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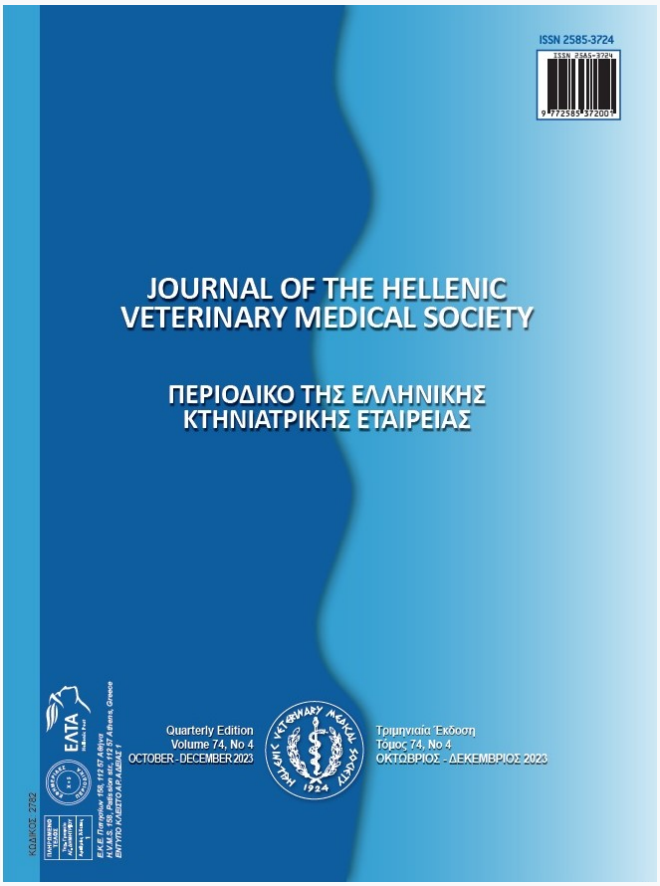

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Research article
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Prevalence of Abomasum Nematode infection in Sheep from North of Iran

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ABSTRACT: In many countries, small ruminants provide the primary source of human protein and play an important role in livestock production. Parasitic infections, especially gastrointestinal parasites, cause economic losses such as reduced fertility and milk production, damage to the leather industry, weight loss, treatment costs, and losses in severe infections. Thus, identifying and classifying these parasites, including the above cases, is essential for scientific research in any country. This study aimed to Prevalence of Abomasum Nematode infection in Sheep from North of Iran. In the present cross-sectional descriptive study, we have studied the prevalence of infection with abomasum nematodes in sheep in northern Iran from April 2020 to September 2021 in 2400 abomasum sheep slaughtered in industrial slaughterhouses in Gilan and Mazandaran provinces (1200 sheep from each province). With three age groups of below two years, two to four years, and above four years and gender segregation of hosts, after necropsy and preparation of sheep abomasal mucosa chip and isolation and segregation of samples, we studied the morphologic and morphometric characteristics of the samples. The actions were performed according to the taxonomic keys and using SPSS software V.16 and Paired Sample T-Test statistical test to determine the level of significance of the data ($p < 0.05$) to classify and compare the obtained data and examine the ratio. The sex of the host was determined by the age of the animal and the prevalence of the parasite at the mentioned ages. The present study results and comparison of the prevalence of infection in Gilan and Mazandaran provinces showed that *Marshallagia marshalli* had the highest prevalence of 94.6% and 91.9% in Mazandaran and Gilan province, respectively. The prevalence of *Ostertagia circumcincta* was 87.2% and 77.2% in Gilan and Mazandaran provinces. The prevalence of *Ostertagia occidentalis* was 86.9% in Gilan province and 78% in Mazandaran province, while the prevalence of *Parabronema skrjabini* was 86.6% in Gilan province and 61.2% in Mazandaran province. The prevalence of *Haemonchus contortu*s was 66.8% and 60.5% in Gilan and Mazandaran, the lowest prevalence in these two provinces. The present study results showed the importance of combating the spread of parasitic infections with strategic treatment methods and biological control of these parasites. Also, various reports of drug resistance in abomasal nematodes should be emphasized more and more by competent bodies.

Keywords: Abomasum, Nematodes, North of Iran, Parasitic infections, Sheep.

