The Journal of Animal & Plant Sciences, 23(4): 2013, Page: 986-989
ISSN: 1018-7081

PREVALENCE OF GASTROINTESTINAL PARASITES IN KOREAN NATIVE GOATS (*CAPRA HIRCUS AEGAGRUS*)

E. B. Gebeyehu, M. G. Seo, B. Y. Jung*, J. W. Byun*, J. K. Oem*, H. Y. Kim* and D. Kwak

College of Veterinary Medicine, Kyungpook National University, Buk-gu, Daegu 702-701, Korea,
*Animal and Plant Quarantine Agency, Anyang, Gyeonggi 430-727, Korea,
Contact address of author e-mail: dmkwak@knu.ac.kr

ABSTRACT

The current study was conducted to investigate the prevalence and intensity of gastrointestinal (GI) parasites in Korean native goats (*Capra hircus aegagrus*). Fecal samples from 241 goats in 57 herds were collected and examined for parasite eggs/oocysts and counted by using standard qualitative and quantitative techniques. A total of 167 (69.3%) goats were found to be infected with one or more GI parasites. Of these, 163 (67.6%) were infected by coccidia, 54 (22.4%) by nematodes and 5 (2.1%) by cestodes. *Eimeria* spp. was the only coccidian parasite identified while strongyle group (20.7%) was the most prevalent nematode detected. The prevalence of *Eimeria* was significantly higher ($P<0.05$) than that of the other GI parasites. Heaviest parasitic load was observed for *Strongyloides* (23.5%) although its prevalence was lower compared to other GI parasites. In addition, mixed parasitic infections were found in 31.7% of the goats. Higher odds of goats being infected by all GI parasites were observed for adults than in young goats except for *Moniezia*. Since parasitic infections result in decreasing productivity leading to economic loss, a well-coordinated and permanent sanitary monitoring is suggested.

Key words: Gastrointestinal parasites; Korean native goats; *Capra hircus aegagrus*; Prevalence.

INTRODUCTION

The domestic goat is among the earliest animals domesticated by humans. They are distributed worldwide with higher concentrations in tropical areas and in dry zones (Di Cerbo *et al*., 2010). The world's goat population in 2004 was estimated to be over 743 million of which most of them were found in developing countries (Galan, 2005; Di Cerbo *et al*., 2010). Korea has a goat population of about 562,000 (KOSIS, 2005), which are mainly raised for meat and natural health supplements.

Gastrointestinal (GI) parasitic infection is a serious threat to small ruminant production systems. Single or mixed infections with *Eimeria* and GI nematodes had been reported to constrain goat production worldwide (Sharma *et al*., 2009). It causes considerable economic loss to the goat industry in terms of mortality, decreased productivity, stunted growth, loss of body weight and treatment cost (Gwaze *et al*., 2009; Akhter *et al*., 2011; Hassan *et al*., 2011). The severity of the GI parasitic infection in goats could be due to the vulnerability of goats to internal parasites, which might be from their poor immunity compared to other species of livestock.

The prevalence rate of parasitic infections may vary and clinical diseases may or may not occur due to various environmental factors in different areas (Sharma *et al*., 2009). A high prevalence of GI nematodes and coccidial oocysts were reported in countries with tropical and temperate regions such as India, Bangladesh, South Africa, Sri Lanka, Italy and Mongolia with the prevalence rate ranging from 20–96% (Faizal and Rajapakse, 2001; Sharkhuu, 2001; Gwaze *et al*., 2009; Sharma *et al*., 2009; Di Cerbo *et al*., 2010; Hassan *et al*., 2011). However, such reports of GI parasites in Korean native goats (*Capra hircus aegagrus*) are scarce. Hence, the aim of the present study was to determine the prevalence of single and concurrent infections of GI parasites and the intensity of infections in Korean native goats.

