Journal of Animal Research: v.12 n.1, p. 39-45. February 2022

DOI: 10.30954/2277-940X.01.2022.6

Dynamics of Gastrointestinal Parasitism in Sheep during Peri-parturient Period on Organized Farm

Dinesh Kumar Sharma[1]*, Gopal Das[1], Ajoy Mandal[2], Nitika Sharma[1] and Yogendra Kumar Kushwah[1]

[1]ICAR- Central Institute For Research on Goats, Makhdoom P.O. Farah, Dist. Mathura UP, INDIA
[2]ICAR- NDRI Eastern Regional Center, Kalyani, Kolkata, INDIA

**Corresponding author: DK Sharma; E-mail: lkofwb@yahoo.co.in*

Received: 06 Oct., 2021 **Revised:** 17 Jan., 2022 **Accepted:** 21 Jan., 2022

ABSTRACT

The strongyle and coccidian parasitism was monitored through faecal eggs/oocysts count in Muzaffarnagri ewes, during peri-parturient period (PPP) to study the prevalence and effect of different environmental factors. The data generated on faecal count were transformed using log transformation (log (n +100)) for normalization. The transformed data were analyzed through least squares analysis considering the effects of factors like physiological state (pregnancy/lactation), season of lambing and years. Resulted means were back-transformed and presented as Geometric means. Strongyle worms and coccidian infections were the major infections affecting the ewes. *Haemonchus contortus* was the predominant strongyle worm in the ewes though worms like *Oesophagostomum* and *Trichuris* spp. were also observed. Coccidian infection was mixed and seven species of Eimeria were recorded. Overall prevalence of coccidian and strongyle worm in ewes during PPP was found to be 54.31 and 33.40 percent respectively. Specific coccidian prevalence in pregnant and lactating ewe during PPP was 54.98 and 48.18 percent respectively while strongyle prevalence was 31.07 and 36.50 percent, respectively. The coccidian prevalence in peri-parturient ewes differed kidding and lactating season-wise and Year-wise. However, the observation with strongyle worm infection was reverse. Mean faecal egg count (FEC) in lactating ewes was found to be significantly higher (P<0.001) than pregnant ewes. Also, means FEC in ewes lambed in two different seasons were significantly (P<0.001) different. Similarly significant variations in FEC were observed between years of lambing. Though, mean FOC in pregnant and lactating ewes did not differ significantly yet the effect of lambing season on FOC was significant and ewes lambed in first season (February–April) showed lower FOC mean.

HIGHLIGHTS

- Prevalence of Strongyle worms and coccidian infection between pregnant and lactating Muzaffarnagari ewes was not significantly different.
- Coccidian prevalence observed in ewes lambing and lactating in 1st season (7.04%) was quite low compared to 2nd lambing and lactating season (71.80 %).
- Effect of lambing season on both FOC and FEC in ewe was significant.

Keywords: Sheep, Gastrointestinal parasitism, peri-parturient

Gastrointestinal (GI) parasitism, especially due to gastrointestinal nematodes, is quite common and leads to serious production losses in goats and sheep. Suarez *et al*. (2017) reported about 42 per cent increase in milk production in response to anthelmintic treatment in dairy goats. The problem is widespread and more common in grazing animals than those stall-fed. The factors like age of animal, season, stocking rate and physiological state are important determinants for incidence and intensity of the infection of GIT nematodes. Physiological states of animals like pregnancy and lactation are known to

How to cite this article: Sharma, D.K., Das, G., Mandal, A., Sharma, N. and Kushwah, Y.K. (2022). Dynamics of Gastrointestinal Parasitism in Sheep during Peri-parturient Period on Organized Farm. *J. Anim. Res.*, **12**(01): 39-45.

Source of Support: None; **Conflict of Interest:** None

cause immunity loss in females and make them more susceptible to gastrointestinal parasitism. Generally, higher productivity of animals leads to increase their vulnerability to diseases due to low immune status of animals at this stage. This is also marked by the peri-parturient rise of faecal egg counts in many breeds of sheep, worldwide. The higher FECs in pregnant and lactating sheep during the peri-parturient period have been attributed to more numbers of worms and simultaneously increased fecundity of worms in such physiological state of animals. Peri-parturient change in faecal egg counts (FEC) in sheep is considered as an indicator of resistance against GI nematodes and varies from breed to breed. The study on peri-parturient rise in some breeds is important as it also contributes to pasture contamination and thus the incidence of parasitic gastroenteritis.

