Parasite Fauna and Infection of Sheep with Parasitosis

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Abstract: The purpose of our research was to study the parasitic fauna and infection of sheep with parasites in the northern and southern regions of the Republic of Kazakhstan. For this, we conducted a study to determine the species diversity of sheep parasites. The study was set from 2010-2020 years on infected sheep in the northern and southern parts of the Republic of Kazakhstan. The experiments were conducted at the Department of Veterinary Medicine of S. Seifullin KazATU and the KazNIVI in Almaty. The species diversity of parasites of adult sheep was studied. The materials for parasitological laboratory studies were sheep feaces taken from 50 sheep. Vital diagnostics of helminthiasis were carried out by scatological studies of 50 sheep using the well-known methods of Fulleborn, Weid, and Boyaichyan. To establish the timing of infection, selective coprolarvoscopic studies of fecal samples taken from pastures were carried out. First, the invasive larvae were isolated from fecal samples by the Berman-Orlov method. Differential diagnosis of trichostrongylides was carried out according to the method of Y.Y. Shumakovich. Among the sheep of the Akmola and Karaganda regions, strongylatoses parasitizing in the gastrointestinal tract are recorded: Nematodyrosis, osterigasis, hemonhoz, marshallagiasis, esophagostomosis, and, less often, bunostomosis. The development of eggs and larvae of the invasive stage in pasture conditions is noted at the end of the first decade of May. The first cases of infection of lambs are observed in late May-early June. Thus, based on the three-year results obtained, it can be concluded that the absence of antiparasitic measures leads to infection of almost all livestock within 5-7 months and in subsequent years, reinfection occurs, which ultimately causes a decrease in productivity and increase mortality, especially among young animals up to 1.5 years of age.

Keywords: Invasive Larvae, Sheep Parasites, Species Diversity, Strongylatoses

Introduction

Today, sheep breeding is one of the most important branches of the agro-industrial complex of Kazakhstan, which, in several cases, is the only source of obtaining the most important types of products: Wool, meat-button, fur, and fur sheepskins. But today one of the problems in the development of sheep breeding in the Republic of Kazakhstan is the high infection of sheep with parasitosis (Master Plan, 2013; Business Plan, 2021).

Parasites are an integral part of the biological diversity of natural ecosystems and are an indicator of the health status of their host populations (Boyahchyan et al., 2016; Aitpaeva et al., 2021). The scientific basis for the conservation of biodiversity of various ecosystems is research on the inventory of fauna and parasitic complexes. In natural rangelands, where, as a rule, antiparasitic measures are not carried out, most domestic and wild animals become infected with parasitic diseases and permanently seed the external environment with the invasive principle (Suleimenov et al., 2014; Ertaş et al., 2022). Therefore, the study of the species diversity of parasites and the infection of animals with them is of great interest not only for parasitologists, zoologists, and ecologists but also for veterinary medicine specialists from the point of view of ensuring the parasitological safety of natural ecosystems and developing measures to combat diseases caused by parasites (Roerber et al., 2013).
Helminthiases in Kazakhstan have their own epizootological and epidemiological characteristics due to specific natural climatic and socio-economic conditions. The entire territory of the republic is favorable for the spread of various types of helminths and people are at high risk of contracting the main zoonoses (Čebra and Stang, 2008; Liddell et al., 2020). Parasitic nematodes (roundworms) of small ruminants and other livestock have major economic impacts worldwide. Despite the impact of the diseases caused by these nematodes and the discovery of new therapeutic agents (anthelmintics), there has been relatively limited progress in the development of practical molecular tools to study the epidemiology of these nematodes. Specific diagnosis underpins parasite control and the detection and monitoring of anthelmintic resistance in livestock parasites, presently a major concern around the world (Mohammadi et al., 2022).

Sheep are distributed according to spatial variation in resources, such as forage (Moradpour et al., 2018; Mandla et al., 2022) and the suitability of environmental parameters (Juránková et al., 2021). Their distribution can be further altered by other external factors such as predation and parasitism (Yeasmin et al., 2014; Alade and Bwala, 2015).

The purpose of our research was to study the parasitic fauna and infection of sheep with parasites in the northern and southern regions of the Republic of Kazakhstan. For this, we conducted a study to determine the species diversity of sheep parasites.

