

OCCURENCE OF *GIARDIA SP.* IN GOAT IN SERBIA

Ivan Pavlović^{1*}, Snežana Ivanović¹, Nemanja Zdravković¹, Dragana Ružić Muslić², Violeta Caro-Petrović², Jovan Bojkovski³, Marija Pavlović¹

¹ Scientific Veterinary Institute of Serbia, 11000 Belgrade, Serbia

² Institute for Animal Husbandry, 1100 Beograd-Zemun, Serbia

³ Faculty of Veterinary Medicine University in Belgrade, 11000 Belgrade, Serbia

*Corresponding author: dripavlovic58@gmail.com

Abstract

Giardia spp. are flagellates that are found in the intestinal tract of humans and other mammals, birds and amphibians. Infections with giardia have been reported widely in livestock and companion animals in different parts of the world. Evidence of infection in humans and animals of *Giardia* sp. especially of assemblage A and B has firmly established giardiasis as a zoonotic disease. At goat giardiasis usually result with diarrhea, especially in young animals, which in turn adversely affect production resulting in economic losses. So far, no research has been done related to goat giardiasis in Serbia, and here we present the results of the first studies of the presence of giardiasis in goats in our country.

Key words: *Giardia* sp., goat, kids, Serbia

Introduction

G. duodenalis (syn. *Giardia lamblia*, *Giardia intestinalis*), a flagellate parasite, is one of the most prevalent and widespread intestinal parasite in humans and several vertebrate animal (mammals, birds, amphibian) worldwide. Parasites causing a diarrheal condition known as [giardiasis](#). According morphology and genetic evidence six species have been recognized in the genus *Giardia*. These include *G. duodenalis* in humans and other mammals, *G. muris* and *G. microti* in rodents, *G. psittaci* and *G. ardeae* in birds and *G. agilis* in amphibians (Adam, 2001). Phylogenetic analysis and enzyme electrophoresis examination *G. duodenalis* revealed the existence of eight assemblages A–H within the species. Assemblage A and B is usually occurred at human but in goats higher occurrence genotype E, with genotypes A and B being less frequent (Giangaspero et al., 2005; Castro-Hermida et al., 2006; Gomez-Munoz et al., 2009; Lim et al., 2013).

Parasites takes on two morphologically distinct forms during its life cycle. The replicative form is a motile pear-shaped cell that survives only in host small intestines called a trophozoite. Trophozoites swim through the intestinal mucus until they attaches to

the epithelium by a ventral adhesive disc or sucker (Cernikova et al., 2018). To the host intestinal epithelium then divide by binary fission, forming either more trophozoites or the non-replicative cyst stage. Cysts pass through large intestine of the host and are shed in the feces. Giardiasis represents a major public health concern in both developing and developed countries and infected animals (pets or domesticated species) present a main source of human infection because transmission of the *G. duodenalis* occurs directly (fecal/oral) by cyst contaminated food or water (Thompson et al., 2008; Robertson, 2009).

Ruminants which infected with *G. duodenalis* are mostly asymptomatic, but subclinical signs such as impairment in feed conversion efficiency, reduction in growth rate and persistent diarrhea. In small ruminants, giardiasis more surveys from sheep than goat populations and therefore fewer publications on giardia in goats (Taminelli and Eckert, 1989; Xiao, 1994; Diaz et al., 1996; Olson et al., 1997; Akinkuotu et al., 2016)

So far, no research has been done related to goat giardiasis in Serbia, and here we present the results of the first studies of the presence of giardiasis in goats in our country performed during 2018 and 2019.

Materials and methods

In total we examined 1274 fecal samples from 24 goats herds in various part of Serbia. This follows the application of faecal concentration techniques, especially zinc sulphate flotation and centrifugation. Direct smear or wet mount examination for trophozoites can also be performed. However, because of the cyclical nature of cyst excretion, several samples need to be examined to detect the organism. The diagnosis of giardiasis is commonly established by microscopic identification of cysts or less commonly trophozoites in faecal wet smear stained with iodine.

Examinations were performed with AxioLab A1 microscope with the AxioCam 105 Color microscope camera and Zen Lite software, manufactured by Carl Zeiss.

Results and discussion

During our examination infection with giardia we established only in two herd and to 42 animals (figure 1).



Figure 1. *Giardia duodenalis*

A prevalence we established in pre-weaned animals (≤ 3 months) having a much higher compared to those that were over 3 months (figure 2). That confirmed results of numerous examination that infections are normally significantly higher in pre-weaned kids compared to that in older one (Xiao,1994; Geurden et al.,2008; Taminelli and Eckert,2008, Ma et al.,2014).

