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NOTA CORTA [SHORT NOTE]

COCCIDIA AND GASTROINTESTINAL NEMATODE INFECTIONS IN SEMI- INTENSIVELY MANAGED JAKHRANA GOATS OF SEMI- ARID REGION OF INDIA

[INFECCIONES CON COCCIDIAS Y NEMATODOS GASTROINTESTINALES EN CABRAS JAKHRANA EN SISTEMAS SEMINTENSIVOS DE LA REGIÓN SEMIÁRIDA DE LA INDIA]

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SUMMARY

The coccidia and gastrointestinal nematode infections were monitored in 273 Jakhrana goats maintained at the Central Institute for Research on Goats, Makhdoom, Mathura, India to study the prevalence rate and to determine the effects of various environmental factors on intensity of infection. The animals were reared under semi intensive feeding system. The fecal samples were collected and examined for a period of 2 years. The data on faecal egg/oocystes count (FEC/FOC) were analyzed by least-squares analysis after suitable log transformation (Log_e FEC/FOC + 100). The prevalence and intensity of infection were determined in animals according to their ages (0-3 month, >3-6 month, >6-12 month and >1 year), sex, year and season of sample collection. The predominant coccidia oocysts were of *Eimeria ninakohlyakimovae*, and the major gastrointestinal nematode species identified was *Haemonchus contortus* The overall prevalence rates for coccidial and gastrointestinal nematode infections manifested as singles or concurrent states were 42.86 and 39.19%, respectively. The coccidial oocysts was highest (92.31%) in >3-6 month aged kids followed by >6-12 month (75.51%) and >1 year of age (40.86%). Females had higher occurrence (49.86%) than males (45.20%) for coccidial infection. The prevalence rate of oocysts was highest in rainy season (54.55%) followed by summer (46.0%) and winter (37.0%) season. The gastrointestinal nematode prevalence was 33.33, 0.0, 57.14 and 41.00 percent in 0-3 month, >3-6 month, >6-12month and >1 year aged animals, respectively. Seasonal prevalence of gastrointestinal nematode infection was 28.74, 67.27 and 13.98 percent during summer, rainy and winter season, respectively. Concurrent infection with *Eimeria* and gastrointestinal nematodes were found in 17.22% of animals and restricted to animals of >6-12 month of age and above. The overall least-squares means for GOPG (oocysts/g of faeces) and GFEC (eggs/g of faeces) were 268.71 and 74.16, respectively. The effect of age, year and season of sampling had significant ($P<0.01$) effect on nematode infection, however, only the effect of age was significant ($P<0.01$) for coccidia infection.

Key Words: Coccidia, Gastrointestinal nematodes, Goats, Prevalence

INTRODUCTION

Coccidia and gastrointestinal nematode infections in goats are the most common and of paramount importance worldwide. They are major constraints in small ruminant production systems. Both of these infections manifested as single or mixed infections adversely influence the goat production in temperate and tropical climates (Rahman, 1994, Borgsteede and Dercksen, 1996; Faizal and Rajapakse, 2001). Coccidia infections, specially of Eimerian species, are well recognized in goats in India (Vihan et al., 1988; Sharma and Singh, 1997; Radha et al., 2004) and lead to production losses by reducing weight gain or through mortality (Sharma and Singh, 1997) in kids. Studies on gastrointestinal nematode infections have been made in various goat breeds (Chauhan et al., 2003). Most of these studies are on occurrence, epidemiological, treatment and physiopathological aspects in single infection. Concurrent *Eimeria* and gastrointestinal nematode infections in goats raised in the semi-arid region are common in the country (Sharma et al., 1997). The economic importance of concurrent infections has been demonstrated experimentally (Rahman, 1994; Sharma et al., 2000) and naturally in field (Faizal et al., 1998). The prevalence rate of infections may vary and clinical disease may or may not appear because various environmental factors play a vital role in the parasitic infections in natural and captive conditions. Thus, the assessment of *Eimeria* and gastrointestinal nematode infections and the combined effect of these infections

in goats managed in this semi-arid region is a prerequisite for the development of appropriate control strategies of parasitic infections. There is very little information available on the prevalence of concurrent *Eimeria* and gastrointestinal nematode infections of Jakhrana goats in this semi-arid region. Hence, the present study was carried out to determine the status of these infections as single or mixed and the effects of various environmental factors on intensity of infection in Jakhrana goats managed in semi intensive feeding system.