The present study deals with natural gastrointestinal parasitism in pregnant and lactating ewes of Muzaffarnagari breed in India. Muzaffarnagari is quite a robust, large-sized Indian sheep breed with very good productive traits and with minimum health hazards. However, animals suffer from gastrointestinal parasitism even after scheduled pre and post-monsoon season deworming irrespective of their age. The present work was undertaken to study the dynamics of gastrointestinal parasitism of this breed in peri-parturient period (late pregnancy and early lactation) and further its contribution to the environment and pasture infection through faecal egg discharge.

MATERIALS AND METHODS

Location

The study was conducted at an organized Muzaffarnagari sheep farm of the Central Institute for Research on Goats, Makhdoom, Mathura (India) (27.100N,78.020 E and 169.2 m MSL). The place is situated in ravines of Yamuna River. The topography of the place is an undulated wasteland with sandy soil having scarcely distributed bushy vegetation and coarse grasses. Climate is semi-arid with average rainfall 257.49 mm and average minimum and maximum temperature range (19.13-44.38 ^{o}C), the highest temperature recorded in 2019 being 50 ^{o}C.

Animals

Pregnant animals from Muzaffarnagari sheep flock of ICAR-CIRG institute was used for the present study. Muzaffarnagari sheep is a large sized, robust and highly productive Indian sheep breed with minimum health problems. The animals at this organized flock are being maintained in a semi-intensive system of feeding management. As per schedule, the animals were bred twice a year having two lambing seasons in March-April and October and November. They were fed with grains in stall (150-250 g) and allowed at least 6 hours of grazing daily. The pregnant ewes are especially cared in the last phase of gestation as they are provided with high quality of ration to meet out the growth requirement of the fetus. The animals are dewormed routinely twice a year i.e. pre and post-monsoon with suitable anthelmintic and also when faecal egg count (FEC) necessitates deworming.

Sample collection

Faeces samples from pregnant ewes were collected aseptically from the rectum by manual fingering. Collections of samples were made during the last one month of pregnancy and the first one month of lactation. Collected samples were processed for faecal eggs/oocysts count (FEC/FOC) at the earliest and immediately after they reached the laboratory after collection or else the samples were stored in the refrigerator at 4 ^{o}C for next day processing. A total of six samplings, three before lambing and three after lambing, were made with at least 10 days interval in between. The samples were collected in two lambing seasons i.e. 1st (February-April) and 2nd (September-November) of years 2015 and 2016.

Parasitological examination

Faecal eggs/oocysts count was performed using the standard method of modified Mac-master technique (MAFF 1977). For identification of parasitic infections, the egg positive samples were put for copro-culture and identification of prevalent gastrointestinal nematodes was performed through examination of morphological characters of developed larvae. For coccidian infection, the samples were placed in a 2 per cent solution of Potassium dichromate in a Petri-dish in a thin layer aerated from time to time by blowing with a pipette. Identification and speciation of Coccidian infection were based on morphological and sporulation time of sporulated oocysts in randomly pooled 10 samples at different time during study.

STATISTICAL ANALYSIS

The prevalence (%) of GI parasites was calculated using the following formula:

$$\text{Prevalence} = \frac{\text{Animals infected in a particular year/season/physiological stages}}{\text{Total animals available in a particular year/season/physiological stages}} \times 100$$

Statistical analysis for significance of difference of prevalence of GI parasites between physiological stages, years of sampling and seasons of sampling were done using Chi-Square (χ^2) test.

Data so generated on FEC and FOC being uneven were normalized by log transformation. For log transformation, all raw faecal eggs/oocysts count (n) was added with 100 and then log-transformation was applied. All statistical analyses were carried out on log-transformed values to avoid skewness. Least squares analysis of variance (Harvey, 1990) was performed to assess the effect of different environmental factors including the physiological stages of animals on FEC or FOC of animals. In the preliminary analysis, all the main effects viz, physiological stages of animals, season of sampling, year of sampling, litter size, weight of lamb at birth and interaction effects were considered. However, all the non-significant effects were excluded in the final model, considering only the effect of physiological stages of animals, lambing/lactating season, and year of lambing. The age of ewe was considered by linear regression on the FEC/FOC of the ewe. However, for interpretation of results, the least-squares means of log-transformed value was again re-transformed to obtain the geometric means of FEC/FOC.