MATERIALS AND METHODS

The study was carried out in central and southern regions of Korea. The entire study area lies between 34˚20' and 37˚11' North latitude and between 126˚07' and 129˚19' East longitudes with a mean annual temperature of 13.6˚C and mean annual precipitation of 1,500 mm. The study was conducted on 241 goats from 57 herds. Age, sampling season and geographic region were also recorded. Fecal samples were collected during the period of November 2009 to August 2011. Fresh fecal samples were obtained directly from the rectum. Qualitative and quantitative parasitological examinations were performed by fecal floatation technique following standard procedures that used a saturated solution of sodium nitrate for the presence of parasite eggs/oocysts (Zajac and Conboy, 2006). The parasite eggs/oocysts were examined and identified by microscopy based on the morphology and size of the eggs/oocysts up to the

parasite genus level. For quantitative analysis, the modified McMaster technique was used to estimate eggs/oocysts per gram of feces (EPG/OPG). Chi-square test was used to analyze the significant difference among the proportions, where a *P*-value <0.05 was regarded as significant. An odds ratio analysis with 95% confidence interval was computed from the prevalence. The analytical software package GraphPad Prism version 5.04 (GraphPad Software Inc., USA) was used for the statistical analysis.

RESULTS AND DISCUSSION

The overall prevalence of infection with GI parasites was 69.3%. Of this, 67.6% was infected by coccidia, 22.4% by nematodes and 2.1% by cestodes. *Eimeria* spp. was the only coccidian parasites identified in this study. The most prevalent GI nematode observed in this study was the strongyle group (20.7%) compared to *Strongyloides* (7.1%) and *Trichuris* spp. (1.7%) (Table 1). From cestodes, only *Moniezia* spp. was detected. The prevalence of *Eimeria* was significantly higher (*P*<0.05) than that of other GI parasites. Additionally, 89.5% of the herds were infected by GI parasites (Table 1).

The intensity of infection measured by fecal egg/oocyst count varied from light to heavy infection (Table 2). In a high percentage of animals, light parasitic infections were found while heavy infections were less common. Heaviest parasitic load was observed for *Strongyloides* (23.5%) although its prevalence was lower compared to other GI parasites. Single and mixed parasitic infections were also examined in this study in which single infections by *Eimeria* (65.9%) were higher than the mixed (double and triple) infections (31.7%). Cases of co-infection with coccidia and nematodes (29.3%) were the highest among the mixed infections observed in this study. The results of single and mixed infections are summarized in Table 3.

Risk factor analysis for goats affected by GI parasites revealed that adult goats (≥2 yr) had higher odds of being infected by *Eimeria*, strongyles and *Trichuris* while younger goats (<2 yr) had higher odds of being infected by *Moniezia*. The odds of being infected by *Strongloides* were not determined for age due to zero prevalence in young goats. The odds of goats being infected by *Eimeria*, strongyles and *Strongyloides* were higher for goats infected in the warm-rainy season than in the cold-dry season. Similarly, the odds of goats being infected by all GI parasites observed in the current study were higher for goats in the southern region than in the central region (Table 4).

A relatively lower prevalence (69.3%) of GI parasites was observed in the current study compared to the prevalence (98.4%) reported in a similar investigation of internal parasites in Korean native goats grazing on the western mountains and southern islands of Gyeongnam province (Suh *et al*., 1987). Similarly, less prevalence was observed for *Eimeria* spp. in the current study compared to previous reports in other countries (Faizal and Rajapakse, 2001; Sharma *et al*., 2009). On the other hand, comparable findings for the prevalence of *Eimeria* were reported in Jordan (Abo-Shehada and Abo-Farieha, 2003). A similar comparison in other studies for cases of strongyles, *Strongloides*, *Trichuris* and *Moniezia* were found to have a lower prevalence (Pathak and Pal, 2008; Gadahi *et al*., 2009; Di Cerbo *et al*., 2010). However, a similar result was observed for *Moniezia* in a study conducted in Mongolia (Sharkhuu, 2001).

The observed differences in prevalence between the present and other previous studies could be mainly due to variations in geographical and climatic conditions. Among other factors that may further contribute to the discrepancies observed could be the breeds of the host, grazing habits and different husbandry practices (Ouattara and Dorchies, 2001). The physiological statuses of the animals like parturition, lactation stage and pasture contamination can also influence the prevalence of GI parasites in different areas (Armour, 1980). The high prevalence of GI parasites at the herd level (89.5%) in this study indicates that infection of GI parasites is a widespread problem in Korean native goats.