MATERIALS AND METHODS

Location of the study. The study was conducted at the Central Institute for Research on Goats, Makhdoom, Farah, Mathura, India. The Institute is situated in semi-arid zone of western Uttar Pradesh (27.10º N, 78.02º E) about 169.2 Meters (MSL). The land is undulating with a difference of about 5-6m between the lower and higher levels, forming part of the Jamuna alluvial. The soil is sandy and vegetation is composed of natural pasture and bush. The climate is almost semi-arid. The variation in temperature ranges from 28ºC to over 45ºC in summer (April to July) and 6 to 24ºC in winter (November–February). Winter is generally dry and cold. The annual rainfall is about 750mm and scattered during the months from June to September.

Animals and their management. The Jakhrana goat, a fairly large-sized breed, is one of the most important dairy goat breeds in India and found in the semi-arid tract of the Rajasthan province of the country. The habitat of this breed is a small hamlet in the Aravali hill ranges, particularly in Jakhrana village of Behror Tehsil region of the Alwar district in Rajasthan. In general, animals were housed separately according to their ages, sex, physiological status and health status. The animals were generally maintained under semi-intensive feeding management with 6 h of grazing and stall feeding with seasonally available green fodders, supplemented with concentrate mixtures. Weaning of kids is generally practiced at 3 months of age. The kids were stall fed up to 3 months of age and were provided some concentrate mixture as mesh and after that they were allowed to graze for a very short period of time. All the animals including kids were dewormed in post monsoon season (October). Anti-coccidial treatment was given at the age of 2 months.

Experimental design and data recording. A total of 273 Jakhrana animals aged between 3 to 18 months were considered for this study. Faecal samples were collected from animals once over a period of 2 years (2006 and 2007) and samples were examined for the presence of nematode eggs and coccidia oocystes. From every faecal sample nematode eggs per gram of faeces (EPG) and *Eimeria* Spp. oocysts per gram of faeces (OPG) were estimated by the standard McMaster techniques. Faecal samples with eggs were put for culture and larvae hatched out were identified. For *Eimeria* Spp. culture and speciation, the samples were put in to a thin layer of 2% potassium dichromate solution in a petridish for 10 days at 26-28°C (MAFF, 1987) and sporulated oocystes were examined for morphological and micrometric characters.

Statistical analyses. The analysis of FEC and OPG data was carried out by least-squares analysis of variance (Harvey, 1990) after transformation of raw data to $\log_e$(FEC+100). The faecal nematode egg and *Eimeria* Spp. oocyst counts were log-transformed in order to stabilize variance. The results were back-transformed by taking antilogarithm of least-squares means (LSM) and presented as Geometric means (GFEC). The data were classified according to the ages of animals, viz., 0-3 month, >3-6 month, >6-12 month and >1 years of age. The following model was used: $Y_{ijkmn} = \mu + Y_i + S_j + T_k + A_m + e_{ijkmn,}$ where, Y_{ijklmn} is the record for the n^{th} animal, S_i is the fixed effect of the i^{th} year of sampling (i =1,2), S_j is the fixed effect of the j^{th} season of sampling (j=1,2), T_k is the effect of the k^{th} sex of animals (k=1,2), A_m is the effect of the m^{th} age groups of animals (m=1,2,3, 4) and e_{ijkmn} is the residual error element with standard assumptions. The comparison of different sub-groups mean was made by Duncan's Multiple Range Test (DMRT) as described by Kramer (1957).

RESULTS AND DISCUSION

Faecal culture. The animals were exposed to natural infection of mixed populations of coccidial oocysts as well as economically important nematode genera with a predominace of *Haemonchus contortus* (95.6%), together with *Oesophagostomum* spp., *Strongyloides* spp. and *Trichuris* spp in sporodic cases. The coccidia oocystes were identified as *Eimeria christenseni (52.9%), E. jochejevi (50.0%), E. ninakohlyakimovae (70.5%),* and *E. arloingi (26.4%)*. Previous results (Sharma et al. 1997; Arora et al., 2003) reported that in this area, the strongyle population is dominated by *Haemonchus contortus*. Predominant *H. contortus* infection encountered in the present study was similar as reported by Faizal and Rajapakse, 2001, in crossbred goats. Other nematodes as observed through coproculture and thereafter morphological examination of hatched larvae, were similar as reported by some other workers (Faizal and Rajapkse, 2001; Agrawal et al. 2004).

