.62	5.8	8.8	8.8	5.8	4.1	5.5	5.5	5.5
Protozoa	I	3	4	1	2	2	1	1	1	1	2	1	1	0	2	0	1
	P (%)	3.8	5.1	1.2	2.5	4.6	2.3	2.3	2.3	2.3	2.9	5.8	2.9	-	4.1	-	5.5
Mixed Infection	I	5	2	3	4	2	1	1	2	3	1	2	1	0	2	2	0
	P (%)	6.4	2.5	3.8	5.1	4.6	2.3	2.3	4.6	8.8	2.9	5.8	2.9	-	11.1	11.1	-

Note: I =Infection, P = Prevalence, Bf=Buffalo, Sh=Sheep,GT=Goat,Cw=Cow

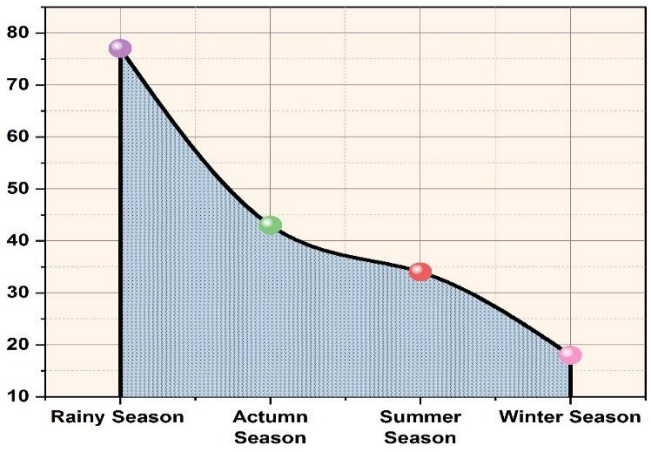

Figure (2). Seasonal disorder of dairy animals (Source: Author)

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Discussion

The study, which was carried out in the Sirmaur area of northern India, found that 94% of household ruminants had moderate GI helminth parasite infections. A single species of cestode, two trematode, and three nematode species were the leading causes of the diseases. Infections with nematodes were the most common, followed by those with trematodes, protozoa, and cestodes, which were the least common.The results highlight the significant incidence of nematodes and are consistent with research on domestic ruminants in different parts of India. In comparison to Fasciola, the trematode Paramphistomum was found to be more common in cows, according to the study. Haemonchus, a nematode, became the most common parasite, especially in sheep and goats. Summertime had the highest rate of infections, followed by winter, autumn, and the rainy season. The impacts of regional environmental elements are shown by the variations in frequency throughout investigations. The helminth species found in the study in accordance with those frequently observed in household ruminants in the tropical regions of India.

CONCLUSION

The study addressed the lack of information on the epidemiology of gastrointestinal helminth infections in dairy animals by concentrating on cows, buffaloes, sheep, and goats in a particular area. They performed a cross-sectional analysis following the collection of feces samples and the gathering of seasonal data for a total of 183 animals. Nematodes, protozoa, cestodes, and trematodes were the most prevalent helminth species. These findings emphasized the necessity of targeted intervention and management techniques that reduce adverse impacts on dairy animals' overall wellness, milk production, and decreased weight. The low overall prevalence findings were essential to creating preventative and treatment evaluates that would maintain dairy animal production.It is essential to understand the study's limitations, especially its sample size and geographic focus, since they may require to represent larger regional differences. To enhance the generalizability of results and explore other variables influencing the incidence of helminth infections in dairy animals in a wider structure, future research endeavours have to aim for an extensive and varied dataset. They provide the foundation for proactive measures and educated decisions that protect the local dairy animals' health and productivity.

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