Although a light degree of infection was observed in the current study for all the GI parasites, EPG/OPG with <1000 has been reported to negatively affect the weight gain of goats (Faizal and Rajapakse, 2001). Hence, the magnitude of the degree of infection observed in the current study might reflect the possibilities that the GI parasitic load could result in debilitating the animals' condition or in the worst case scenario, result in mortality of young/stressed goats (Akhter *et al*., 2011).

In this study, age, season and region were identified as risk factors for GI parasitic infections. The odds of being infected by most GI parasites were higher in adult goats than in young goats. Although the odds ratio was not similar, a higher prevalence in adult goats was observed in reports from Ethiopia (Dinka *et al*., 2010). This could be due to the higher sample size of the adult goats in the herds, which were investigated in current study. However, the present findings do not agree with the previous studies (Gwaze *et al*., 2009) in that younger goats were more susceptible to GI parasitic infection than adults.

Higher parasitic infections were detected during the warm-rainy season than in the dry-cold season. This might be related to the availability of browse and a longer browsing time in the warm-rainy season by the host (Pathak and Pal, 2008) and sufficient moisture and temperature, which create favorable conditions allowing for the larval development, oocyst sporulation and survival of the infective stage larva (Faizal and Rajapakse, 2001). Furthermore, the increased browsing

time increases the chance of contact between the host and parasites (Ouattara and Dorchies, 2001).

The results in the present study showed that coccidia, nematodes and cestodes as single or mixed infections are prevalent in Korean native goats. The parasitic load might result in production losses by debilitating the animals' condition or through mortality in young/stressed goats leading to high economic loss. The results also suggest a need for well-coordinated, permanent sanitary monitoring of goat farms to reduce the prevalence and intensity of parasitic load.

Table 1: Overall prevalence of gastrointestinal parasites in Korean native goats

Parasite		Animal (n=241)		Herd (n=57)	
		No. (%) of positive	95% CI*	No. (%) of positive	95% CI*
Coccidia	*Eimeria* spp.	163 (67.6)**	61.5–73.2	51 (89.5)	78.8–95.0
Nematodes	Strongyles	50 (20.7)	16.1–26.3	23 (40.4)	28.6–53.4
	Strongyloides spp.	17 (7.1)	4.5–11.0	9 (15.8)	8.6–27.4
	Trichuris spp.	4 (1.7)	0.6–4.2	4 (7.0)	2.9–16.7
	Total	54 (22.4)	17.6–28.1	26 (45.6)	33.3–58.4
Cestodes	*Moniezia* spp.	5 (2.1)	0.9–4.8	4 (7.0)	2.9–16.7
Total		167 (69.3)	63.2–74.8	51 (89.5)	78.8–95.0

*CI, confidence interval. **$P < 0.05$, significantly different.

Table 2: Degree of infection by gastrointestinal parasites in 241 Korean native goats

Parasite	No. of infected animals	Degree of infection* (%)		
		Light	Moderate	Heavy
Eimeria spp.	163	77 (47.2)	67 (41.1)	19 (11.7)
Strongyles	50	29 (58.0)	14 (28.0)	7 (14.0)
Strongyloides spp.	17	7 (41.2)	6 (35.3)	4 (23.5)
Trichuris spp.	4	4 (100)	0 (0)	0 (0)
Moniezia spp.	5	3 (60)	2 (40)	0 (0)

*determined by evaluation of eggs/oocysts per gram of feces (EPG/OPG): light infection, OPG/EPG < 1,000; moderate infection, 1,000 ≤ OPG/EPG < 10,000; heavy infection, OPG/EPG ≥ 10,000.

Table 3: Prevalence of single and mixed infections of gastrointestinal parasites in Korean native goats

Infection	Parasite*	No. (%#) of positive	95% CI§
Single	Coc	110 (65.9)	58.4–72.6
	Nem	3 (1.8)	0.6–5.1
	Ces	1 (0.6)	0.1–3.2
Double	Coc + Nem	49 (29.3)	22.9–36.7
	Coc + Ces	2 (1.2)	0.3–4.2
	Nem + Cest	0 (0)	–
Triple	Coc + Nem + Ces	2 (1.2)	0.3–4.2

*Coc, Coccidia; Nem, Nematodes; Ces, Cestodes. #Percentage was calculated from the positive samples (n=167).
§CI, confidence interval.