Materials and Methods

“The research was approved by the ethical commission of the Faculty of Veterinary Medicine and Livestock Technology of the N. S. Seifullin KATU (extract from minutes No. 1 dated January 11, 2010)”

The research was carried out from 2010-2020 years on sheep for the infestation in the northern and southern parts of the Republic of Kazakhstan. The experiments were carried out at the Department of Veterinary Medicine of S. Seifullin KazATU and the KazNIVI in Almaty. The species diversity of parasites of adult sheep was studied. The materials for parasitological laboratory studies were sheep feces taken from 50 sheep. The invasion of animals with endoparasites was determined by the method of in vivo diagnostics. Vital diagnostics of helminthiasis were carried out by scatological studies of 50 sheep using the well-known methods of Fulleborn, Weid, and Boyahchyan.

To establish the timing of infection, selective coprolarvoscopic studies of fecal samples taken from pastures were carried out. First, the invasive larvae were isolated from fecal samples by the Berman-Orlov method. Differential diagnosis of trichostrongylides was carried out according to the method of (Čebra and Stang, 2008; Liddell et al., 2020).

Fecal Egg Counts

Fecal samples were collected directly from the rectum of each animal during the experimental epidemiology (paper I) and the anthelmintic-resistance (papers III and IV) studies. The numbers of fecal nematode eggs were determined using a modified McMaster technique with saturated sodium chloride solution as the floating medium. In each case, 3 g of feces were mixed in 42 mL of saturated salt solution and the number of nematode eggs Per Gram of Feces (EPG) was obtained by multiplying the number of nematode eggs counted in two squares of the McMaster slide by a dilution factor of 50. The nematode eggs present were identified in general terms as strongylid eggs, since relevant nematode genera produce eggs that are similar in appearance and cannot be discriminated easily, except for the eggs of Nematodirus, Strongyloides, and Trichuris species (Čebra and Stang, 2008; Moradpour et al., 2018; Mohammadi et al., 2022).

Fecal Cultures, Larval Identification and Enumeration

Duplicate composite fecal cultures, consisting of 2 g of feces from each animal, were done for each group of animals in the experimental epidemiology (paper I) and anthelmintic-resistance (papers III and IV) studies. The pooled fecal materials were incubated at room temperature (approximately 22–25°C) for 14 days and then the nematode larvae were harvested, identified to species level, and quantified according to Anon and (Čebra and Stang, 2008; Moradpour et al., 2018; Mohammadi et al., 2022). Where possible, 100 larvae were identified and counted for each experimental group of animals (Mandla et al., 2022).

Data Analyses

All of the parasitological and performance data (EPG, fecal culture larval counts, tracer, and abattoir post-mortem worm counts) were first entered into the Microsoft Excel program. The fixed effects of age and sex of animals, seasons, and years on EPG were analyzed with repeated measures analyses according to the SAS mixed procedures (Statistical Analysis System Institute, version 9.1, Cary, NC, USA).

Results

In the conditions of Kazakhstan, in different regions, the sheep population is used for pastures at different times of the year. For example, if in the north of the republic until the second decade of April, the sheep-head of the private sector is kept indoors, then in the southern regions the grazing period begins in the second decade of March. Therefore, the time of infection in the northern regions of Kazakhstan, in comparison with the southern regions, comes 1-1.5 months later.
When studying for the infestation of sheep in the Akmola and Karaganda regions in 2017, due to the lack of medical treatments, the initial infestation was almost at the same level.

But, regardless of the time of infection, the invaded animal is a source of pasture contamination with invasive elements, thereby posing a danger of infestation by helminthiases of lambs of the current year of birth (Table 1). Thus, at the beginning of wintering in 2017, sheep in all agricultural formations and rural districts of the Akmola region were infected by almost 87% with trichostrongyliasis (Fig. 1) and 27.5% with monieziosis. Nematodyrosis was established in young animals up to 1.5 years old, in which the extensiveness of invasion was 33.4% (Fig. 2).

In a comparative aspect, high intensity of nematodirosis invasion was recorded in young animals up to one-year-old (14-78 ind.), while in young animals older than 1 year during the peak of invasion, up to 23 specimens were found in three drops of the sample.

In general, it should be noted that in young sheep, nematodirosis proceeded in a subacute form (most often, lambs died 7-9 days after the first clinical signs were discovered in them).

