Onderstepoort Journal of Veterinary Research, 68:101–104 (2001)

The impact of traditional management on seasonal internal parasite burdens and productivity of indigenous Tswana goats in southern Botswana

S.J. NSOSO*, J.B. MACHETE, M. MOLATOLE, R.T. NDEBELE, N.N. LEBANI, R.G. CHABO, A.M. KALAKE, L. JACYNA, B.W. SEGADIMO and O.M. MINE

Botswana College of Agriculture, Private Bag 0027, Gaborone, Botswana

ABSTRACT

NSOSO, S.J., MACHETE, J.B., MOLATOLE, M., NDEBELE, R.T., LEBANI, N.N., CHABO, R.G., KALAKE, A.M., JACYNA, L., SEGADIMO, B.W. & MINE, O.M. 2001. The impact of traditional management on seasonal internal parasite burdens and productivity of indigenous Tswana goats in southern Botswana. *Onderstepoort Journal of Veterinary Research*, 68:101–104

Data collected monthly over a period of two years were live weight, packed cell volume (PCV), nematode faecal egg counts (FECs) and coccidial oocyst counts from faecal analyses for 100 mixed age (3–7 years) indigenous Tswana does. The aims of this experiment were to determine seasonal FECs and coccidial oocysts in these goats and quantify the relationships of these burdens to liveweight and PCV. FECs significantly ($P < 0.05$) varied with season, with the warmer seasons viz spring, summer and autumn having higher log (x + 1) parasite burdens than the cooler winter, while seasonal trends for coccidial oocysts were not obvious. PCV was also significantly ($P < 0.05$) lower in the warmer seasons than winter. FECs and coccidial oocysts in all seasons were less than the mean log (x + 1) of 3.3 inferred to reduce production in small stock. Correlation coefficients were strongly negative: –0.95 for FECs and liveweight and –0.84 for FECS and PCV, indicating that these worms had a negative impact on productivity. A further study should be conducted to quantify the effects of controlling these parasites during the warm seasons on productivity.

Keywords: Coccidia, live weight, nematodes, packed cell volume, Tswana goat

INTRODUCTION

In Botswana, goats contribute to household income, food security and socio-cultural activities. More than 90 % of these goats are kept under the traditional management system (Botswana Government 1993), which, as in most developing countries, is characterized by poor husbandry and low veterinary care, which leads to low productivity. The performance data of goats raised under such a management system based on properly designed holistic research protocols is either incomplete or not available. On parasite infestations *per se* there is some information on their negative impact on the productivity of small ruminants (Botswana Government 1970–1990, 1990–1996) but this is not at an acceptable level concerning particularly their epidemiology and variations within different genetic populations. For these reasons appropriate systems for internal parasite control cannot be designed in most instances. The objectives of this study were to:

- Characterize seasonal variations in the burdens of some internal parasites in Tswana goats maintained under the traditional management system
- Quantify the impact of these parasite burdens on liveweight and packed cell volume for the goats.

* Author to whom correspondence is to be directed
E-mail: SNSOSO@TEMO.BCA.BW

Accepted for publication 9 January 2001—Editor

MATERIALS AND METHODS

Animals

A base population of 100 mixed-age (3–7 years) Tswana does was established at the Botswana College of Agriculture in late 1996 from goats purchased from all over southern Botswana in the early 1990s. The goats were classified as of the Tswana breed on their typical phenotypic appearance and were maintained under animal husbandry conditions typical of those of traditional management in Botswana, i.e they were allowed to browse and graze freely but, apart from commercial mineral blocks had little or no feed supplementation. No control measures for external and internal parasites were applied unless they were considered to be warranted when an animal or animals manifested clinical signs induced by such infestations. During the day the goats were let out on to natural pasture from 08:00–17:00. They were kraaled overnight. The natural pasture is categorised as hard-veld. Water was provided in the mornings before the goats went out to graze, at 14:00 and at kraaling time.

Bucks were introduced to the does for mating in late autumn of both years of the experiment. The does kidded during early spring each year.

The does were weighed and blood and faecal samples were collected every month for a period of 2 years from January 1997 to December 1998.

Packed cell volume (PCV) analysis

Blood from each goat was drawn from the jugular vein into 10 ml vacutainers containing EDTA (Becton Dickinson Vacutainer System Europe, Meylan, Cedex-France, England). After drawing, each blood sample was mixed by inverting the tube several times, and a capillary tube was filled with blood from each sample and thereafter and sealed with Crista Seal (Hawskley & Sons Ltd, Sussex, UK). The capillary tubes were centrifuged at maximum speed for 5 min in a haematocrit centrifuge (Damon/IEC Division, MA, U.S.A), and the PCV was determined using a Hawskley Micro-Haematocrit Reader (Hawskley & Sons Ltd, Sussex, UK).