Table 4: **Odds ratio for gastrointestinal parasites in relation to season, region and age**

Variable	Odds ratio of infections by gastrointestinal parasites				
	Eimeria	**Strongyles**	***Strongyloides***	***Trichuris***	***Moniezia***
Age Adult vs Young	9.60 (4.89–18.82)	10.13 (3.01–34.15)	ND*	1.06 (0.09–11.93)	0.13 (0.01–1.15)
Season Cold vs Warm	0.32 (0.15–64)	0.18 (0.04–0.77)	0.70 (0.15–3.18)	17.31 (1.75–171.23)	23.76 (2.60–219.10)
Region Central vs Southern	0.25 (0.14–0.44)	0.75 (0.40–1.42)	0.08 (0.01–0.60)	0.46 (0.05–4.53)	0.34 (0.04–3.14)

*ND, not determined.

Acknowledgments: This work was supported by a grant from Animal, Plant and Fisheries Quarantine and Inspection Agency of Korea (B-AD21-2010-11-03).

REFERENCES

Abo-Shehada, M. N. and H. A. Abo-Farieha (2003). Prevalence of *Eimeria* species among goats in northern Jordan. Small Rumin.Res. 49:109–113.

Akhter, N., A. G. Arijo, M. S. Phulan, I. Zafar and K. B. Mirbahar (2011). Prevalence of gastro-intestinal nematodes in goats in Hyderabad and Adjoining Areas. Pakistan Vet. J. 31:287-290.

Armour, J. (1980). The epidemiology of helminth disease in farm animals. Vet. Parasitol. 6:7–46.

Di Cerbo, A. R., M. T. Manfredi, S. Zanzani and K. Stradiotto (2010). Gastrointestinal infection in goat farm in Lombardy (Northern Italy): Analysis on community and spatial distribution of parasites. Small Rumin. Res. 88:102–112.

Dinka, H., W. Tigre, M. Wagari and F. Regassa (2010). Preliminary study on major health problems of the newly introduced Boer goat breed in Ethiopia. World Appl. Sci. J. 11:803–807.

Faizal, A.C.M. and R. P. V. J. Rajapakse (2001). Prevalence of coccidian and gastrointestinal nematode infection in cross breed goats in the dry areas of Sri Lanka. Small Rumin. Res. 40:233–238.

Gadahi, J. A., M. J. Arshed, Q. Ali, S. B. Javaid and S. I. Shah (2009). Prevalence of gastrointestinal parasites of sheep and goat in and around Rawalpindi and Islamabad, Pakistan. Vet. World. 2:51–53.

Gwaze, F. R., M. Chimonoyo and K. Dzama (2009). Prevalence and loads of gastrointestinal parasites of goats in the communal areas of the Eastern Cape province of South Africa. Small Rumin. Res. 84:132–134.

Hassan, M. M., M. A. Hoque, S. K. M. A. Islam, S. A. Khan, K. Roy and Q. Banu. (2011). A prevalence of parasites in black bengal goats in Chittagong, Bangladesh. Int. J. Livest. Prod. 2:40–44.

KOSIS. (2005). Korean Statistical Information System. http://kosis.kr/common/meta_onedepth.jsp? vwcd= MT_ CTITLE & listid=MT_CTITLE_m

Ouattara, L. and P. Dorchies (2001). Gastro-intestinal helminths of sheep and goats in subhumid and sahelian areas of Burkina Faso. Rev. Med. Vet. 152:165–170.

Pathak, A. K. and S. Pal (2008). Seasonal prevalence of gastrointestinal parasites in goats from Durg district of Chhattisgarh. Vet. World. 1:136–137.

Sharkhuu, T. (2001). Helminths of goats in Mongolia. Vet. Parasitol. 101:161–169.

Sharma, D. K., N. Agrawal, A. Mandal, P. Nigam and S. Bhushan (2009). Coccidia and gastrointestinal nematode infections in semi-intensively managed Jakhrana goats of semi-arid region of India. Trop. Subtrop. Agroecosystem. 11:135–139.

Suh, M. D., S. D. Kwak, S. G. Yeo and J. S. Kim (1987). A survey on the prevalence of internal-parasites in Korean native black goats of Gyeongnam area. J. Inst. Develop. Livestock Prod. 14:63–70.

Zajac, A. M. and G. A. Conboy (2006). Veterinary Clinical Parasitoloy. Blackwell publishing, New York.