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BOVINE SARCOCYSTOSIS IN KOSTANAY REGION

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Abstract

This article presents the results of the prevalence of sarcocystis invasion of cattle in the Kostanay region. The selection of cattle muscles and morphological studies were carried out from January to April 2023. In total, 100 carcasses, including 75 carcasses of bulls aged 2-3 years and 25 carcasses from cows aged 7-9 years, were examined at the slaughterhouses of the city of Kostanay, where cattle for slaughter come from different districts of the Kostanay region. During visual veterinary and sanitary examination of carcasses, macrocysts were not found. Microscopy of 300 samples of muscle tissue was carried out to determine the contamination of carcasses. During the research, it was found that sarcocysts were found in the muscles of steers and cows. The localization sites, shape, size of sarcocysts and their intensity were studied. According to morphological features the cysts correspond to the description of Sarcocystis bovicanis (S.cruzi).

Key words: cattle; extensiveness; intensity; microscopy; muscles; sarcocystosis.

Basic position and Introduction

Protozoal diseases caused by parasites belonging to the type of protozoa are widespread in many countries of the world and represent a serious danger to modern society. Sarcocystis occupies an important place among protozoan diseases, due to its wide spread, multiplicity of hosts, constant growth of morbidity and significant social and economic damage caused by it. According to Lithuanian scientists, sarcocystosis is one of the most widespread parasites of domestic cattle, as well as of many wild mammals, birds

and humans. The high prevalence of infection in cattle reaches 44.9-98.1%, in sheep 100%, and in pigs 30.1-50.0% and horses 34.7-63.9% [1].

According to G.S. Sivkov, S.A. Ryabov, A.A. Listishenko (2005), V.I. Abakumov, O.V. (2008), N.M. Polyanskaya, P.A. Svintsova, O.V. Serdobintseva (2002), J.K. Latif, V.S. Delemi, Mohammed (1999) domestic ruminants are especially strongly affected and the invasion by sarcocysts in the regions ranges from 0.2 to 98% [2-7].

Sarcocystis is a chronic disease of animals and wild birds characterized by affection of skeletal muscle tissue, including muscles of tongue, pharynx, esophagus and internal organs. Severe damage results in muscle degeneration, emaciation, tissue hydraemia and often fatal outcomes. To date, sarcocysts have been found in the muscles of over 150 animal species. The causative organisms are parasites belonging to the genus Sarcocystis [8, 9, 10].

Currently, there is no information on the spread of sarcocystosis among farm animals in the Kostanay region, in this regard, the purpose of our research was to study the prevalence of bovine sarcocystosis in Kostanay region, to identify indicators of extensiveness (EI) and intensity (II), as well as determine the morphological features of muscle cysts.

Materials and Methods

To study spread of sarcocystis infestation in cattle at the slaughter points of Kostanay city where cattle are sent for slaughter from different districts of the region in the period from January to April 2023 were examined 100 carcasses, including 75 carcasses from steers aged 2-3 years, belonging to farms of Karasu, Uzunkol and Naurzum regions and 25 carcasses from cows aged 7-9 years from Denisovsky region. Visual veterinary and sanitary examination of the carcasses, macrocysts were not found. Further research was conducted at the Research Institute of Applied Biotechnology of A.Baitursynov Kostanay Regional University.

The intensity of invasion was determined by microscopic studies using compressor MI 4.2.2747-10 [11].

The material for the research was 300 samples of muscle tissue from the neck, diaphragm legs and skeletal muscles obtained from 100 cattle. Muscle parts were applied to a synthetic mesh. The muscle samples were impregnated with 0.2% aqueous methylene blue solution for 20-30 minutes. After staining, muscle pieces along with the synthetic mesh were placed on filter paper for drainage. This process is performed to remove excess dye. The samples were held on the filter paper for only a few seconds. The stained muscle pieces were immersed in a 1.5% acetic acid solution for 15-20 minutes to lighten the samples. Light agitation was performed to avoid sticking of the samples. Next, the samples were placed again on filter paper for drainage and then transferred to a glass compressor consisting of two glass plates tightened with screws.