In the southern regions of Kazakhstan (according to research by KazNIVI employees), myxinvia was recorded on 2 farms in Zhambyl and South Kazstanskaya regions, where an average (3-24 specimens) invasion was noted in terms of intensity (Table 2).

At the same time, the eggs of moniesia were found in 27.5% of the sheep population, which pollute not only the near-koshar area but also the pasture, which in turn poses a danger of infection of lambs of the current year of birth by swallowing oribatid ticks infested with cusciceroids (Fig. 3).

Of the 68 sheep, 61 heads, or 89.7% are infected with strongylatoses (trichostrongyliasis), 30.8% with nematodirosis, and 39.7% with monieziasis. Sheep, especially lambs of the current year of birth, who are in pasture conditions, are thin, weak, and profuse diarrhea is observed.

When examining fecal samples from sheep belonging to Otkanzhar LLP of the Nurinsky district of the Karaganda region, the following genera of helminths were identified to establish the helminth fauna (Table 3).

Based on the obtained copolarvoscopic studies, it follows that the sheep of Koigeldy-Astyk LLP have the main trichostrongylids, which are characteristic of the sheep-head of the northern region of Kazakhstan, namely: Ostertagia, nematodira, hemonchus, and trichostrongyla (Fig. 4 and 5).

In terms of specific gravity, nematodiras, hemonchies, and ostertagias occupy dominant positions, their share in the total infection is 66-75%.

The other two types, i.e., trichostrongyla and esophagostomas were recorded less frequently than in the previous species.

In the spring-summer period, the timing of the development of eggs and invasive larvae of trichostroglids in the environment under pasture conditions was studied (Table 4).

Thus, in the conditions of the pastures of the Akmola region, the development of eggs of trichostrongyliids begins when a stable temperature (+14°C) occurs. The development and achievement of the larvae of the invasive stage are observed in the period of May 17-19.

The first cases of infection of lambs with trichostrongyliasis in two rural districts of the Akmola region were in late May and early June.

To draw up scientifically based measures according to the plan in the conditions of northern Kazakhstan, in 2019, relevant studies were continued.

We found that in this region of the republic during the autumn deworming, the infection of ruminants until the second decade of May is up to 3-5% of the total population. But, climatic changes in recent years usually introduce their adjustments, as in 2019, when the animals left the pasture 2-2.5 weeks earlier.

Therefore, the main livestock of sheep in the conditions of northern Kazakhstan, in particular in the Akmola region, are infected from the third decade of April and continues until the end of September inclusive. But, regardless of the time of infection, the infested animals are a source of contamination of pastures with invasive elements, thereby posing a danger of infestation by helminthiases of lambs of the current year of birth.

As can be seen from Table 5, despite the spring-summer period of 2018, taking into account the fact that the winter of 2018-2019 in these regions was harsh and the spring was rather cool (sometimes down to minus 4-6°C), sheep in three agricultural formations and rural districts of Akmola oblast are infected with up to 80% strongylatoses.

Nematodyrosis, as in previous years, was established in 84 young animals up to 1.5 years of age, in which the extent of invasion was 25.7%. This disease was recorded in rural districts and LLPs, where they used the same pasture areas every year.

High intensity of invasion was recorded in sheep with strongylatosis (9-134 specimens), while in nematodyrosis, the intensity of invasion was up to 56 specimens, which indicates a rather long development of nematodynia eggs in the external environment than in other strongylates.

To establish biochemical changes in blood in sick and healthy animals, the following enzymes were compared: Aspartate Aminotransferase (AST), alanine Aminotransferase (ALT), Alkaline Phosphatase (ALP), which play the role of degrading coenzymes. It was found that ALT and AST in sheep suffering from helminthiases are contained, respectively, by 4.2±0.002 katal and 6.09±0.006 katal, which is more than in healthy animals (deworming before the study). The activity of the enzymes ALP and GGT are also increased.
Table 1: Initial infection of sheep with helminthiases

| Region, district, LLP | Number of heads | Trichostron-hylidosis | Nematodyrosis | Monieziosis |
|-----------------------|-----------------|-----------------------|---------------|-------------|
| Akmola region         |                 |                       |               |             |
| Koigeldy - Astyk LLP  | 137             | 112/82.0              | 39/28.8       | 64/47.0     |
| The private sector of the Prirechensky rural district | 188             | 171/91.3              | 78/41.4       | 39/20.9     |
| International r/d     | 92              | 74/80.6               | 24/26.7       | 11/12.8     |
| Torgaysky r/d         | 127             | 118/93.6              | 46/36.6       | 37/29.1     |
| Average E1            | 544             | 475/86.9              | 187/33.4      | 151/27.5    |
| Karaganda region      |                 |                       |               |             |
| Otkanzhar LLP         | 68              | 61/89.7               | 21/30.8       | 27/39.7     |
| Average E1            | 68              | 61/89.7               | 21/30.8       | 27/39.7     |