RESULTS AND DISCUSSION

The results of the analysis of data have been shown in Tables 1-3. During the study period, a total of 440 faecal samples were collected and examined for parasitological information. The major parasitic infections were strongyle worms and coccidia. The overall prevalence rates of coccidian infection and strongyle worm were 54.31 and 33.40 per cent respectively. In pregnant sheep, the prevalence of coccidia and strongyle worm infection was 54.98 and 31.07 per cent respectively. The corresponding values of respective prevalence in lactating animals were 48.19 and 36.50 per cent respectively. On analysis with Chi-square test, the *P* values for the difference in prevalence in coccidian and strongyles infections between pregnant and lactating animals were 0.156 and 0.232, respectively (Table 1) and these differences in prevalence were statistically non-significant for both coccidian and strongyle infections.

Observations on the ewes lambed in different seasons revealed that prevalence of coccidian infection (71.80%) was more in ewes lambed in 2nd season (September – November) than those lambed in 1st season (7.40 %) in February-April. Further, the prevalence of strongyle worms in the ewes lambed in the 1st and 2nd season were 36.29 and 32.78 per cent respectively. Difference in prevalence of coccidian infection for ewes lambed in two different seasons were highly significant (P<0.001) in this study, however, it was non-significant (P>0.05) for strongyles infection. Year-wise comparisons of prevalence of GI parasites revealed that the prevalence of coccidian infection in the ewes lambed in the year 2016 was (71.67%) quite higher than the corresponding prevalence value of 38.20% in the year 2015. However, for strongyles infection, the prevalence was higher in ewes lambed in 2015 as compared to ewes lambed in 2016 (39.32% vs. 23.69%). Year-wise variations in prevalence for both coccidian and strongyles infection were significant in this study (Table 1).

Coccidian infection was of mixed type and based on oocysts' sporulation and their morphological characteristics seven Eimeria species were identified. The identified species were *Eimeria parva, E. pallida, E. faurei, E. ovinoidalis, E. intricata, E. granulosa, E. ahsata*. The most prevalent species were *Eimeria pallida* (39.89 %) and *E. parva* (34.86%) (Table 2).

The overall least-squares mean of faecal egg count of strongyle worms, in pregnant goats, as observed in the last month of pregnancy, was 4.61±0.002, while the corresponding value in lactating goats (first month of lactation and after) was 4.62±0.003. However, both the means were different significantly and the mean FEC in lactating goats being more (P<0.01) (Table 3).

Season-wise analysis of data, however, revealed that the ewes lambed and lactating in the 1st season i.e.

Table 1: Factor wise prevalence of parasitic infections in goats.

Source of Variation	No. of obs.	Strongyles (%)	P value	Coccidian (%)	P value
Overall	440	33.40 (147)		54.31 (239)	
Physiological states					
Pregnant	251	31.07 (78)	*P* = 0.232	54.98 (138)	*P*= 0.156
Lactating	189	36.50 (69)		48.18 (91)	
Lambing and Lactating seasons					
1	135	36.29 (49)	*P* = 0.473	7.40 (10)	*P* =0.000
2	305	32.78 (100)		71.80 (219)	
Year of sampling					
2015	267	39.32 (105)	*P* = 0.009	38.20 (102)	*P*= 0.000
2016	173	23.69 (41)		71.67 (124)	

*Figures in parenthesis are number of observations.

Table 2: Prevalence of Eimerian species in Muzaffarnagari Sheep during Peri-parturient period

Sl. No.	Eimeria Species	Prevalence (%)	Prevalence range (%)
1	*Eimeria parva*	34.86	28.97-44.34
2	*Eimeria pallida*	39.89	34.71-43.92
3	*Eimeria faurei*	9.19	6.66- 14.01
4	*Eimeria ovinoidalis*	4.77	1.96-7.77
5	*Eimeria intricata*	4.16	2.54-7.43
6	*Eimeria granulosa*	3.81	2.08-6.86
7	*Eimeria ahsata*	3.29	1.73-4.79