Figure 1 - Fresh muscle preparations placed in a glass compressorium

Muscle tissue samples stained with methylene blue were examined using a light microscope at a magnification of ×100 to ×400, where the number of sarcocysts in each slice was counted, and the intensity of invasion was estimated by counting sarcocysts in 28 slices of muscle tissue. The total parasite count was used to determine the intensity of invasion. The criteria for assessing the infestation intensity are shown in Table 1.

Table 1 - Criteria for assessing the intensity of sarcocystic invasion

The intensity of invasion	Number of cysts of Sarcocystis spp.	
	in the microscope field of view	in 28 slices of compressorium
weak	1-3	under 50
medium	under18	51-200
strong	over 18	over 201

Sarcocyst invasion was conventionally classified as strong (over 200 sarcocysts in 28 sections), medium (51-200 sarcocysts), and weak (up to 50 sarcocysts) [12-15]. The size characteristics of sarcocysts were statistically processed using Statistica StatSoft 10 software.

Cytometric measurements were performed using an OPTIKA PRIVIEW microscope software calibrated with an ocular ruler. The confidence coefficient was determined by conventional methods using the Microsoft Office Excel 2007 software package.

Results

Kostanay region is located in the north of Kazakhstan and borders five regions of the Republic of Kazakhstan (Aktobe, Ulytau, Karaganda, Akmola and North Kazakhstan) and three regions of the Russian Federation (Orenburg, Chelyabinsk and Kurgan). The territory is characterized by relatively flat terrain and "extreme" continental climate. Winters are long, frosty, with

strong winds and snowstorms, and summers are hot and dry. The annual rainfall is 350-500mm in the north of the region and 240-280mm in the south. The region includes 16 districts and 4 cities of regional subordination. In order to carry out the research the territory of the region was conditionally divided into zones: northern, southern, western and eastern. The northern zone, a zone of temperate moisture (forest-steppe), united four northern districts; the southern zone, a zone of insufficient moisture (steppe) - four districts and the city of Arkalyk. The remaining eight districts are assigned to the western and eastern zones.

From January to April 2023, 300 samples of muscle tissue were examined. Animals came from four zones of the region. Infection of slaughtered cattle with sarcocysts of different ages and zones is presented in Table 2.

Table 2 - Extent of cattle infestation

Region	Species of animals	Age	No. of surveyed	No. of infected	% of infection
North	steers	2-3 y.o.	25	24	96
South	steers	2-3 y.o.	25	25	100
Western	cows	7-9 y.o	25	25	100
Eastern	steers	2-3 y.o.	25	25	100

The data in Table 2 show that in the northern region out of 25 examined carcasses of two-three-year-old steers, sarcocysts were found in 24 carcasses. Infestation rate in the northern zone is 96%. In the Southern, Eastern and Western zones the rate of infestation of steers and cows aged 7-9 years is 100%.

Carcasses of 2-3-year old steers of the northern, southern and eastern zones (Table 3) were highly infested with Sarcocystis spp.

Table 3- Number of Sarcocystis spp. cysts in cattle muscle by zone

Region	Species of animals, Age	Place of sampling	Sarcocystis spp. cysts detected (%) in muscle		
			weak	medium	strong
North	steers 2-3 y.o.	Neck	88±4,89	8±0,44	-
		Diaphragm	17±0,94	9±0,50	-
		Skeletal	8±0,44	3±0,17	-
South	steers 2-3 y.o.	Neck	11±0,61	13±0,72	1±0,06
		Diaphragm	9±0,50	4±0,22	-
		Skeletal	5±0,28	-	-
Western	cows 7-9 y.o	Neck	72±4,00	28±1,56	-
		Diaphragm	48±2,67	36±2,00	8±0,44
		Skeletal	21±1,17	15±0,83	-

Eastern	steers 2-3 y.o.	Neck	12,5±0,70	48±2,67	-
		Diaphragm	48±2,67	10±0,56	4±0,22
		Skeletal	5±0,28	-	-

Infestation of neck muscles with sarcocysts was observed in 24 carcasses, which is 96%, in 5 carcasses diaphragm muscles were affected, which corresponds to 20%, skeletal muscles were affected in 7 carcasses, which corresponds to 28% of the total number of carcasses examined.

Weak intensity of invasion in the skeletal muscles was detected in 3 districts of the studied zones, medium - of four.