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INTRODUCTION

In many countries, small ruminants provide the primary source of human protein and play a crucial role in livestock production. However, sheep are raised under poor husbandry conditions in many areas, making them susceptible to various diseases. Indeed, Parasitic infections are more common in chronic form and clinic. Many factors influence determining the severity of infection, some of them are related to the host, such as age, sex, breed, the strength of the immune system, and feeding of animals. Furthermore, Parasite-related factors include the life cycle, the length of time the parasite survives in the environment, the organ of the host that is affected. Environmental factors such as weather conditions, season, and vegetation type also play a role(Aghazadeh and Yakhchali, 2020). In this regard, several parasitic gastrointestinal nematodes are involved in parasitic diseases. Under natural conditions, a single species can rarely cause gastrointestinal and respiratory infections. Even in clinical cases attributed to one species such as *Haemonchus contortu*s or nematodes, several other species are usually present. Infection with roundworms (nematodes) is common in ruminants. Moreover, economic losses parasites are also more likely to be due to nematodes in developing countries (Sazmand*et al*., 2020). Another reason for the importance of parasitic diseases, especially worm infection in ruminants, is their negative impact on livestock production and economic losses that directly and indirectly affect livestock and livestock production. Parasitic infections, especially gastrointestinal parasites, cause economic losses such as reduced fertility and milk production, weight loss, treatment costs, damage to the leather industry, and losses in case of heavy contamination (Hosseini and Meshgi, 2015). Furthermore, the ease of breeding and rearing sheep has made this animal the main source of red meat supply in the country. Thus, identifying the causes of sheep wastage at the abattoir can be extremely important to increase the efficiency of meat production and improve the breeding of this economic animal (Eslami, 2018). Most nematode infections that occur in the digestive and respiratory tracts of sheep belong to the order Strongylida. Although their life cycles are similar, some exceptions have significant implications for disease, epidemiology, and control measures (Aghazadeh and Yakhchali, 2020). In Iran, gastrointestinal tract infections of sheep with *Trichostrongylus*, *Marshallagia marshalli*, *Camel strongylus mentulatus*, *Haemonchus contortus,,* and *Parabronema skrjabini* have been reported (Eslami and Ranjbar Bahadori, 2004). Various studies have shown that a nematode species undergo polymorphism under the influence of different geographical factors and hosts, as well as different temperatures, hence, exhibit structural differences compared with the natural species. Moreover, similar changes have been observed in nematodes of the Trichostrongylidae, and their families, including Ostertagiinae, Haemoncinae, and Cooperinae. Indeed, factors causing these changes include security, climate, and nutrition. In order to determine the various aspects of a worm, such as morphology and pathogenicity, treatment, accurate characteristics of the parasite are required. Therefore, determining the morphological characteristics of a worm is very important for the taxonomy of worms. Because the changes made may confuse the detector and report a new species based on the secondary changes. On the other hand, by determining the exact morphology of the worm, we can make conclusions about the degree of immunogenicity of the host against the parasite. It is reported that the worms are shorter in safe and resistant animals, and the shortening of the vulva reduces the number of eggs in the uterus in females. (Hashempoor, 2015; Nabavi, 2017). The target of this study is to Prevalence of Abomasum Nematode infection in Sheep from North of Iran.

MATERIALS AND METHODS

Areas under study

We have studied the geographical areas in North Iran. The climatic zone is coastal regions of the Caspian Sea, with an annual rainfall of 40 to 150 cm. There is rainfall in most months of the year. The relative humidity is high, and the average annual temperature ranges from 8 to 26. Rasht city (Gilan province) locates in region 1 of the climate classification of Iran. Rasht has an area of about 180 square kilometers. Its altitude is 8 meters above sea level, its average annual temperature is 15.9 °C, and its annual rainfall is 1,359 mm. Its annual temperature ranges from 37 to -5 °C. The second city is Sari (Mazandaran province), which locates in region 1 of the climate classification of Iran. Sari has an area of about 54 square kilometers. Its altitude is 54 meters above sea level, its average annual temperature is 15 °C, and its annual rainfall is 789.2 mm. Its annual temperature is 22.4 to -5.2.

Sample collection

This cross-sectional descriptive study was performed on 2400 slaughtered sheep (1200 heads from each province of Gilan and Mazandaran) in indus-

trial slaughterhouses by simple random sampling. The population of sheep in each province is divided into two groups of 600 males and females, each of which is divided into three age groups of less than two years, two to four years and over four years. In order to obtain sampling after obtaining permission from the relevant authorities and coordination with the technical officials of slaughterhouses, in certain time periods April 2020 to September 2021, the following measures have been taken. After dissection and examination of the abomasum, the abomasum of the slaughtered sheep was completely shaved using a plastic file and kept in separate sampling containers and transferred to the laboratory for separation. Then pour the sample in a stainless-steel sieve (100 mesh) and rinse with city water. After deeply sucking the iodine logol and adding sodium thiosulfate solution, which removes the dye from the rest of the contents, the creams retain the iodine logol color, which facilitates the collection of the worms. Since its contents are stained, with the help of white background, examination light, cream-colored needle and pliers inside the petri dish, all available creams can be examined. The samples were also isolated and kept in cold water and kept in the refrigerator at 4 °C for 12 hours to accelerate and complete the recovery process of the worms. The samples are then transferred to other containers containing 70% alcohol with 5% glycerol and cooled again (4 °C). They were clarified with lactophenol solution to determine sex and species and examined under a light microscope with 4, 10 and 40 lenses. Calibrated eye microscope and lens were used to isolate and record information.

