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A Seasonal Survey on the Helminths Infections of the Ruminants Slaughtered in the Abattoirs of Mazandaran Province, Northern Iran

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ABSTRACT

Background: Gastrointestinal infections in ruminants are a major cause of economic losses. The present study aimed to evaluate the prevalence and seasonal variations of gastrointestinal helminth parasitic infections in the slaughtered animals in Mazandaran province, northern Iran.
Methods: This descriptive study was conducted on 300 cattle ruminants (sheep and goats) in Mazandaran province during September 2015-March 2017. The animals were assessed using parasitological methods. The contents of abomasa, small intestine, muscles, and liver were evaluated macroscopically and microscopically.
Results: Among 300 ruminants, 178 (59.33%) were positive for various species of gastrointestinal helminthes, including *T. colubriformis*, *O. circumcincta*, *M. marshalli*, *H. contortus*, *Habronema spp.*, *P. skrjabini*, *T. saginata*, *Echinococcus* spp., *Fasciola* spp., and *Dicrocoelium* spp. Babol was the most infected city ($P = 0.001$), and spring and summer had higher infection rates. Females were significantly more infected than males, and the animals aged more than nine months were infected more commonly than younger animals ($P < 0.05$).
Conclusion: According to the results, the rate of gastrointestinal helminth infection was relatively high among the slaughtered ruminants in northern Iran in terms of economic and zoonotic importance, which threatens animal production and public health.

1. Introduction

Ruminants are sources of animal hides, skin, and protein, supplying most of the daily meat and products to humans that are reared in traditional systems in many countries. Furthermore, animal wastes play a key role in agriculture [1]. Clinical and sub-clinical helminths diseases adversely affect the productive and reproductive potential of domesticated livestock. Gastrointestinal nematodes lead to the significant reduction of appetite, deterioration of physical conditions, anemia, hypoproteinemia, reduced digestive absorptive efficiency, and other pathogenic complications and even death in ruminants [2-5], which imposes severe losses on the economics of ranchers and the country in general [6].

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Gastrointestinal nematodes are prevalent in Iran, especially in Mazandaran district and many other areas of the country [7]. The frequency of gastrointestinal helminths is associated with agroclimatic circumstances such as the quantity and quality of the field, temperature, humidity, rainfall, and grazing behavior of animals [8]. Another influential factor in this regard is the seasonal changes in the relative proportion of these animals in several environmental zones across the world [9]. Data on the occurrence and scattering of various species of ruminant gastrointestinal nematodes are essential to the design of control plans.

Given the economic and health importance of intestinal nematodes in domestic animals and lack of comprehensive data in this regard in Iran, the present study aimed to investigate the prevalence and seasonal variations of different gastrointestinal helminth parasitic infections in the slaughtered cattle (sheep and goats) in the abattoirs of Mazandaran province in northern Iran and propose the optimal solutions to restrict nematode infection in these animals to help with the further studies.

2. Materials and Methods

2.1. Study Area

This retrospective study was conducted in Mazandaran province, located in the north of Iran. Mazandaran province covers an area of 23,831 square kilometers and is downward to the Caspian Sea, bordering with Golestan (northeast), Guilan (northwest), and Tehran provinces (south) with the latitude of 36°15′N-36°45′N and longitude of 52°15′E-53°E. Mazandaran province plays a pivotal role in the replacement of populations and travelers and has diverse geographical conditions (hills, valleys, and plains). The climate of the area is sub-humid to humid, with the yearly rainfall range of 718-1,274 millimeters [10].

2.2. Sample Collection

Samples collected weekly from 300 cattle (sheep and goats) during September 2015-March 2017. Sampling was performed at the local abattoirs of five regions in Mazandaran province, including Babol, Amol, Sari, Nowshahr, and Behshahr (Table 1). The age, sex, hosts, season, type of breeding, and place of sampling were recorded. The abomasa, small intestine, liver, and various body tissues of the animals were transferred to the laboratory and examined within five hours after slaughter. The abomasa and small intestine were opened, their contents were concentrated over a 100-mesh sieve, and the entire sieve contents were examined microscopically. In addition, the mucosa were observed and scratched meticulously to remove any adhering worms, and the muscles and livers were also examined.