Carcasses from the northern zone of the region were almost all infested, only one carcass was not infested with sarcocysts. Neck, diaphragm and skeletal muscles of 2-3-year-old steers from the northern zone were weakly and moderately infested, and in steers from the southern and eastern zones the skeletal muscles were free from Sarcocystis spp.

Weak degree of sarcocysts lesion was found in 0.45 % of the examined carcasses, medium - in 0.13 %, strong degree - in 0.05 %. As a whole, microscopic examination of the muscle samples from 75 carcasses of 2-3 years old steers showed positive results for 74 carcasses. The muscles of the neck and crura of the diaphragm were more affected; in the skeletal muscles the invasion was classified as weak. Of the 75 cases of Sarcocystis infestation in animals, weak invasion was 55%, moderate - 38%, strong - 6.7% of all detected cases of infestation. The highest number of Sarcocystis spp. cysts was found in the neck muscles and crura of the diaphragm, the lowest number in the skeletal muscles (Table 3).

The maximum number of Sarcocystis spp. cysts was found in diaphragm muscles, 2,090.18 specimens; less in neck and skeletal muscles, 1,323.73 specimens.

In neck, skeletal, and diaphragm crura muscles, the bulk of Sarcocystis spp. cysts had elongated, spindle-shaped, and oval shapes with pointed and rounded tips, of different lengths (Fig. 2-4). In the diaphragm muscle fibers, cysts were predominantly shaped with long, sharp ends (Figs. 3). Individual specimens of cysts in neck muscles and crura of diaphragm, as well as in skeletal muscles, had a spindle shape (Figs. 4) and there were no significant differences in size.

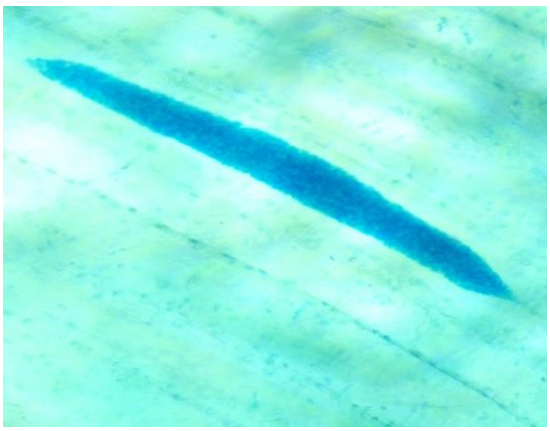

Figure 2 - Elongated-longitudinal shape of cysts in the neck muscles

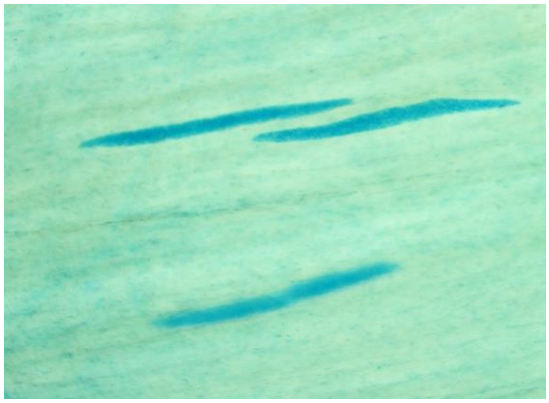

Figure 3 - Spindle-shaped cysts in the diaphragm muscle

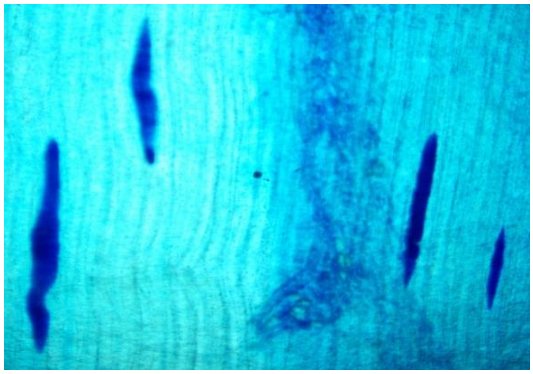

Figure 4 - Elongated cysts with blunt end in neck muscles

Discussion

During the visual veterinary and sanitary examination, pathological changes (exhaustion, hydroemia, discoloration, calcification of muscle tissue, degenerative changes) and parasite cysts were not detected in muscle samples. However, during microscopic studies, it was found that all samples of both necks, diaphragms and skeletal muscles contained tissue cysts of Sarcocystis spp.