Morphological and morphometric characteristics of some of the most important nematodes of sheep abomasum

In the nematode *Haemonchus contortus,*, worm length is 10-20 mm, asymmetrical Copulatory bursa has 12 thin sexual ribs which the middle part is on the left lateral, containing the median Y-shaped rib. The spicules are dark brown and have a length of 460-506 micrometers from each appendage near the posterior end, distinct from the end of the spicules, and terminating in a knob at the end, the gubernaculum is a relatively large, brown, and sometimes tan. It is lighter than a spicule and 250-312 micrometers long. The circumference of the gut is bright red, giving the worm the appearance of a barber spring or cylinder (Figure 1; A1, A2.). Ostertagia species, which live in the abomasum and rarely in the small intestine of sheep, goats, cows, and other ruminants, are known as brown abomasal worms. These worms are thin and may have light skin in the anterior region. The head is no more than 25 micrometers wide, and the skin in other parts of the body has 25-35 longitudinal grooves but no transverse lines. The lateral, dorsal, and membranous appendages connect to the Copulatory bursa, located on the anterior side of the dorsal part. Being covered, the length of the male worm is 12-16 mm in *Ostertagia occidentalis*. Spicules are brown, thick, 290-320 micrometers long, and each is divided into three broad branches at the end (Figure 1; C). In *Ostertagia circumcincta*, the male worm is 7.5-8.5 mm long, and its spicules are thin and a rod 280-320 micrometers long and separated at the end of a sharp branch. Moreover, the main branch is button-shaped, and the gubernacu-

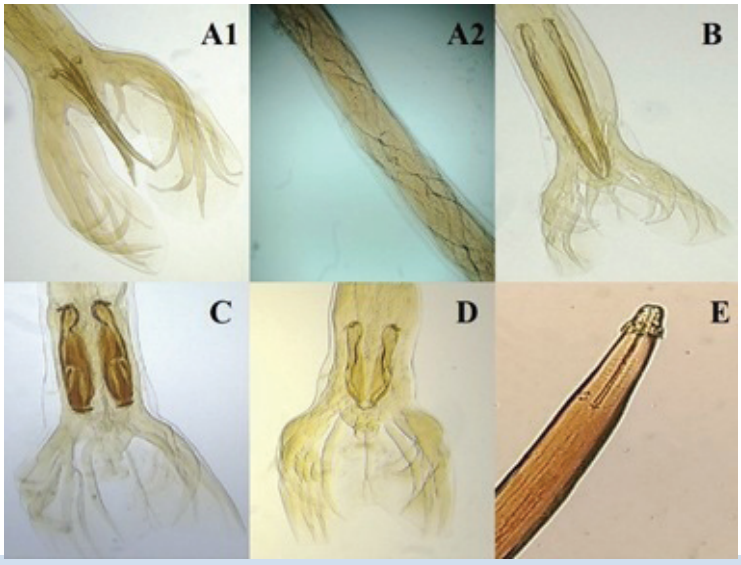

Figure 1: A1, A2. *Haemonchus contortus* Male, Female. B, *Ostertagia circumcincta*. C, *Ostertagia occidentalis*. D, *Marshallagia marshalli*. E, *Parabronema skrjabini*.

lum is rocket-like and 90 micrometers long at the end. The posterior part of the body opens outwards, and a thick band with 4-5 transverse lines can be seen near the end of the tail. The eggs are 80-100 micrometers by 40-50 micrometers in size (Figure 1; B). In *Marshallagia marshalli*, the male worm is 10-13 mm long and has a long conical Copulatory bursa. The dorsal or median ribs are long and narrow and have a length of 280-400 micrometers. Each branch is divided into two branches. The spines are pale yellow and 250-280 micrometers long. Each is divided into three branches, and there is no gubernaculum at the end. Moreover, the length of the female worm is 12-20 mm. It is possible that the genital pores are covered by a porous membrane. The egg is larger than in other nematodes of the gastrointestinal tract, except nematodes, and measures 178-218 micrometers by 78-100 micrometers (Figure 1; D). The *Parabronema skrjabini* nematode has a long cylindrical mouth with a thick wall and two false lateral lips, each with three appendages. The anterior end of the worm has abdominal dorsal cutaneous shields and 6-horseshoe-shaped ropes. The male end is twisted, and the spines are dissimilar entirely (Figure 1; E). (Eslami and Ranjbar Bahadori, 2004; Eslami, 2018; Hashempoor, 2015; Heidari *et al*., 2009; Changizi*et al*., 2011; Hosseini and Meshgi, 2015; Razavi *et al*., 2016).