Table 2: Infection of sheep with helminthiases in the southern region of the republic

| Region, district, LLP | Number of heads | Fascioliasis | Strongylatoses | Monieziosis |
|-----------------------|-----------------|--------------|----------------|-------------|
| Jambyl Region         |                 |              |                |             |
| Peasant farm "Baiterek" | 50             | 12.0         | 78.0           | 26.0        |
| Average E1            | 50              | 4-7          | 9-11           | 8-13        |
| South Kazakhstan region |               |              |                |             |
| Pleasant farm "Dikhanbai" | 40             | 15.0         | 68.0           | 29.0        |
| Average E1            | 40              | 11-21        | 6-24           | 3-18        |

Table 3: Fauna of sheep trichostrongylids in Koigeldy-Astyk LLP

| Fecal sample no. | Nematodiras | Ostertagius | Hemonchies | Trichostron-gilus | Esophagotoma |
|------------------|-------------|-------------|------------|-------------------|--------------|
| No. 1            | 16          | 12          | 24         | 2                 | 1            |
| No. 2            | 8           | 42          | 4          | -                 | -            |
| No. 3            | 27          | -           | 19         | -                 | -            |
| No. 4            | -           | 38          | 11         | -                 | -            |
| No. 5            | 12          | -           | 16         | -                 | -            |
| No. 6            | 9           | 38          | -          | -                 | -            |
| No. 7            | -           | 47          | -          | -                 | -            |
| No. 8            | 4           | -           | -          | -                 | -            |
| No. 9            | 23          | -           | 7          | 3                 | -            |
| No. 10           | -           | -           | 16         | -                 | -            |
| No. 11           | -           | 11          | 2          | 9                 | -            |
| No. 12           | 4           | 9           | -          | 6                 | 7            |
| Intensity of invasion, copies | 4-27        | 9-47        | 2-24       | 2-9               | 1-13         |

Table 4: Terms of development of invasive larvae of strongylates of the gastrointestinal tract in the external environment and the first cases of infection of lambs

| Research date | Formation of first stage larvae | The timing of the development of invasive larvae | The first cases of infection of lambs |
|---------------|--------------------------------|---------------------------------------------|-----------------------------------|
| 15.04.18., 19.04.18., 22.04.18., 25.04.18., 29.04.18., 04.05.18. | do not develop | Do not develop | not detected |
| 12.05.18.     | found in all samples L<sub>1</sub> and L<sub>2</sub> | Large number of L<sub>3</sub> | not detected |
| 17.05.18.     | found in all samples L<sub>1</sub> and L<sub>2</sub> | Accumulation of Invasive Larvae (IL) | not detected |
| 22.05.18.     | found in all samples L<sub>1</sub> and L<sub>2</sub> | 7 samples contain from 12 to 63 larvae | not detected |
| 27.05.18.     | found in all samples L<sub>1</sub> and L<sub>2</sub> | In three samples of larvae from 29 to 42 IL | Trichostrongylide eggs were found in 4 lambs |
| 29.05.18.     | found in all samples L<sub>1</sub> and L<sub>2</sub> | IL of all 4 genera of trichostrongylides | found in 6 lambs |
| 02.06.18.     | found in all samples L<sub>1</sub> and L<sub>2</sub> | | found in 11 lambs |
| 08.06.18.     | found in all samples L<sub>1</sub> and L<sub>2</sub> | | found in 17 lambs |
| P.S. L<sub>1</sub>, L<sub>2</sub>, and L<sub>3</sub> – respectively, invasive larvae of the 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> stages of development | | | |
Table 5: Infection of sheep with helminthiases in the spring-summer period

| Region, district, LLP                      | Number of heads | Strongylatoses | Nematodyrosis | Monieziosis |
|--------------------------------------------|-----------------|----------------|---------------|-------------|
| Koigeldy-Astyk LLP                         | 192             | 147/76.6       | 39/20.3       | 16/8.30     |
| Prirehensky rural district                 | 81              | 68/83.9        | 28/34.6       | 29/35.8     |
| Timofeevsky rural district                 | 53              | 44/82.5        | 17/32.1       | 8/15.1      |
| El by region                               | 326             | 259/79.4       | 84/25.7       | 53/16.3     |
| II by region                               | 9-134           | 3-560          | 4-310         |             |