Table 3: Factor-wise Least squares means of FEC/FOC in female goats

Source of Sources of Variance	No. of Obs.	Strongyle eggs			Coccidian Oocysts		
		L S Means	SE	Geometric means	L S Means	SE	Geometric means
Overall mean	440	4.6156	0.0019	209.68	4.6205	0.0022	308.95
Physiological stages							
Pregnant	251	4.6121**	0.0024	139.07	4.6177	0.0029	252.17
Lactating	189	4.6191	0.0025	280.54	4.6233	0.0030	365.90
Season of lambing & lactation							
1st Season (Feb.-Mar.)	135	4.6080**	0.0034	56.67	4.6130**	0.0041	157.21
2nd season (Oct. -Nov.)	305	4.6232	0.0019	363.86	4.6280	0.0023	461.84
Year of sampling							
2015	267	4.6248**	0.0020	396.47	4.6225	0.0024	349.61
2016	173	4.6064	0.0032	24.61	4.6185	0.0038	268.38

February-March, showed significantly lower mean of FEC (4.61±0.003) as compared to the those lambed and lactated in the second season i.e. October-November (4.62±0.002). Year-wise analysis of data revealed that the average values for FEC in ewes lambed and lactated in the different years were significantly different (P<0.01). In the present study, ewes lambed in 2015 had higher mean FEC (4.6248±0.0020) than those of ewes lambed in the year 2016 (4.61±0.003) (Table 3).

The overall FOC in pregnant sheep, as observed in the last month of pregnancy, was 4.62±0.003. The corresponding value of FOC in lactating ewes, as observed in the first one month of lactation, was 4.62±0.003. Both these values when tested statistically, difference was found non-

significant unlike the FEC of strongyle worms. Statistical analysis, however, revealed a significant difference between the mean FOC values of ewes lambed and lactated in 1st and 2nd seasons. The sheep, lambed and lactated in 2nd season, had mean FOC (4.63±0.002) higher than the corresponding mean FOC value (4.61±0.004) observed in sheep lambed and lactated in the 1st season. Year-wise data analysis on FOC, observed in the faecal samples collected from sheep during one month peri-parturient period in the year 2015 and 2016, revealed that mean values of FOC for these years were statistically similar (4.62 ± 0.002 and 4.62 ± 0.004, respectively) in our study.

The occurrence of strongyle worm infections viz. *Haemonchus contortus* and *Oesophagostomum* sp. as observed in the present study was also described in other studies (Priyanka *et al*., 2020; Viassoff *et al.,* 2002; Singh *et al*., 1997; Maimadu *et al*., 2020; Islam *et al*., 2017). The prevalence of strongyle worm infection in our study (33.40%) was much less than the prevalence (65.9%) reported by Islam *et al*. (2017) in sheep. The predominance of *Haemonchus* in our study was as described by David *et al*. (2020). Differences in prevalence can, however, be explained on the basis of local management of animals, their body condition and health, age, physiological states and prevailing environmental in place of study.

The significantly higher mean of FEC in lactating ewes as compared to pregnant ewes in the current study was also observed by Yadav *et al*. (2006) in their earlier study for the same flock, where they reported that the mean FEC of lactating ewes was significantly higher than those of dry and pregnant ewes. Vlassoff *et al*. (2002) from New Zealand also found that mean FEC was higher in lactating ewes in the peri-parturient period. In this study, significantly higher mean FEC in lactating sheep can be attributed to lactation stress and hormonal suppression of immunity as prolactin hormone in lactating ewes has been associated with immunosuppression (Barger, 1993). Further, Barger (1993) reported that ewes tend to lose their acquired immunity to nematode infection around the time of parturition and during lactation. As shown in Table 2, the significantly higher mean of FEC in 2015 than 2016 in Muzaffarnagari sheep flock can be ascribed to variations in environmental conditions, management and stocking rate in farms in different years as these factors decide the availability of infection to animals in farm and grazing area as well (Agrawal *et al*., 2015). The linear regression effect of age on mean FEC was not found significant in present study.

Sorathiya *et al*. (2017) described a positive correlation of helminthes prevalence to lactation status and housing quality. Beasly *et al.* (2010) reported that lactating suckled ewes had a lower anti-parasitic local immune response, which was measured by the reduced titer of total antibodies, the IgG(1), IgM, IgA and IgE, than those measured in dry and early weaned ewes. Gonzalez- Garduno *et al*. (2018) also described higher mean FEC values in stabled lactating ewes and growing lamb as compared to pregnant ewes, and non-pregnant ewes are mainly attributed it to change in immune status.