Data analysis

Statistical analysis was performed by using the software package SPSS version 16.0 for windows (SPSS Inc., Chicago, IL, USA). Odds ratios (OR), confidence interval (CI), Paired Sample T-Test and p-value were calculated separately for each variable. P-value of less than 0.05 was considered statistically significant.

RESULTS

Morphological examination of abomasal nematode samples was revealed from a total of 2400 sheep slaughtered in abattoirs of Gilan and Mazandaran (1200 sheep from each). In Gilan province, the highest prevalence was related to the genus *Marshallagia marshalli* with a prevalence of 91.9% (1103/1200); followed by *Ostertagia circumcincta* and *Ostertagia occidentalis* with 87.2% (1046/1200) and 86.9% (1043/1200), respectively. *Parabronema skrjabini* with 86.6% (1039/1200); and finally, *Haemonchus contortu*s with 66.8% (802/1200) had the lowest prevalence. Comparing the prevalence by host sex (sheep studied), the highest prevalence was related to *Marshallagia marshalli* with 46.2% (550/1200); followed by *Parabronema skrjabini* with 43.7% (524/1200); *Ostertagia occidentalis* with 43.5% (522/1200). *Ostertagia circumcincta* with 42.7% (512/1200) and *Haemonchus contortu*s with 32.75% (393/1200) had the lowest prevalence in males. *Ostertagia occidentalis* with 44.5% (523/1200) and 43.4% (521/1200); *Parabronema skrjabini* with 42.9% (1215/515); and *Haemonchus contortu*s with 34% (409/1200) had the lowest prevalence in female sheep, respectively. In terms of prevalence by age, in sheep less than two years old, the highest prevalence was related to *Ostertagia occidentalis* and *Marshallagia marshalli* with 33.3% (400/1200). *Ostertagia circumcincta* with 33.1% (1238/398), *Parabronema skrjabini* with 31% (382/1200), and *Haemonchus contortu*s with 25.5% (303/1200) had the lowest prevalence. In sheep aged 2 to 4 years, the highest prevalence was related to *Ostertagia occidentalis* and *Ostertagia circumcincta* with 31.1% and 31% (374/1200) and (372/1200), respectively. *Marshallagia marshalli* with 28.8% (1200/346); *Parabronema skrjabini* with 24% (288/1200) and then *Haemonchus contortu*s with 23.6% (284/1200) had the lowest prevalence in sheep 2 to 4 years. In sheep over 4 years old, *Parabronema skrjabini* with 30.8% (129/369) had the highest prevalence and *Marshallagia marshalli* with 29.8% (357/1200); *Ostertagia circumcincta* 23% (276/1200); followed by *Ostertagia occidentalis* with 22.4% (269/1200). *Haemonchus contortu*s with 17.9% (215/1200) had the lowest prevalence in sheep over 4 years old. Regarding the average percentage of infection in Gilan province, 83.88% of the studied sheep were infected with abomasum nematodes, of which 41.77% were male and 42.11% were female sheep. The average percentage of infection in sheep by age was divided into three groups (under two years, 2 to 4 years, and also more than 4 years). It was 31.4% for sheep under 2 years; 27.7% for sheep 2 to 4 years; and 24.78% for sheep older than 4 years. In general, in terms of the prevalence of each genus in Gilan province, *Ostertagia occidentalis* had a prevalence of 91.9%; *Ostertagia circumcincta* 87.2%; *Ostertagia occidentalis* and *Parabronema skrjabini* with 86.9% and 86.6%, respectively; and *Haemonchus contortu*s had the prevalence of 66.8% (Table.1). In Mazandaran province, the highest prevalence was related to *Marshallagia marshalli* with 94.6% (1135/1200); *Ostertagia occidentalis* and *Ostertagia circumcincta* with 78% (936/1200) and 77.2% (926/1200), respectively, followed by *Parabronema skrjabini* and Ham with the prevalence of 61.2% (740/1200) and 60.5%

Table1: The Prevalence of abomasum nematodes of sheep in Gilan Province

Species	Location	Gender				Age						
		Male		Female		<2		2-4		>4		
	Gilan	Infect %	N	Infect %	N	Infect %	N	Infect %	N	Infect %	N	Infect %
Haemonchus contortus,	802	66.8	393	32.75	409	34	303	25.5	284	23.6	215	17.9
Ostertagia circumcincta	1046	87.2	512	42.7	534	44.5	398	33.1	372	31	276	23
Ostertagia occidentalis	1043	86.9	522	43.5	521	43.4	400	33.3	374	31.1	269	22.4
Marshallagia marshalli	1103	91.9	554	46.2	549	45.75	400	33.3	346	28.8	357	29.8
Parabronema skrjabini	1039	86.6	524	43.7	515	42.9	382	31.8	288	24	369	30.8
Percentage of average sheep infection		83.88		41.77		42.11		31.4		27.7		24.78