Fig. 1: Discovered Trichostrongyliide eggs in sick sheep

Fig. 2: Eggs of nematodes found in lambs in Koigeldy-Astyk LLP

Fig. 3: Oribatid mites infested with cysticercoids found in soil samples of the Torgai rural district

Fig. 4: Invasive nematode larva

Fig. 5: Detected invasive ostertagia larvae

An increase in the activity and an increase in the content of these enzymes in the blood serum are explained by the violation of protein and carbohydrate metabolism, which leads to the degeneration of liver cells during the migration of strongylate larvae.

When studying fresh grass (in the morning after dew) according to Berman-Orlov for the presence of strongylate larvae, we found invasive larvae of nematodir and ostertagia. Based on the coprolarvoscopic studies obtained, it should be noted that trichostrongylidoses are characteristic of sheep in the northern region of Kazakhstan.

In addition, in the climatic conditions of this area, the development of trichostrongyliid eggs in the pasture reaches the invasive stage by May 17-20. Therefore, the intensity of infection of lambs with trichostrongylidosis in rural districts is observed at the end of May and in the first decade of June.

Monieziosis by the end of the spring period mainly affects older sheep. Of the investigated fecal samples, eggs of moniesia were observed in ewes and young animals in the last year of birth and amounted to 53 heads,
or 16.3%. This suggests that these animals were infected in the autumn of 2018. In general, the number of sheep infected with various helminthiases in the first half of 2019 ranged from 16 to 76%, depending on the genus of the helminth.

When examining 623 sheep in the second half of 2019, we found that the infection rate is increasing (Table 6).

So, out of 623 sheep, 504 heads, or 87.7% are infected with strongylatosis, including 31.1% or 194 heads with nematodyroses.

In the context of rural districts and agricultural formation in Koigeldy Astyk LLP and the Ulentinsky rural district, 91-96% of sheep are infected with strongylatosis, which indicates a high extent of the invasion. In two other rural districts, 61-81% of sheep are contaminated with strongylatosis.

Nematodyrosis was most often recorded among lambs of the current year of birth and in youngsters born in 2017 at the end of June-at the beginning of July 2018. So, in the investigated fecal samples in 25-38% of cases, from 9 to 86 eggs were noted, which indicates a high intensity of invasion. It should be noted that the total infection of sheep in 2010 was facilitated by the high ambient temperature and low air humidity, which reduces the development of eggs to a minimum (up to 3-5 days) in the middle of summer.

Monieziosis, as in 2017, was noted already in June-July 2018 with a coverage of 41-56% of sheep. But, among sheep in Koigeldy-Astyk LLP, as well as in Ulentinsky and Timofeysky rural districts, the extent of invasion is 6-15% lower compared to infection in Zhantekinsky rural district (Fig. 6).

In addition, as it is known, the crowded keeping of sheep indoors (at high humidity and temperature) in winter, with delayed shearing at the beginning of the summer period, infestation with ectoparasites (sifunculates, lice-eaters-sheep’s fleece) is often observed.

The ectoparasites identified by us not only disturbed the animals but led to the loss of live weight and wool. In the summer, in three economic entities, we examined 95 heads of sheep for infestation with ectoparasites (Table 7, Fig. 7).

During visual clinical examination, it was found that sheep fleece (Melophagus ovinus) and lice-eaters (Bovicola caprae) are most often recorded in sheep.

As can be seen from Table 7, the sheep population of 3 subjects (including those of the sheep belonging to the faculty of KazATU, despite the treatments carried out in April 2018) is infected with up to 86-87% of ectoparasites, mainly of two types.

Thus, the infection of sheep with helminthiases and ectoparasitosis belonging to private farmsteads in rural districts and agricultural formations in 2018, due to the lack of planned treatment and prophylactic treatments on the part of animal owners and local leaders, remained high, as in previous years.