When analyzing the data obtained, it was found that the highest EI was noted in all districts of the region. The extent of invasion in the northern zone is 96%. In the southern, eastern and western zones, the infection rate of bulls and cows aged 7-9 years is 100%. Carcasses of 2-3-year-old bull calves of the northern, southern and eastern zones turned out to be heavily infested with Sarcocystis spp.

A weak intensity of invasion in skeletal muscles was detected in 3 districts, the average – out of four. However, two heads of cows in the Denisovsky district and two- to three-year-old bulls in the Karasu district had a very strong intensity of invasion .

Conclusions

The received data testify to the wide spread of sarcocystosis invasion in cattle in Kostanay region. Extensity of invasion is 99%. The intensity of invasion is more weak, from 1 to 4-7 cysts in a slice, medium from 18 to 181 and strong from 207 to 279 specimens.

Morphometric data suggest the presence of invasion in cattle in our region by at least two representatives of the genus S. bovicanis and S. bovifelis, forming thin-walled and thick-walled cysts.

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References

1 Januskevicius V., Januskeviciene G., Prakas P., Butkauskas D., Petkevicius S. Prevalence and intensity of Sarcocystis spp. infection in animals slaughtered for food in Lithuania [Text] / Veterinarni Medicina. - 2019. -№64 (04). - P.149–157.

2 Abakumov V.I., Salimov V.A., Gasanov P.P., Monitoring sarkocistoza korov v hozjajstvah Samarskoj oblasti [Text] / Izvestija FGOUVPO Samarskaja gosudarstvennaja sel'skohozjajstvennaya akademija. -2008. -№1. –P.127-129.

3 Popov Ju.A., Rasprostranenie sarkosporidioza zhivotnyh v nekotoryh oblastjah Kazahstana [Text] / Vozbuditeli i perenoschiki parazitozov i mery bor'by s nimi. -1988. – P.153.

4 Serdobinceva O.V., Sarkocistozy zhivotnyh Saratovskoj oblasti [Text] / Veterinarija -2011. -№4. –P.31-33.

5 Poljanskaja O.V., Sivkov G.S., Rasprostranenie sarkocistoza krupnogo rogatogo skota v Tjumenskoj oblasti [Text] / Tr. Vserossijskogo nauch. - issled. instituta veterinarnoj jentomologii i arahnologii -2002. -№44. – P.134-135.

6 Latif B.M., Delemi, J.K., Mohammed B.S., Prevalence of Sarcocystis spp. in meat producing animals in Irag [Text] / Veter. Parasitology -1999. -№84 (12). –P. 85-90.

7 Klimova E.S., Mkrtchjan M.Je., Jepizootologija sarkocistoza domashnih i dikih zhvachnyh zhivotnyh [Text] / Teorija i praktika bor'by s parazitarnymi boleznjami. Sbornik nauchnyh statej po materialam mezhdunarodnoj konferencii. -2020. -№21. – P.137-141.

8 Abuladze K.I., Demidov N.V., Nepoklonov A.A., Parazitologija i invazionnye bolezni sel'skohozjajstvennyh zhivotnyh [Text]/ Moskva: Agropromizdat. -1990.

9 Novak M.D., Engashev S.V., Parazitarnye bolezni zhivotnyh [Text]/ Moskva: RIOR, INFRA-M. -2018.

10 Vershinin I.I. Protozojnye bolezni sel'skohozjajstvennyh zhivotnyh. [Text]/ Moskva: Kolos. -1982.

11 MUK 4.2.2747-10 Metody sanitarno-parazitologicheskoj jekspertizy mjasa i mjasnoj produkcii [Text]/ Vved. 2010.10.11.- M.: Federal'noj sluzhby po nadzoru v sfere zashchity prav potrebitelej i blagopoluchiya cheloveka G.G.Onishchenko, -2010.

12 Salimov V.A., Morfometricheskaja harakteristika cist Sarcocystis spp. u molodnjaka krupnogo rogatogo skota [Text]/ Rossijskij parazitologicheskij zhurnal -2014. -№1. - P 34-39.

13 Doronin-Dorgelinskij E.A., Sivkova T.N., Morfologicheskie izmenenija v myshechnoj tkani krupnogo rogatogo skota pri sarkocistoze [Text] / Agrarnyj vestnik Urala. -2019. -№3(182). - P.28-31.