(726/1200), respectively. Comparing the prevalence by host sex revealed that the highest prevalence of *Marshallagia marshalli* was 47.25% (567/1200) in males, followed by *Ostertagia occidentalis* with 38.6% (464/1200) and *Ostertagia circumcincta* with the prevalence of 37.9% (455/1200). Hamon *Parabronema skrjabini* had the lowest prevalence of 30.3% (364/1200) and 29.6% (356/1200) in males. In females, *Marshallagia marshalli* had the highest prevalence of 47.3% (1268/568), followed by *Ostertagia occidentalis* and *Ostertagia circumcincta* with the prevalence of 39.3% (470/1200) and 39.25% (471/1200). Moreover, *Parabronema skrjabini* and *Haemonchus contortu*s had the lowest prevalence of 32% (384/1200) and 30% (362/1200), respectively. In terms of prevalence by age, in sheep less than two years old, the highest prevalence of *Marshallagia marshalli* was 33.3% (400/1200), followed by *Ostertagia circumcincta* and *Ostertagia occidentalis* 27.8% (334/1200) and *Parabronema skrjabini* with the prevalence of 26.5% (318/1200). *Haemonchus contortu*s with 25.75% (309/1200) had the lowest prevalence. In sheep aged 2-4 years, *Marshallagia marshalli* had the highest prevalence of 33.3% (400/1200). The lowest infection rate was related to*Ostertagia occidentalis* with 26.58% (319/1200); *Ostertagia circumcincta* with 24.75% (1200/297); *Haemonchus contortus with* 22.25% (267/1200) and *Parabronema skrjabini* with the rate of 21.5% (258/1200). In sheep over 4 years old, the highest prevalence was related to *Marshallagia marshalli* with 27.91% (335/1200); *Ostertagia circumcincta* and *Ostertagia occidentalis* with 24.58% (295/1200) and 23.58% (283/1200), respectively. *Parabronema skrjabini* with 13.66% (164/1200) and *Haemonchus contortu*s with 12.5% (150/1200) had the lowest prevalence. Regarding the average percentage of infection in each province, 74.3% of the studied sheep in Mazandaran were infected with abomasum nematodes, of which 36.73% were male and 37.57% were female. In terms of the average percentage of infection in sheep by dividing the age into three groups (under two years, 2 to 4 years, and also more than 4 years) 28.2% of sheep under 2 years were involved, along with 25.7% of 2-4 year old sheep; and 20.4% of sheep were over 4 years old. Regarding the prevalence of each genus in Mazandaran province, the lowest prevalence *was* related to*Marshallagia marshalli* with 94.6%; *Ostertagia occidentalis* with 78%; *Ostertagia circumcincta* with 77.2%, *Parabronema skrjabini* with 61.2%; and *Haemonchus contortu*s with the prevalence of 60.5% (Table.2).

Table2: The Prevalence of abomasum nematodes of sheep in Mazandaran Province

Species	Location	Gender				Age						
		Male		Female		<2		2-4		>4		
	Mazandaran	Infect %	N	Infect %	N	Infect %	N	Infect %	N	Infect %	N	Infect %
Haemonchus contortus,	726	60.5	364	30.3	362	30	309	25.75	267	22.25	150	12.5
Ostertagia circumcincta	926	77.2	455	37.9	471	39.25	334	27.8	297	24.75	295	24.58
Ostertagia occidentalis	936	78	464	38.6	472	39.3	334	27.8	319	26.58	283	23.58
Marshallagia marshalli	1135	94.6	567	47.25	568	47.3	400	33.3	400	33.3	335	27.91
Parabronema skrjabini	740	61.2	356	29.6	384	32	318	26.5	258	21.5	164	13.66
Percentage of average sheep infection		74.3		36.73		37.57		28.2		25.7		20.4