To obtain more accurate data on infection and to take adequate measures for treatment and prevention, additional studies were carried out in 2019.

In the conditions of Akmola oblast, the infestation of sheep by helminthiases mainly occurs in the grazing period (from May to September), but in some years, when the autumn is warm, it can continue until mid-October and indoors.

As you know, according to the weather report service, the end of 2018 was characterized by relatively warm weather (the average temperature for October-November was minus 8-11.2°C and the stall keeping of animals, including sheep, moved only in the third decade of November.

In the majority of strongylates, the invasive larvae that had invaded the body at the end of September 2018 after a slight migration in the body (mainly the submucosa and sub-sera) and 3-4 weeks after the reverse migration in the intestinal lumen became sexually mature.

Therefore, in this region of the republic, in the period from November-December to January of the next year, the extensiveness of the invasion increased due to the autumn reinvasion (Table 8).

As can be seen from Table 10, the infestation of sheep in December-February of the last and the current year in only two rural districts is 93.9% with strongylatoses, 43.9% with nematodiosis, and 34.5% with monieziosis. The high contamination with helminthiases is explained by the constant grazing of animals in a limited area.

In addition, it should be noted that some owners of sheep, especially heavy-licking and lambing ewes, are kept in warm rooms, which leads to the re-infection of lambs of the current year from the moment of birth through litter, contaminated feed, etc.

A strong degree of invasion intensity can be observed by strongylatoses (from 12 to 128 ind.). Nematodyrosis, to which young animals under 1.5 years of age are more often exposed, also has an average intensity of invasion (9-42 eggs).

In the same period, among young animals, up to 1 year old, which were in the pasture in the summer of 2018, the eggs of moniesia were recorded in the amount of 26-49 specimens. We explain the high intensity of invasion in young animals by the joint keeping with adult sheep. At the same time, in adult ewes and breeder rams, the extensiveness of invasion ranges from 3 to 17-19 eggs, which indicates the phenomenon of carriers, which are sources of invasion for lambs and young animals.

The species composition of helminths in sheep from different regions is almost the same. So, for example, in cultured samples of sheep feces from the Korgalzhyn and Erimentau districts, in the study using the Berman-Orlov method, invasive larvae of nematodir, hemonchus, ostertagia, and trichostrongil differed only in their quantitative composition (Table 9).
77.6% of the livestock. But, among these animals, in parts of the Akmola region, we found that the intensity, respectively. Our data show that in young sheep, compared while in young animals, 9 ostertagia larvae were found in adult sheep sedimentary liquid in the winter period, invasive hemonchus II, copies EI, on average, was infected with strongylatoses II by region, 11-960 9-860 297/47.6 14-380

Table 7: Infection of sheep with ectoparasites in the summer-autumn period

| Rural district, district | Studied head | El by ectoparasites % |
|--------------------------|--------------|-----------------------|
| 1 | Timofeevsky r/d | 44 | 39/88,6 |
| 2 | Koigeldy Astyk LLP | 39 | 32/82,1 |
| 3 | Faculty training sheep | 12 | 11/91,7 |
| Total | 95 | 82/86,3 |

Table 8: Infection of sheep with helminthiasis in the winter period of 2010-2011

| Name of r/d, LLP | A NUMBER of heads | Strongylatoses | Strongylatoses | Strongylatoses |
|------------------|-------------------|----------------|----------------|----------------|
| Zhantekinsky r/d | 67                | 63/94,1        | 29/43,3        | 20/29.8        |
| Ulentinsky r/d   | 81                | 76/93,8        | 36/44,4        | 31/38,3        |
| EL, %            | 148               | 139/93,9       | 65/43,9        | 51/34,5        |
| II, copies       | 12-128            | 9-42           | 3-48           |

Table 9: Species composition of strongylates of the gastrointestinal tract of sheep of the Akmola region in the winter period of 2019

| Name of r/d   | Number of samples examined and age | II of invasive strongylate larvae: |
|---------------|-----------------------------------|-----------------------------------|
|                |                                    | Hemonchies | Nematodirasis | Ostertagius | Trichostrongyla |
| Zhantekinsky  | 12 from adults 4-11                 | 4-11      | 21-28         | 6-63        | -              |
|                | 9 from young 9-12                  | 9-12      | 24-38         | -           | 7-19           |
| Sofievsky     | 16 from adults 2-18                | 2-18      | 18-51         | 19-109      | 4-58           |
|                | 11 from young 23-41                | 23-41     | 22-58         | 4-9         | 1-27           |