2.3. Sample Examination

The washing process was entirely surveyed to find parasites. The identification of the parasites was completed based on numerous morphological and morphometric factors, such as the total body length, spicule, vulval flap, synlophe patterns, forms of the dorsal ray, cephalic structures, structure of the copulatory bursa, cervical papillae, and gubernaculum observations [11].

2.4. Statistical Analysis

Data analysis was performed in SPSS version 22 using descriptive statistics (frequency and percentage). In addition, Chi-square and Fisher's exact test were used to assess the differences in the cities, seasons, sex, age groups, animals, and types of breeding. In all the statistical analyses, the alpha value was set at 0.05.

3. Results and Discussion

Among 300 ruminants, 178 cases (59.33%) were positive for various species of gastrointestinal helminths. In different cities in Mazandaran province, the infection rate was observed to be comparatively higher in Babol ($P < 0.001$) (Table 1). Furthermore, the obtained results indicated that the infection rate was higher in spring and summer. Table 1 shows the distribution of the helminths parasites of the slaughtered animals in terms of gender.

According to the findings, the prevalence of nematodes and trematodes was significantly higher in females. In addition, the associations between age, animals, breeding types, and three types of parasites were considered significant ($P < 0.05$). The prevalence of helminths in terms of age indicated that the prevalence rate of the infection was higher in the animals aged more than nine months compared to the younger animals. The cattle were observed to be more infected with all types of parasites, while industrial breeding was associated with the lower prevalence of the infection as opposed to traditional breeding (Table 1).

Most of the studies regarding the evaluation of parasitic infections in abattoirs have been based on the helminthic diseases caused by nematodes, cestodes, and trematodes, and data is scarce on protozoan infections [12-13]. In the current research, 40.7% of the ruminants were infected with single or mixed endoparasites. We assessed cows, sheep, and goats, and the parasite rate varied among different ruminants. Consistent with the findings of Eslami *et al.* (1997), the highest infection rate was observed in cows [14].

The transmission of parasitic diseases is significantly associated with the climate.

According to the information in Table 1, the prevalence of parasitic infections was higher in summer and spring, and a significant difference was observed between nematodes and season ($P = 0.014$). However, the associations of trematode ($P = 0.076$) and cestode infections ($P = 0.281$) with seasons were not considered significant. In the infective stages, larvae urgently need moisture and optimal temperature for growth and survival in the pasture. Extremely hot or extremely low temperatures cause unfavorable conditions for the endurance and growth of parasitic larvae, thereby leading to the poor availability of infective larvae in the pasture. Therefore, summer and winter are probably not suitable for parasite transmission [15].

In a similar study, Radfar *et al.* (2011) reported that the prevalence of parasitic infections during autumn and winter was significantly higher compared to summer ($P < 0.05$) [16]. In another study conducted by Bana and Sultana (2009), autumn as a rainy season was observed to have the highest incidence, while the infection rate was moderate during spring and summer ($P < 0.05$) [17].

Table 1: Prevalence of total helminthic infections in terms of cities, season, sex, age, animals, and type of breeding

Parameters	Sample Size	Nematode N (%)	Cestoda N (%)	Trematode N (%)	Total infection N (%)
City					
Babol	100	64 (64.0)	11 (11.0)	21 (21.0)	69 (69.0)
Amol	41	12 (29.3)	4 (09.8)	8 (19.5)	20 (48.8)
Sari	59	21 (35.6)	8 (13.6)	10 (16.9)	35 (59.3)
Behshahr	50	13 (26.0)	4 (08.0)	13 (26.0)	21 (42.0)
Nowshahr	50	20 (40.0)	8 (16.0)	11 (22.0)	33 (66.0)
*P*value*	-	< 0.0001	0.757	0.841	0.001
Season					
Spring	71	36 (50.7)	7 (09.9)	9 (12.7)	41 (57.7)
Summer	109	55 (50.5)	15 (13.8)	31 (28.4)	71 (65.1)
Autumn	64	18 (28.1)	10 (15.6)	12 (18.8)	35 (54.7)
Winter	56	21 (37.5)	3 (05.4)	11 (19.6)	31 (55.4)
*P*value*	-	0.014	0.281	0.076	0.015
Sex					
Male	146	50 (34.2)	12 (08.2)	22 (15.1)	68 (46.6)
Female	154	80 (51.9)	23 (14.9)	41 (26.6)	110 (71.4)
*P*value*	-	0.002	0.070	0.014	< 0.0001
Age					
< 9 Months	157	48 (30.6)	12 (07.6)	19 (12.1)	66 (42.0)
> 9 Months	143	82 (57.3)	23 (16.1)	44 (30.8)	112 (78.3)
*P*value*	-	<0.0001	0.023	< 0.0001	< 0.0001
Animal					
Cattle	156	78 (50.0)	27 (17.3)	42 (26.9)	114 (73.1)
Sheep	90	37 (41.1)	7 (07.8)	13 (14.4)	43 (47.8)
Goat	54	15 (27.8)	1 (01.9)	8 (14.8)	21 (38.9)
*P*value*	-	0.016	0.004	0.032	< 0.0001
Type of Breeding					
Industrial	135	12 (08.9)	3 (02.2)	16 (11.9)	26 (19.3)
Traditional	165	118 (71.5)	32 (19.4)	47 (28.5)	152 (92.1)
*P*value*	-	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Total	300	170 (56.7)	256 (88.3)	237 (79.0)	122 (40.7)