DISCUSSION

The results obtained from the present study were interpreted and the prevalence of infection in Gilan and Mazandaran provinces was compared. It was revealed that *Marshallagia marshalli* had the highest prevalence of 94.6% and 91.9% in Mazandaran and Gilan province respectively. *Ostertagia circumcincta* was 87.2% and 77.2% in Gilan and Mazandaran provinces. *Ostertagia occidentalis* was 86.9% in Gilan province and 78% in Mazandaran province, while *Parabronema skrjabini* was 86.6% in Gilan province and 61.2% in Mazandaran province. *Haemonchus contortu*s was 66.8% and 60.5% in Gilan and Mazandaran, which was the lowest prevalence in these two provinces. According to the results, the highest rate of infection in both provinces was related to the parasite *Marshallagia marshalli*, which shows more or less the same comparative results in terms of age (47.3% and 45.7%). The age of the animal in the population of sheep studied is less than 2 years and 2-4 years in Mazandaran province. The highest prevalence (33.3%) was found in sheep aged 2-4 years and more than 4 years in Gilan province. The average (28.8 and 29.8%) and the lowest prevalence were in Sheep aged > 4 years in Mazandaran province. *Ostertagia circumcincta*and *Ostertagia occidentalis* parasites had a prevalence of 87.2% and 86.9% in Gilan province and 77.2 and 78% in Mazandaran province, respectively. A relatively lower prevalence of *Marshallagia marshalli* was 42.7% and 44.5% in *Ostertagia circumcincta* in Gilan province in males and females, respectively. It was 38.6% and 39.3% compared to Mazandaran province, which is relatively higher values. Comparing the prevalence of *Ostertagia occidentalis* by males and females in Gilanprovince, the values were 43.5. 43.4% while they were 38.6 and 39.3% in Mazandaran province, which were very low. As a result, the prevalence of this parasite in Gilan province is higher than in Mazandaran province. The ratio of age to the prevalence of *Ostertagia circumcincta* in sheep younger than 2, 2 to 4 years old, and older than 4 years, is 33.1, 31, and 23% in Gilan and 27.8, 24.75, and 24.58% in Mazandaran. This indicates a higher prevalence in Gilan province. Based on age, the highest prevalence of *Ostertagia occidentalis* was 33.3, 31.1, and 22.4% in Gilan province and also 27.8, 26.58, and 23.58% in Mazandaran province. Comparing the sex-to-prevalence ratio in *Haemonchus contortus,*, the highest infection rate was in female sheep with 34% and then 32.75% in males in Gilan province, while it was 30 and 30.3% in Mazandaran province, respectively. In the three age groups, in Gilan and Mazandaran provinces, approximately "equal" values of 25.5 and 25.7% were obtained for sheep younger than 2. These values were 23.6 and 22.25% for sheep aged 2 to 4 years; and 17.9% and 12.5% for sheep over four years of age. This is the lowest prevalence of this parasite. The prevalence of *Parabronema skrjabini* nematode was above 42.9 and 43.7% in males and females in Gilan province. It was 9.6 and 32% in Mazandaran province, in sheep less than two years old. This value rate is 24% in Gilan and 21.5% in Mazandaran in 31.8% in Gilan province and 26.5% in Mazandaran province for the ages of 2 and 4 years. However, it was relatively high as 30.8% and 13.66% in Gilan and Mazandaran provinces, respectively for the ages over 4 years. The infection rate of *Haemonchus contortu*s nematode in Gilan province (66.8%) was higher than Mazandaran (60.5%). It was 32.75 and 34% in Mazandaran province and 30.3 and 30% in Gilan province in terms of host sex in males and females. This indicates the greater prevalence of this parasite by sex in Gilan province. According to the age group, the infection with this parasite in both provinces was the highest in sheep less than two years old as 25.5 and 25.75%. This rate was 23.6 and 22.25 for the ages of 2 to 4 years and the sheep above 4 years. It was also much lower than the mentioned values (17.9 and 12.5%). It is indicated that with increasing age, immunity against infection with this parasite was increased. The prevalence of *Ostertagia circumcincta* in Gilan province was 87.2%, which was much higher than Mazandaran province with 77.2%. *Ostertagia occidentalis* in Gilan province was 86.9% and in Mazandaran was 78%. Generally, the prevalence of these two parasitic species in Gilan province was much higher than in Mazandaran province. In the case of Ostertagia parasite, the infection was 44.5% in females in Gilan province, which is more than the study population in Mazandaran province with 39.25%. Moreover, the infection in males in Gilan province was relatively higher (42.7%) than in the Mazandaran province (37.9%). In terms of prevalence ratio based on the defined age groups, the prevalence of Ostertagia parasite were 33.1% and 31% in Gilan province in the ages of < 2 and 2- 4 years, respectively. In the same province, the prevalence of *O.occidentalis* species was approximately "similar" to 33.3 and 31.1%. However, in Mazandaran province, it was 27.8% in sheep less than two years old and in both species, aged 2 to 4 years and more than 4 years. Most infec-