In a similar study conducted in goats, in contrast to our study, Agrawal *et al*. (2010, 2015) however, reported higher mean FEC in dry and pregnant goat than the lactating goats. Chauhan *et al*. (2014) recorded a rise in mean FEC from the dry period to early lactation and then fall thereafter both in goats and sheep.

Mixed coccidian infection in present study was similar as reported in some other study (Etsay *et al.,* 2020; Om *et al*., 2010; More *et al*., 2015; Mohamaden *et al*., 2018). The Eimerian species observed in present study were same as reported by Mohamaden *et al*. (2018) from Egypt and Singh and Swarnkar (2010) from India.

The intensity of *Eimeria* spp. infection in both pregnant and lactating ewes in the present study, as shown mean FOC (Table 2) was statistically same. Our finding, however, differed from David *et al*. (2020) study in Santa Ines sheep from Brazil who described the higher mean FOC in post parturient period and ascribed the results to probably due to the management used, since in addition to better food, they confined the animals. Also, some reports are describing that stress related factors to pregnancy, parturition and lactation can lead to females more susceptible to Eimeria infection (Khodakaram-Tafti and Hashemnia, 2017; Yakhchaki and Golami, 2008).

Significantly higher mean of FEC and FOC in ewes lambed and lactating in 2nd season (October-November) than mean observed in ewes lambed and lactating in 1st season in the present the study may be due to the long spell rainy season (July-September) before 2nd lambing and lactating season in the prevailing conditions. The significantly higher mean of FEC and FOC in goats in the rainy season has also been

reported in some other studies also (Sharma *et al*., 2009; Islam *et al*., 2017) supporting the present finding. There was no significant effect of year of sample collection on mean FOC in sheep.

Present study showed the significantly high prevalence and intensity of Eimerian as well as strongyle infections in 2nd lambing and lactating season. Though it may be due to variation in environmental stress and more number of animals in 2nd lambing and lactating season, yet it need to be addressed to avoid the post natal lambs' infection and a pre parturient anticoccidial therapy would be helpful to limit the infection in lambs to come.

ACKNOWLEDGEMENTS

Authors sincerely acknowledge the help and support provided by Director of the institute along with other technical and supportive staff of sheep farm.

REFERENCES

Agrawal, N., Sharma, D.K. and Mandal, A. 2010. Faecal egg output in Jakhrana goats naturally infected by *Haemonchus contortus*: physiological states and seasons effect. *Indian J. Anim. Sci*., **80**(6): 509-511.

Agrawal, N., Sharma, D.K., Mandal, A., Rout, P.K. and Kushwah, Y.K. 2015. Dynamics of faecal egg count in natural infection of *Haemonchus* spp. in Indian goats. *Vet. World*, (1)3-41.

Barger, I.A. 1993. Influence of sex and reproductive status on susceptibility of ruminants to nematode parasitism. *Int. J. Parasitol*., **23**(4): 463-469.

Beasly, A.M., Kahn, L.P. and Windon, R.G. 2010. The peri-parturient relaxation of immunity in Merino ewes infected with *Trichostrongylus colubriformis*: parasitological and immunological responses. *Vet. Parasitol*., **168**(1-2): 60-70.

Chauhan, K.K., Rout, P.K., Das, G., Singh, S.K., Shukla, S.N. and Roy R. 2014 Susceptibility to natural gastrointestinal nematode infections during different physiological stages in goats and sheep in semi arid tropics. *Glob. J. Anim. Sci. Livest. Prod. Anim. Breeding*, **2**(1): 101-106,

David, C.M.G., Costs, R.L.D., Parren, G.A.E, Rua, M.A.S., Nordi, E.C.P., Paz, C.C.P., Quirino, R., Figueiredo, R.S. and Bohland, E. 2020. Haematological, parasitological and biochemical parameters in sheep during the peri-partum period. *Revista Columbiana de Ciencias Pecuarias*, **33**(2):81-95

Etsay, K., Megbey, S. and Yohannes, H. 2020. Prevalence of sheep and goat coccidiosis in different districts of Tigray region, Ethiopia. *Nigerian J. Anim. Sci.*, **22** (3): 61-69 (ISSN: 1119-4308).

Gonzalez-Garduno, R., Mendoza-de Gives, P., Lopez-Arellano, M.E., Aguilar-Marcelino, L., Torres-Hernandez, G., Ojeda-Robertos, N.F. and Torres-Acosta, J.F. 2018. Influence of the physiological stage of Blackberry sheep on immunological behavior against gastrointestinal nematodes. *Exp. Parasitol*., **193**: 20-26.