*Pearson's Chi-squared test

In the present study, the nematode and trematode infection rate significantly differed between males and females (P = 0.002 and P = 0.014, respectively) (Table 1), which is inconsistent with the findings of Bano and Sultana (2009), Murat *et al.* (2009), and Yahaya *et al.* (2014) [9, 17, 18].

According to the current research, the breeding type of the ruminants was directly correlated with the rate of parasitic infections. Cows are mostly kept indoors in industrials farms where there is no grazing in pasturage and strategic anthelmintic therapy is implemented. In traditional farms, animals are completely tethered on common grazing land, which is shared by many herds and other animals. The results of the present study indicated that the prevalence rate of all the parasites in traditional farms was significantly higher than industrial farms (P< 0.0001).

Our findings demonstrated that the ruminants aged more than nine months were significantly more infected than those aged less than nine months. In a similar research, Garedaghi and Fattahi (2014) reported no significant correlations between the prevalence of infections and season, age, and sex [19]. In another study performed by Gharedaghi *et al.* (2013) in Behshahr (Iran), the prevalence rate of infections in old animals was similar to our findings and 11-13% higher than young animals (1-2 years) [20].

Other studies have reported the prevalence of helminth infections to be within the range of 6.8-82% in Iran and 2.3-86% in other countries [21-24]. In the current research, 73.1% of the cattle, 47.8% of the sheep, and 38.9% of the goats were infected by at least one parasite, and the correlation between parasite infection and type of animals was considered significant (P< 0.0001).

In the present study, the rate of *T. colubriformis* infection was estimated at 38.4% compared to the other nematodes. This rate is higher than the value reported in Pakistan and lower than other regions [25,26]. In a study in this regard, Marcello *et al.* (2014) observed that 48% of bovines were infected by *Trichostrongylus* spp. in Thailand [27]. Some of the factors that facilitate the survival of *Trichostrongylus* larvae and transmission of the parasites in Mazandaran province include climatic conditions, deprived farm supervision methods (e.g., structures, fertilizers, watering systems), and mostly the poor hygienic conditions of farms. However, we observed no significant difference between *Trichostrongylus* prevalence and type of hosts, with the highest rate recorded in the sheep (17.77%), followed by the cattle (17.30%), and the lowest prevalence was recorded in the goats (12.96%). In this regard, Ntonifor *et al.* (2013) reported the prevalence rate of *Trichostrongylus* spp. to be 55.8%, 28.8%, and 9.7% in goats, sheep, and cattle, respectively [28]. On the other hand, Gorski *et al.* (2004) stated that 21.5% of sheep were infected by *Trichostrongylus* in Poland [29].

Marshallagia marshalli is an ostertagia nematode in the abomasum of ruminants. In the present study, 16.66% of the sheep and goats and 17.94% of the cattle had *M. marshalli* infection. Among various species of nematodes in Iran, *M. marshalli* is the major cause of gastrointestinal helminthes in ruminants [14].