tions are found in *O.occidentalis* with 26.58%, then *O.Circumcincta* with 24.75 and 24.58%, and finally 23.58% in *O.occidentalis* in sheep over four years. The prevalence ratio of *Marshallagia marshalli* nematode in Mazandaran province is 94.6 %, which is more than Gilan province with 91.9%. Based on the sex factor of the host of this parasite in Mazandaran province, it was 47.25 and 47.3% in males and females respectively. While it was 46.2 and 45.75% in Gilan province. Regarding the studied ages of infection in the age group under two years in Gilan and Mazandaran provinces, an equal value of 33.3% was obtained, which indicates that the level of infection is equal in the mentioned age group and both provinces. In the case of 2 to 4 years in Mazandaran province, the value was 33.3%, which is higher than the similar amount in Gilan province (28.8%), which is higher in Mazandaran province. Infection is relatively higher as 29.8% in Gilan province in the ages more than 4 years old than Mazandaran province as 27.98%. The infection rate in males and females in Gilan province was 43.7 and 42.9%. It is higher in sheep less than two years old in Gilan province as 31.8% than Mazandaran province as 29.6 and 32%, respectively. However, in Mazandaran province, it was 26.5%. It is indicated that the susceptibility of young sheep to this parasite, in the age group of 2 to 4 years, infection was 24% in Gilan province and 21.5% in Mazandaran province. In the age group over 4 years, the infection was 30.8% in Gilan province, but it was very low as 13.66% in the same age group in Mazandaran province (Table.3). a study by Aghazadeh and Yakhchali (2020) titled Investigation of worm parasite infections of the gastrointestinal tract and respiratory system of Talesh sheep in Gilan province, the feces of 140 tested sheep were examined. The total frequency of worm infections and the highest parasite abundance in the tested sheep was 52.1%. The diversity of trematode eggs, cestodes, and nematodes were 9.3%, 10%, and 52.1%, respectively. Moreover, co-infection in infected sheep with 2 and 3 genera were 15% and 2.9% of nematodes, respectively. Infants of the third stage of gastrointestinal parasitic nematodes of 9 genera including *Ostertagia* (2.3% of 2 species), *Haemonchus* 1.4%, *Trichostrongylus* 1.4%, *Bunostomum* 2.1%, *Strongylus* 0.7%, *Cooperia* 1.4. The percentage of *Nematodirus* was 2.1%, *Chabertia* 1.4%, and *Oesophagostomum* 2.9%. In a study entitled infection of common human and livestock parasites in slaughterhouses of Sanandaj city, Sadeghi-Dehkordi et al. (2019) examined the gastrointestinal tract of 164 sheep. Among them, 48 (29%) were infected with 15 species of nematodes. Furthermore, Kheirandish et al. (2018) conducted a study entitled pathology and incidence of *Parabronema skrjabini* nematodes in small ruminants in Kerman province. They showed that from a sample of 1189 abomasum in the Kerman abattoir, 807 (67.87%) were infected with nematodes, and 382 (32.12%) had no infection with the worm parasites. In this regard, the former samples contained 307 samples (25.82%) infected with *Parabronema skrjabini* and 500 abomasum (42.05%) infected with other nematodes. From those 307 samples infected with *Parabronema skrjabini*, 247 abomasum were chosen for digestion with pepsin and pathological examination. Histopathological examination showed various sections with adult parasites in the mucosal layer of the abomasum. Moreover, in the study of Hosseinzadeh et al. (2016) entitled "Infection of Trichostrongylidae family parasites in Ghezel sheep of East Azerbaijan province using fecal testing, from 120 4- to 6-month-old trout lambs of *Nematodirus*, *Marshallagia marshalli*, *Haemonchus contortus,*, and *Trichostrongylus* accounted for 39, 24, 23, and 14% of infections, respectively. In addition, there is a research carried out by Oliaei et al. (2011) entitled Morphometric study of polymorphism in nematodes of the Trichostrongylidae family of Iranian sheep abomasum, in which a total of 300 sheep from Rasht, Kazerun, and Ahvaz were examined. They used various morphological and morphometric parameters including, width, the length of the esophagus and spicules (male), the distance between vertebrae and anterior end, and distance of genital opening to the end (female). By studying male and female *Haemonchus contortus,*, and *Marshallagia marshalli* worms, and male *Ostertagia circumcincta*, they found statistically significant differences. In the mentioned study, *Trichostrongylus* worm species were not isolated at all, the same as in the present study. In our study, one