Table 10: Infection with helminthiasis of sheep in the spring

| Name of r/d, LLP | Number of heads | Strongylatoses | Strongylatoses | Strongylatoses |
|------------------|-----------------|----------------|----------------|----------------|
| Village Kiima    | 47              | 16/84,2        | 10/52,6        | 5/26,3         |
| Village Sofievka | 69              | 48/71,1        | 21/28,9        | 21/29,0        |
| EL, on average%  | 116             | 64/77,6        | 32/40,7        | 26/27,7        |
| II, copies       | 76-113          | 76-113         | 26-310         | 9-410          |

As can be seen from Table 10, in three drops of sedimentary liquid in the winter period, invasive hemonchus larvae were found in adult sheep 2-18, nematodir-18-51, ostertagia-6-109 and trichostrongyl from 4 to 58 specimens, while in young animals 9-41, 22-58, 4-9 and 1-27, respectively. Our data show that in young sheep, compared with adults, three species of invasive larvae are higher in intensity, except for ostagia.

When examining samples of sheep feces by the Fülleborn method in the spring of 2019 in two rural districts (Kiiminsky and Sofievsky) located in the southwestern and northeastern parts of the Akmola region, we found that the extensiveness of the invasion, on average, was infected with strongylatoses 77.6% of the livestock. But, among these animals, in addition, almost 41% were contaminated with nematodyrosis and 28% with monieziosis (Table 10).

We also identified sexually mature moniesia during the autopsy of the 16 months old young animals that were forcibly killed in 3 heads.

By the end of the summer-pasture period (September), due to the positive temperature (8-13°C) of the environment in the agricultural formations of the Akmola region, where they are engaged in sheep breeding, the infection with helminthiasis continued. In our opinion, this was facilitated by two main factors: Heavy rainfall and increased temperature this year, which ultimately led to the development of invasive larvae in the external environment.
In addition, the flight of the nasocaval gadfly-estrus during this period was observed until August 21 (usually in previous years, their flight ended at the end of July or until August 7).

Thus, based on the three-year results obtained, it can be concluded that the absence of antiparasitic measures leads to infection of almost all livestock within 5-7 months and in subsequent years, reinfection occurs, which ultimately causes a decrease in productivity and increase mortality, especially among young animals up to 1.5 years of age (Ibrayev et al., 2009).

**Discussion**

Sheep are very liable to attack by parasites, probably suffering more severely from cause than any other kind of livestock. The importance of parasites and parasitic diseases in sheep is more evident because sheep are but little subject to serious bacterial plagues or virus diseases (Alade and Bwala, 2015).

Endoparasitic infestations cost the livestock industry many millions of pounds each year through losses in productivity and the costs of control measures. Effective control of these endemic ubiquitous diseases is important, particularly given the expanding world population and the expectation of increasing demand for ruminant products (Ohiolei et al., 2019; Mohammed and Kadir, 2020; Muku et al., 2020).

The same investigation was carried out to determine the prevalence of arthropoda and helminth parasites in sheep at Azimpur, Dhaka from February 2012 to January 2013. A Total of 60 hosts were examined and about 71.67% of sheep were found to be infested with arthropod parasites. In sheep two species of arthropod parasites, Linognathus vituli (61.67%) and Damalinia caprae (68.33%) were identified as ecto-parasites. The prevalence of ectoparasites was higher during summer (85%), followed by winter (75%) and rainy (55%). The higher intensity was also recorded in summer (325.17±1.92). Lambs were found more susceptible (85.71%) than adult (80.95%) and young (56%) sheep and higher in females (77.27%) than in males (68.42%).