Table 2: Helminthic parasites isolated from cattle, sheep, and goat in mazandaran province, northern iran

Parasite	Animal	Cattle N (%)	Sheep N (%)	Goat N (%)	Total N (%)
Nematode	*Trichostrongylus colubriformis*	27 (25.7)	16 (30.8)	4 (18.2)	50 (27.9)
	O. circumcincta	12 (11.4)	7 (13.5)	9 (40.9)	23 (12.8)
	M. marshalli	28 (26.7)	15 (28.8)	0 (00.0)	52 (29.1)
	H. contortus	17 (16.2)	3 (05.8)	2 (09.1)	20 (11.2)
	M. marshalli + *O. circumcincta*	13 (12.4)	6 (11.5)	0 (00.0)	21 (11.7)
	Habronema	1 (00.9)	1 (01.9)	0 (00.0)	2 (01.1)
	P. skrjabini	1 (00.9)	0 (00.0)	0 (00.0)	1 (00.6)
	H. contortus + *M. marshalli* + *O. circumcincta*	6 (05.7)	4 (07.7)	0 (00.0)	10 (05.6)
Cestoda	*T. saginata*	5 (18.5)	0 (00.0)	1 (100.0)	5 (14.3)
	Hydatid Cyst	22 (81.5)	7 (100.0)	3 (37.5)	30 (85.7)
Termatoda	Fasciola	19 (45.2)	4 (30.8)	2 (25.0)	26 (41.3)
	Dicrocoelium	12 (28.6)	3 (23.1)	3 (37.5)	17 (27.0)
	Facsiola + Dicrocoelium	11 (26.2)	6 (46.2)	4 (18.2)	20 (31.7)

On the same note, Bentounsi *et al.* (2007) have reported the prevalence rate of *M. marshalli* infection to be 10% and 85% in Kazakhstan and Algeria, respectively [30].

According to the current research, the prevalence rate of *O. circumcincta* or *Teladorsagia circumcincta* infection was 12.8%. In another study, Al-Megrin *et al.* (2010) claimed that 4% of the camels in Mashhad (Iran) have *Teladorsagia* infection [31]. Furthermore, Kingsely *et al.* (2013) have reported the infection rate of 5.7% in Nigeria [32]. In another study, 100% of the slaughtered reindeers in northern Finland were reported to be infected by *O. gruehneri* [33].

Haemonchosis caused by *Haemonchus contortus* is the most important nematode of the abomasum [34]. These parasites could also cause severe anemia by reducing productivity and lead to death in severely infected animals [35]. In the present study, *H. contortus* infection was detected in 11.2% of the animals. Our findings in this are in line with the study by Nabila (2014), which indicated the H. contortus infection rate to be 9.18% in goats in Saudi Arabia [36], while inconsistent with the findings of Gadahi with the reported prevalence rate of 77.20% in Iran [37].

Liver flukes such as *F. hepatica* and *D. dendriticum* are common helminthic parasites of ruminants in many countries [38]. Several reports have demonstrated the extensive distribution of fascioliasis in Iran [14]. In the present study, 41.3% of the cases were infected by F. hepatica, while the cattle (26.9%) were significantly more infected compared to the Sheep (14.4%) and goats (14.8%) ($P < 0.032$). During 1985-2004, Dalimi *et al.* (2002) reported the prevalence rate of fascioliasis to be 17.8%, 19%, 11.5%, and 34.6% in cattle, sheep, goats, and camels, respectively [39].

Similar to most of the studies in this regard, our findings showed that the infection rate of F. hepatica (8.66 %) was higher than *D. dendriticum* (5.66 %), which could be due to the complexity of the life cycle and resistance of anthelmintic agents by D. dendriticum [38,40]. In the current research, 10% of the animals were infected by hydatid cyst, and consistent with a study conducted on turkey liver (4%), the lungs of the animals were more infected (3%) compared to the other organs [18].

4. Conclusion

According to the results, the rate of gastrointestinal helminth infection was moderately high considering the economic and zoonotic importance in the slaughtered ruminants in northern Iran, which could adversely affect animal production and public health. To diminish these complications, proper anthelmintic regimens and control programs are recommended in ruminants, along with raising awareness regarding public health. Moreover, it is essential to monitor the gastrointestinal parasites of ruminants in order to improve animal production and public health in Iran.

Authors' Contributions

B.R.E., performed laboratory works, I.M., designed the study as A.M., revised the manuscript, and R.Z., and H.V., performed statistical analysis.

Conflict of Interest

The Authors declare that there is no conflict of interest.

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