Table3: Percentage of Genera prevalence

Species Province	*Haemonchus contortus,*	*Ostertagia circumcincta*	*Ostertagia occidentalis*	*Marshallagia marshalli*	Parabronema skrjabini
Gilan	66.8	87.2	86.9	91.9	86.6
Mazandaran	60.5	77.2	78	94.6	61.2

of the most key factors for polymorphism originates in environmental conditions. As mentioned earlier, Iran divides into four climatic zones based on altitude, precipitation, and humidity, etc. Each factor, in turn, can play a very important and crucial role in the development of polymorphisms. By comparing the geographical and biological conditions of sheep in northern provinces (Gilan and Mazandaran) including altitude, average annual temperature, and precipitation, and also neglecting the unauthorized movement of livestock between other provinces, many changes result which may play an important role in the development of sheep nematode polymorphism. We attempt to show the effects of these factors on the morphology and morphometry and Prevalence of the nematodes, including changes in the worm length, the spicules size, the length and size of the eggs in females, the distance from the apex to the anterior end and from the pore to the end of the body. Another factor that can be determined with certainty is the effect of the immune system on the tested animals. All the tested animals have been affected by the immune system due to the small number of worms, which play a key role in the formation of immunity (Nabavi, 2017). The present study showed that the prevalence of infection with abomasum nematodes in sheep between different age groups and host sex is a significant difference that can cause many health and economic problems in the livestock industry in the near future, so it is recommended to the results should be given more attention by research centers to control and prevent the spread of these parasites.

CONCLUSION

According to the results of this study, the importance of combating the spread of parasitic infections with strategic treatment methods and biological control of these parasites, as well as various reports of drug resistance in abomasal nematodes, is an important issue that should be considered more and more by the competent bodies.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

REFERENCES

Aghazadeh, F., &Yakhchali, M. (2020). Study on parasitic helminths infection in gastrointestinal tract and respiratory system of sheep in Gilan Province, northern Iran. Veterinary Researches & Biological Products, 33(1), 26-32.https://dx.doi.org/10.22092/vj.2019.125386.1559

Changizi, E., Salimi Bajestani, M., & Ronaghi, H. (2011). Guide Laboratory Procedures and Identification. Semnan: Iran; University of Semnan Press.

Eslami, A. (2018). Biology and Physiology Helminthes and biology and Ruminants Disease. Tehran: Iran; Lilaz Press.

Eslami, A., & Ranjbar Bahadori, Sh. (2004). Diagnostic Helminthes Infections. Garmsar: Iran; University of Garmsar Press.

Hashempoor, F. (2015). Principles and Methods of Laboratory Veterinary Parasitology. Lorestan: Iran; Marz Danesh Press.

Heidari, H., Sadeghi, MR., &Gharekhani, J. (2009). Parasitology & Veterinary Parasitic Disease. Hamedan: Iran; University of Bo-Ali Sina Press.

Hosseini, H., & Meshgi, B. (2015). Veterinary Parasitology Helmintholology. Tehran. University of Tehran Press. Iran.

Hosseinzadeh, S., Raefat, SA., Moghadam, GhA., Nematolahi, A., &Hajializadeh, R. (2016). Evaluation of trichostrongylidae parasites infection of Ghezel sheep in East Azerbaijan Province using fecal eggs test. Journal of Veterinary Clinical Pathology.10 (37), 61-67.

Kheirandish, R., Radfar, MH., Azizi, SH., &Masnavipoor, A. (2018). Slaughterhouse prevalence of *Parabronema skrjabini* associated with pathologic lesions in small ruminant. Journal of Comparative Pathobiology. 14(4), 2325-2333.

Nabavi, R. (2017). Comparison of Morphologic and Morphometric parameters in Haemonchus nematodes separated from domestic ruminants in the southeast of Iran. Journal of Veterinary Laboratory Research. 72(1), 15-21. https://doi.org/10.22059/jvr.2017.61286

Oliaei, A., Eslami, A., Bokaei, S., Hoghighirad, N., &Hajivandi, L. (2011). Morphometric study of polymorphism in nematodes of the trichosteronangilae family of Iranian sheep abomasum. Journal of Veterinary Microbiology. 7, 37-47.

Razavi, M., Rajabloo, M., &Shayegh, H. (2016). Veterinary Clinical Parasitology. 8nd ed. Shiraz: Iran; University of Shiraz Press.

Sadeghi-Dehkordi, Z., Partiandazanpour, A., Abdolmaleki, N., Sari, A., & Sadeghi-Nasab, A. (2019). Zoonotic Parasites in Slaughtered Animals of Sanadaj Slaughterhouse. Iranian Journal of Infectious Diseases and Tropical Medicine . 24(84), 39-50.

Sazmand, A., Alipoor, G., Zafari, S., Zolhavarieh, SM., Alanazi, A., &Sarigson, N. (2020). Assessment of Knowledge, Attitudes and Practices Relating to Parasitic Diseases and Anthelmintic Resistance Among Livestock Farmers in Hamedan, Iran. Frontiers in Veterinary Science. 7, 584323.https://doi.org/10.3389/fvets.2020.584323