Twelve species of helminth parasites were identified, of them, 3 trematodes, 3 cestodes, and 6 nematodes, the highest prevalence was shown by Strongyloides sp (71.67%) and the lowest by Dictyocaulus sp. (3.33%); found comparatively higher in adults (85.71%) than in young (80%) and 28% in lambs. The male sheep were more susceptible (81.58%) to helminth infection than the female (72.73%). The prevalence of helminthes was found higher in the winter (95%) season. The value of the coefficient of correlation between the prevalence and intensity of infestation of ectoparasites and helminth parasites in sheep was 0.95 and 0.978 respectively. In both cases, these two variables differed significantly (P<0.01) (Yeasmin et al., 2014).
In general, it should be noted that nematodiruses, like many other strongylates, are mostly localized in the thin and thick sections of the gastrointestinal tract of sheep. If the hemonchi parasite in the abomasum, then in the small intestines the representatives of the family are trichostrongylides, which include: Nematodiras, ostertagias, marshallagiasis, trichostrongyls. In the thick section, larger strongylids of the genus are localized: Bunostoma, esophagostoma, habertia, etc.

This study was conducted in Maiduguri, Nigeria to determine how Gastrointestinal parasite infestation was affected by sex, season, age, and body weight and their relationship with hemoglobin concentration in Yankasa sheep. A total of 135 fecal and 135 blood samples were collected in each of the two seasons (dry and raining) of the year 2014, from the University of Maiduguri Livestock teaching and Research Farm, University of Maiduguri Veterinary Large Animal Clinic, and the Maiduguri Abattoir. The fecal samples were analyzed for gastrointestinal parasite eggs and the Haemoglobin concentration of the blood sample was analyzed. The gastrointestinal parasite egg count was estimated using the Modified Mcmaster technique and the hemoglobin concentration was determined using the cyanmethaemoglobin method. Five species of gastrointestinal parasite eggs discovered were: *Strongyle, Strongloides, Coccidian ocyct, Moniezia, and Trichuri* with mean counts of 1080, 320, 1208, 30.2, and 1.60, respectively. There were significant differences ($P<0.05$) between the mean gastrointestinal parasite egg counts among animals of different sexes, age groups, body weight groups, blood hemoglobin concentrations, and in different seasons of the year. Females (3631/67.3%) had higher overall mean parasites egg counts and prevalence than the males (1747/53.4%), and the rainy season (2959/67.4%) was higher than the dry season (2559/53.3%). Age-wise, suckling animals (3286/68.3%) were more infected than the young (2999/59.3%) and adults (1993/53.5%). The group06-31 kg had the highest overall mean egg count and prevalence (3151/68.8%) than the other groups 32-57 kg (1812/62.4%) and 58-81 kg (1125/49.7%). The group with a hemoglobin concentration of 5.7-8.3 g/dL had the highest overall mean parasitic egg counts of 3468 (67.9%) than those of the groups of 8.4-11.3 and 11.4-14.3 g/dL, having 2837 (59.5%) and 1988 (53.7%), respectively; an indication that blood hemoglobin concentration and parasites egg counts were negatively correlated (Alade and Bwala, 2015).

Per-rectal fecal samples from sheep and goats were collected from Quetta and Kalat (Kovak and Zarchi valleys) areas of Balochistan to assess endoparasitism. The qualitative examination showed an 87.7 (50/57) percent prevalence of endoparasites. Nematodirus pathiger was the most prevalent species followed by *Trichuris globulosa*, *Marshallagia marshalli*, and *Strongyloides papillosa*. A considerable segment of small ruminants in these areas has mixed infection. The average number of Eggs Per Gram of feces (EPG) ranged from 291-546. The infected animals were dull, depressed, weak, and poorly conditioned (Rafique et al., 1997).

**Conclusion**

Among the sheep of the Akmola and Karaganda regions, strongylatoses parasitizing in the gastrointestinal tract are recorded: Nematodyrosis, ostertagiosis, hemonhoz, marshallagiasis, esophagostomosis, and, less often, bunostomosis. The development of eggs and larvae of the invasive stage in pasture conditions is noted at the end of the first decade of May. The first cases of infection of lambs are observed in late May - early June.

Thus, based on the three-year results obtained, it can be concluded that the absence of antiparasitic measures leads to infection of almost all livestock within 5-7 months and in subsequent years, reinfection occurs, which ultimately causes a decrease in productivity and increase mortality, especially among young animals up to 1.5 years of age.

The study of the parasitic fauna of sheep will help to develop instructions and measures to reduce infection of parasites during sheep grazing, taking into account the climatic characteristics of various regions of Kazakhstan.

**Author’s Contributions**

All authors equally contributed to this study.

**Ethics**

This article is original and contains unpublished material. The corresponding author confirms that all of the other authors have read and approved the manuscript and no ethical issues are involved.

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