Harvey, W.R. 1990. User's guide for LSMLMW PC-2 Version mixed model least squares maximum likelihood computer program. Monograph Columbus, Ohio, USA.

Islam, S.M., Hossain, S.M., Dey, A.R., Alim, M.A., Akter, S. and Alam, M.Z. 2017. Epidemiology of gastrointestinal parasites of small ruminants in Mymensing, Bangladesh. *J. Adv. Vet. Anim. Res*., **4**(4): 356-362.

Khodakaram-Tafti, A. and Hashemnia, M. 2017. An overview of intestinal coccidiosis in sheep and goats. *Rev. Med. Vet*., **168**(1-3): 9-20.

MAFF 1977. Manual of Veterinary Parasitology Laboratory Technique. Technical Bulletin No.1 Her Majesty's Stationery Office, Ministry of Agriculture, Fisheries and Food, London, pp. 160.

Maimadu, A.A., Bata, S.I., Olabode, M.P., Akinsulie, O.C., Waziri, I.A. and Sabo, J.A. 2020. Prevalence of Gastrointestinal Parasites and their impact in Sheep in Riyom Local Government Area Plateau State. *J. Bacteriol. Parasitol*., **11**(4): 375.

Mohamaden, W.I., Sallam, N.H. and Abouelhassan, E.A. 2018. Prevalence of Eimeria species among sheep and goats in Suez Governorate, Egypt. *Int. J. Vet. Sci. Med*., **6**(1): 6-72.

More, B.V., Lokhande, S.C. and Nikam, S.V. 2015. Observation of Eimeria parva in Goat and Sheep from Beed, M.S., India. *Int. J. Recent. Sci. Res*., **6**(3): 3076-3079.

Om, Hari, Kumar, Sanjiv, Singh and Pawanjit 2010. Prevalence of Coccidia in Mathura Region of Uttar Pradesh. *Vet. World*, **.3**(11):503-505.

Priyanka, Vohra, S. and Singh, S. 2020. Epidemiology of gastrointestinal nematodes in small ruminants in Aeolian plains of Haryana. *The Pharma Innov. J.*, **9**(2): 348-354.

Sharma, D.K., Agrawal, N., Mandal, A., Nigam P. and Bhusan S. 2009. Coccidia and Gastrointestinal nematode infections in semi-intensively managed Jakhrana goats of semi-Arid region of India. *Trop. Subtrop. Agroecosyst.*, **9**.

Singh, D. and Swarnkar, C.P. 2010. Regional profile of ovine coccidiosis in Rajasthan. *J .Vet. Parasitol.*, **24**(2): 121-124.

Singh, D., Swarnkar, C.P., Khan, F.A., Srivastava, P.S. and Bhagwan, P.S.K. 1997. Epidemiology of ovine gastrointestinal nematodes at an organized farm in Rajasthan, *India. Small Rumin. Res*., **26**(1-2): 31-37.

Sorathiya, L.M., Fulsoundar, A.B., Rao, T.K.S. and Kumar, N. 2017. Prevalence and risk factors for gastrointestinal parasitism in traditionally maintained goats flocks of South Gujarat. *J. Parasit. Dis*., **41**(1): 137-141.

Suarez, V.H., Martinez, G.M., Vinabal, A.E. and Alfaro, J.R. 2017. Epidemiology and effect of gastrointestinal nematodes on dairy goats in Argentina. *Onderstepoort J. Vet. Res.*, **84**(1): 1240.

Viassoff, A., Leathwick, D.M. and Heath, A. 2002. The epidemiology of nematode infections of sheep. *N Z Vet. J*., **49**(6): 213-21.

Yadav, N.K., Mandal, A., Sharma, D.K., Rout, P.K. and Roy, R. 2006. Genetic studies on Faecal Egg Counts and Packed cell Volume following in Natural Haemonchus contortus infection and their relationship in Muzaffarnagari Sheep. *Asian-Australas J. Anim. Sci*., **19**(11): 1524-1528.

Yakhchaki, M. and Golami, E. 2008. Eimeria infection (Coccidia: Eimeriidae) in sheep of different age groups in Sanandaj City, Iran. *Vet. Arhiv*., **7**:57-64.