Prevalence of infections. The overall prevalence rates for coccidial and gastrointestinal nematode infections were 42.86% (117/273) and 39.19% (107/273), respectively in the study flock. The highest coccidial oocysts was observed in kids (92.31%) of >3-6 months of age followed by >6-12 month (75.51%) and >1 year of age (40.86%). Sex-wise prevalence rate of coccidial oocysts indicated the females (49.86%) had higher oocysts load in their faeces than males (45.20%). The prevalence rate of oocysts was highest in rainy season (54.55%) followed by summer (46.0%) and winter (37.0%) season. The gastrointestinal nematode prevalence was 33.33, 0.0, 57.14 and 41.00 percent in 0-3 month, >3-6 month, >6-12month and >1 year aged animals, respectively. Seasonal prevalence of gastrointestinal nematode infection was 28.74, 67.27 and 13.98 percent during summer, rainy and winter season, respectively. Concurrent infection with *Eimeria* and gastrointestinal nematodes was 17.22% (47/273) in this study. Age wise prevalence of concurrent infection was restricted to >6-12 month (24.8%) and >1 year (19.0%) of age. The overall prevalence rate of concurrent infections in goats in the present study was lower than the prevalence of 78% reported by Faizal and Rajapakse (2001). Concurrent infection in present study was, however, restricted to >6-12 month goats. The finding was in contrast to Faizal and Rajapakse (2001) who reported the prevalence of concurrent infection in all the age groups.

Effect of environmental factors on intensity of infections. Least-squares means for the various environmental effects on coccidial oocysts and gastrointestinal egg counts in Jakhrana goats are presented in Table- 1.

Table-1. Least-squares means (with back-transformed means shown in brackets) for log-transformed oocysts (LOPG), Geometric mean of OPG, log-transformed FEC (LFEC) and Geometric mean of FEC (GFEC) by various environmental effects in Jakhrana goats

Parameters	No. of obs.	LOPG (GOPG)	LFEC (GFEC)
Overall mean	273	5.91±0.15 (268.71)	5.16±0.11 (74.16)
Year of sampling			
2006	205	5.78± 0.15 (223.76)	5.37 ± 0.11^{a} (114.86)
2007	68	6.03± 0.21 (315.72)	4.95 ± 0.16^{b} (41.17)
Season of sampling			
Summer	87	5.75±0.17 (214.19)	5.06 ± 0.13^{b} (57.59)
Rainy	110	6.16±0.21 (373.43)	5.96 ± 0.16^{c} (287.61)
Winter	76	5.80±0.21 (230.30)	4.46 ± 0.16^{a} (0.0)
Sex of animal			
Male	96	5.96±0.18 (287.61)	5.18± 0.14 (77.68)
Female	177	5.86±0.16 (250.72)	5.18± 0.12 (70.68)
Age groups			
0-3M	12	4.81 ± 0.41^{c} (22.73)	5.49 ± 0.32^{b} (142.26)
>3-6M	26	7.49 ± 0.30^{a} (1690.1)	4.37 ± 0.23^{a} (0.0)
>6-12M	49	5.66 ± 0.22^{bc} (187.95)	5.26 ± 0.17^{b} (92.48)
>12M	186	5.67 ± 0.16^{b} (190.03)	5.50 ± 0.09^{b} (144.69)

Means with different superscripts differed significantly (P<0.05) from each other

The overall mean oocyst count (no. of oocyst/g of faeces)was 268.71. Significant (P<0.01) variations in oocyst count exist among the different age groups of animals. Highest (1690.1) number of oocysts was observed in kids having age group of >3-6 months, whereas minimum (22.73) oocysts load was found in kids of pre-weaning age (0-3 months of age). The effects of season and year of sampling and sex of animals on faecal oocyst count were non-siginficant (Table 1). The study revealed that the year and season of sampling and age groups of animals had significant (P<0.01) effect on FEC count of animals. The highest

(287.61) GFEC was noticed in rainy season followed by summer (57.59) and winter (0.0) season. Age-wise GFEC of animals indicated the presence of higher degree of infection in pre-weaned (0-3 months of age) and adult kids (>1year of age). Higher degree of infection in adult in present study was justified and corresponds to author's previous report (Sharma and Singh, 1997). The higher degree of infection in 0-3 M age and further zero incidence in 3-6 M group could not be explained and might have been due to lesser number of observations in this groups or due to different age grouping in present study. Significant seasonal variations in degree of infection (EPG) were also reported by earlier workers (Gupta et al. 1987; Muraleedharan, 2005) in goats. The significant seasonal variations in FEC in our study might be due to variations in temperature, humidity and rainfall, which significantly influence the availability, survival and rate of development of infective larvae on pasture (Smith and Sherman 1999; Faizal and Rajapakse, 2001).

CONCLUSION

The present study indicated that both Eimeria and gastrointestinal infections as single or mixed infections are prevalent in this region for this breed. The prevalence of concurrent infection with *Eimeria* and gastrointestinal nematodes together was low and only restricted to animals of >6-12 months of age and above. The intensity of coccidial infections decreased with the advancement of age whereas, the prevalence was higher in animals after 6 months of age for nematode infection. Different environmental effects viz. year and season of sampling, age groups of animals significantly influenced the intensity of nematode infection but only age of animals had significant effect on coccidial infection.

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