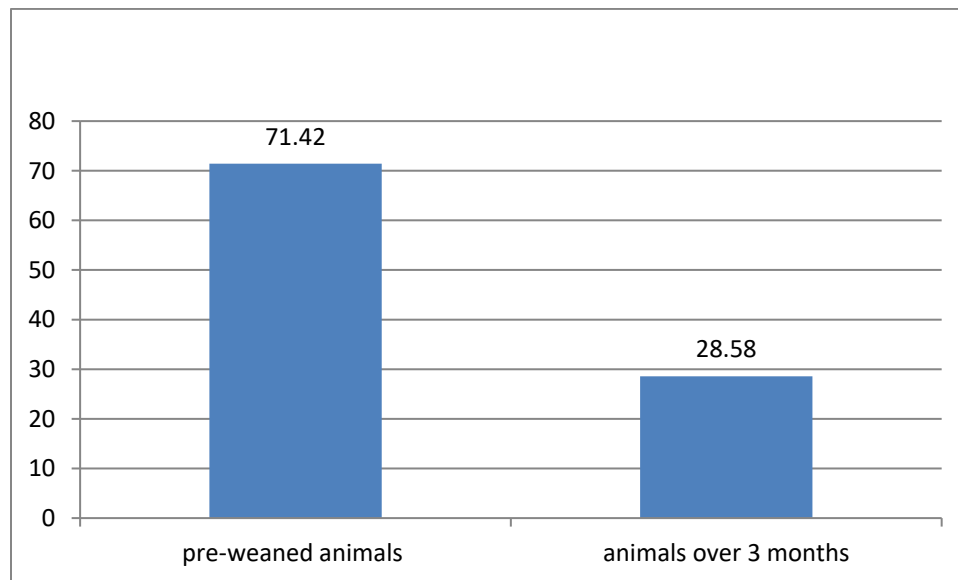


Figure 2. Prevalence of *G. duodenalis* in pre-weaned and animals over 3 months

Examination of goat giardiasis established that most infections with giardia are asymptomatic (Castro-Hermida et al.,2007). Clinical signs that may be observed, mostly in young animals that are foul-smelling diarrhoea which is lightly colored, greasy and mixed with mucous and reduced weight gain (Olson et al.,1995; Aloisio et al.,2006). This symptoms we found during our research too.

As these were the first studies of giardiasis in goats in Serbia, they did not include molecular identification of the giardia genotype. A numerous genotyping studies of *G. duodenalis* in ruminants report a higher occurrence of genotype E, with genotypes A and B being less frequent (Ruiz et al., 2008). Studies performed in Belgium have reported zoonotic genotype A infections in goats (Geurden et al.2008) and in study in Malaysia and India reported genotypes A and B in goats (Lym et al., 2013, Utaaker et al., 2017). These findings suggest that goats could be a potential source of zoonotic infection with giardia.

In the all cases in therapy were used febendazole an effective molecule, at least in terms of complete clinical recovery. They confirming observations of other authors, who successfully treated goats infected with *G. duodenalis* using similar therapy protocols (Xiao et al., 1996).

Conclusions

The present study confirmed the presence of *Giardia duodenalis* in goat herds in Serbia. At goat giardiasis usually result with diarrhea, especially in young animals, which in turn adversely affect production resulting in economic loss. At the same time, diseased goats pose an epidemiological danger because they excrete infectious forms of giardia in their feces. In order to get acquainted with the genotype of established parasites, further research will be focused on the molecular identification of established parasites in goats.

Acknowledgements

This study was supported by the Ministry of Education, Science and Technological Development, Republic of Serbia (Contract for research funding No. 451-03-68/2020-14/200030) and its part of project BT 31053