14 Smirnov A.V., Urban V.G., Smol'kina A.S., Orlova D.A., Golubkina T.V., Veterinarno-sanitarnaja ocenka mjasa i produktov uboja pri invazionnyh i nezaraznyh boleznjah zhivotnyh [Text] / Sankt-Peterburg: SPGAVM. -2015.

15 J.P. Dubey, B.M. Rosenthal., Bovine sarcocystosis: Sarcocystis species, diagnosis, prevalence, economic and public health considerations, and association of Sarcocystis species with eosinophilic myositis in cattle [Text] / International Journal for Parasitology -2022. –No 1. doi: 10.1016/j.ijpara.2022.09.009

References

1 Januskevicius V., Januskeviciene G., Prakas P., Butkauskas D., Petkevicius S. (2019). Prevalence and intensity of Sarcocystis spp. infection in animals slaughtered for food in Lithuania. Veterinarni Medicina. 64 (04),149–157.

2 Abakumov V.I., Salimov V.A., Gasanov P.P., (2008). Monitoring sarkocistoza korov v hozjajstvah Samarskoj oblasti. Izvestija FGOUVPO Samarskaja gosudarstvennaja sel'skohozjajstvennaja akademija. (1), 127-129.

3 Popov Ju.A., (1988). Rasprostranenie sarkosporidioza zhivotnyh v nekotoryh oblastjah Kazahstana. Vozbuditeli i perenoschiki parazitozov i mery bor'by s nimi. (1), 153.

4 Serdobinceva O.V., (2011). Sarkocistozy zhivotnyh Saratovskoj oblasti. Vterinarija. (4), 31-33.

5 Poljanskaja O.V., Sivkov G.S., (2002) Rasprostranenie sarkocistoza krupnogo rogatogo skota v Tjumenskoj oblasti. Tr. Vserossijskogo nauch. - issled. instituta veterinarnoj jentomologii i arahnologii. (44),134-135.

6 Latif B.M., Delemi J.K., Mohammed B.S., (1999). Prevalence of Sarcocystis spp. in meat producing animals in Irag. Veter. Parasitol. 84 (12), 85-90.

7 Klimova E.S., Mkrtchjan M. Je., (2020). Jepizootologija sarkocistoza domashnih i dikih zhvachnyh zhivotnyh. Teorija i praktika bor'by s parazitarnymi boleznjami. Sbornik nauchnyh statej po materialam mezhdunarodnoj konferencii. (21), 137-141.

8 Abuladze K.I., Demidov N.V., Nepoklonov A.A. (1990). Parazitologija i invazionnye bolezni sel'skohozjajstvennyh zhivotnyh. Moskva: Agropromizdat.

9 Novak M.D., Engashev S.V., (2018). Parazitarnye bolezni zhivotnyh. Moskva: RIOR, INFRA-M.

10 Vershinin I.I. (1982). Protozojnye bolezni sel'skohozjajstvennyh zhivotnyh. Moskva: Kolos.

11 MUK 4.2.2747-10 Metody sanitarno-parazitologicheskoj jekspertizy mjasa i mjasnoj produkcii.

12 Salimov V.A., (2014). Morfometricheskaja harakteristika cist Sarcocystis spp. u molodnjaka krupnogo rogatogo skota. Rossijskij parazitologicheskij zhurnal. (1), 34-39.

13 Doronin-Dorgelinskij E.A., Sivkova T.N., (2019). Morfologicheskie izmenenija v myshechnoj tkani krupnogo rogatogo skota pri sarkocistoze. Agrarnyj vestnik Urala. 3 (182), 28-31.

14 Smirnov A.V., Urban V.G., Smol'kina A.S., Orlova D.A., Golubkina T.V. (2015). Veterinarno-sanitarnaja ocenka mjasa i produktov uboja pri invazionnyh i nezaraznyh boleznjah zhivotnyh. Sankt-Peterburg: SPGAVM.

15 Dubey J.P., Rosenthal B.M. (2022). Bovine sarcocystosis: Sarcocystis species, diagnosis, prevalence, economic and public health considerations, and association of Sarcocystis species with eosinophilic myositis in cattle. International Journal for Parasitology. 1.