References

- Adam, R.D (2001): Biology of *Giardia lamblia*. Clinical Microbiology Reviews, 14: 447–475.
- Akinkuotu, O.A., N. Okwelum, S.A. Famakinde, A.C. Akinkuotu, O.T. Oseni (2016): *Giardia* infection in recently acclimatized kalahari red goats in Nigeria. Nigerian Veterinary Journal, 37:16-23
- Aloisio F., G. Filippini, [P.Antenucci](#), E. Lepri, G. Pezzotti, M. Simone (2006): Cacciò, [Edoardo Pozio](#)l. Severe weight loss in lambs infected with *Giardia duodenalis* assemblage B. Veterinary Parasitology, 142: 154–158.
- Castro-Hermida J.A., A.Almeida, M.González-Warleta, J. M Correia Da Costa, M.Mezo (2006): Prevalence and preliminary genetic analysis of *Giardia* isolated from adult sheep in Galicia (northwest Spain). Journal of Eukaryotic Microbiology, Suppl.1, 153: 72–73.
- Castro-Hermida J.A., A.Almeida, M.Gonzalez-Warleta, J.M.Correia da Costa, C. Rumbo Lorenzo, M. Mezo (2007): Occurrence of *Cryptosporidium parvum* and *Giardia duodenalis* in healthy adult domestic ruminants. Parasitology Research, 101:1443-1448.
- Cernikova L.,C.Faso,A.B.Hehl (2018):Five facts about *Giardia lamblia*. PLOS Pathogens, 14 (9): e1007250. doi:10.1371/journal.ppat.1007250
- Diaz, V., M.Campos, J. Lozano, I.Manas, J.Gonzalez, J (1996): Aspects of animal giardiosis in Granada province (southern Spain). Veterinary Parasitology, 64:171–176.
- Giangaspero,A.,B.Paoletti, [R.Iorio](#), [D.Traversa](#) (2005):Prevalence and molecular characterization of *Giardia duodenalis* from sheep in central Italy. Parasitology Research, 96: 32–37.
- Geurden T, P.Thomas S.Casaert, J.Vercruysse, E.Claerebout (2008): Prevalence and molecular characterisation of *Cryptosporidium* and *Giardia* in lambs and goat kids in Belgium. Veterinary Parasitology,155:142–145.

Gomez-Munoz, M.T., C.Navarro, M.M.Garijo-Toledo, M.A.Dea-Ayuela, S.Fernandez-Barredo, M.T.Perez-Gracia, M.V.Dominguez-Marquez, R.Borras (2009): Occurrence and genotypes of *Giardia* isolated from lambs in Spain. *Parasitology International*, 58:297-299.

Lim, Y.A.L., M.A.K.Mahdy, T.K.Tan, X.T. Goh, A.R.Jex, M.J.Nolan, R.S.K.Sharma, R.B. Gasser (2013): First molecular characterization of *Giardia duodenalis* from goats in Malaysia. *Molecular and Cellular Probes*, 27:28-31.

Ma, L., I.Sotiriadou, Q.Cai, G.Karanis, G.Wang, (2014): Detection of *Cryptosporidium* and *Giardia* in agricultural and water environments in the Qinghai area of China by IFT and PCR. *Parasitology Research*, 113:3177–3184.

Olson, M.E., T.A.McAllister, L.Deselliers, D.W.Morck, K.J.Cheng, A.G.Buret, H.Ceri (1995): Effects of giardiasis on production in a domestic ruminant (lamb) model. *American Journal of Veterinary Research*, 56:1470–1474.

Olson, M.E., Thorlakson, C.L., Deselliers, L., Morck, D.W., McAllister, T.A., 1997. *Giardia* and *Cryptosporidium* in Canadian farm animals. *Veterinary Parasitology*, 68:375–381.

Robertson, L.J (2009): *Giardia* and *Cryptosporidium* infections in sheep and goats: a review of the potential for transmission to humans via environmental contamination. *Epidemiology and Infection*, 137:913–921.

Ruiz, A., P.Foronda, J.F.González, A.Guedes, N.Abreu-Acosta, J.M.Molina, B.Valladares (2008): Occurrence and genotype characterization of *Giardia duodenalis* in goat kids from the Canary Islands, Spain. *Veterinary Parasitology*, 154:137–141.

Taminelli, V., J.Eckert (1989): The frequency and geographic distribution of *Giardia* infections in ruminants in Switzerland. *Schweitzer Archive für Tierheilkunde*, 131: 251–258.

Thompson, R.C., C.S.Palmer, R.O’Handley (2008): The public health and clinical significance of *Giardia* and *Cryptosporidium* in domestic animals. *Veterinary Journal*, 177:18–25.

Utaaker, K.S., N.Myhr, R.S.Bajwa, H.Joshi, A.Kumar, L.J.Robertson (2017): Goats in the city: prevalence of *Giardia duodenalis* and *Cryptosporidium* spp in extensively reared goats in northern India. *Acta Veterinaria Scandinavica*, 59:86.

Xiao, L (1994): *Giardia* infection in farm animals. *Parasitology Today* 10, 436–438.

Xiao, L., K.Saeed, R.P.Herd (1996): Efficacy of albendazole and fenbendazole against *Giardia* infection in cattle. *Veterinary Parasitology*, 61:165–170.