Faecal collection and analysis

Faecal samples were taken from the rectum and placed in a clean sampling bottle. In the laboratory, 5 g of faeces from each sample were weighed into a clean sampling bottle and then crushed with a spoon. Forty-five glass beads were placed in the sample to further facilitate crushing. Twenty-eight millilitres of water were added to the bottle, which was then tightly closed and shaken well. The mixture was sieved through a coarse sieve into a clean beaker. The sieved material was thoroughly mixed and thereafter transferred to a centrifuge tube and then centrifuged for 3 min at 1 500 revolutions per min. The supernatant fluid was decanted and saturated aqueous sodium chloride solution was added to fill the tube to the former level of the decanted supernatant. Using a pipette a McMaster slide was filled and examined for the presence of nematode eggs and coccidial oocysts under a light microscope using a 10x objective lens. These were counted according to the modified McMaster method. Nematode eggs and coccidial oocysts occurring on or within the engraved lines on both halves of the slide were counted and the counts multiplied by 50 in order to obtain the numbers of eggs and oocysts per gram of faeces per goat.

STATISTICAL ANALYSIS

The data were analyzed using general linear model. Nematode faecal egg and coccidial oocyst counts were log transformed (log x + 1) because the original data were not normally distributed. The fixed effect fitted was season. Seasons were defined as follows: summer (November, December and January), autumn (February, March and April), winter (May, June and July) and spring (August, September and October). Least squares means were separated using a *t*-test in the Statistical Analysis System (SAS Institute 1988). Correlations of least squares means were calculated to relate parameters of interest. The results reported are based on least squares means.

RESULTS AND DISCUSSION

The helminth eggs obtained by the faecal analyses were identified as being those of nematode species and coccidial oocysts were also observed but not identified to a species level. Such nematode eggs and coccidial oocysts have been determined in faecal samples of Tswana goats by previous researchers (Botswana Government 1990–1996) who did not, however, report on the impact that these internal parasites had on the goats production nor on the seasonal variations in the prevalence of these parasites. Knowledge of these facts is important in order to design holistic management plans for profitable goat enterprises.

The nematode faecal egg counts (FECs) showed significant ($P < 0.05$) seasonal variation, with the warmer seasons, that is spring, summer and autumn having higher faecal egg counts than the cooler winter, while seasonal trends for coccidial oocysts were not obvious (Table 1). The higher incidences of FECs in the warmer seasons than in the cooler season is attributed to more conducive environmental conditions during the warmer seasons, i.e higher tempera-

TABLE 1 Least squares means (± sem) for parasite burdens, liveweight and packed cell volume for Tswana does raised under traditional management

Season	Faecal nematode egg counts*	Coccidial oocysts*	Liveweight (kg)	Packed cell volume (%)
Summer	3.08 ± 0.03[a]	2.47 ± 0.04[a]	28.00 ± 0.37[a]	25.19 ± 0.25[a]
Autumn	2.56 ± 0.03[b]	2.98 ± 0.03[b]	29.78 ± 0.36[b]	28.56 ± 0.21[b]
Winter	2.41 ± 0.03[c]	2.90 ± 0.02[b]	31.70 ± 0.32[c]	29.58 ± 0.19[c]
Spring	2.87 ± 0.02[d]	2.72 ± 0.03[c]	28.98 ± 0.34[ab]	23.08 ± 0.20[d]

* Characterized as log (x + 1)
[abcd] Values bearing different superscript letters within column are significantly different ($P < 0.05$)

TABLE 2 Correlations between internal parasite burdens, liveweight and packed cell volume for Tswana does raised under traditional management

	Faecal nematode egg counts*	Coccidial oocysts*	Liveweight	Packed cell volume
Faecal nematode egg counts[†]	–	–0.92	–0.95	–0.84
Coccidial oocysts*	–	–	+0.77	+0.69
Liveweight	–	–	–	+0.78

* Characterized as log (x + 1)

tures and moisture (Kibirige-Sebunya & Diteko 1994). Therefore, farmers should be advised to drench their animals with a suitable antihelmintic during the warmer seasons and also at the end of winter to prevent a sudden build-up in numbers of these parasites when conditions become conducive for their multiplication.

The liveweights of the goats were significantly higher ($P < 0.05$) in the winters than those in the other seasons, which were generally similar (Table 1). The higher liveweights of the period under review in winter were due to the majority of the does being pregnant. There is a tendency for animals to gain weight during pregnancy. This is due to what is commonly referred to as pregnancy anabolism. During pregnancy anabolism there are more body reserves accumulated than are broken down, resulting in weight gain. Pregnancy anabolism is a physiological process which increases the birth weight of the offspring and induces increased milk production of the dam in order to promote a faster growth rate in the offspring (McDonald, Edwards & Greenhalgh 1992).

The packed cell volumes were significantly ($P < 0.05$) affected by season. Spring had the lowest PCVs, winter the highest, and the other two seasons intermediate values (Table 1). These trends in PCV have never previously been reported before for Tswana goats. The PCV values reported here are, however, within the values reported in the literature. Jain (1993) reported a PCV range of 22–32 %, which is similar to values of the present study. This indicates that the internal parasites did not have a pronounced negative impact on the goats. This could indicate that this indigenous breed is able to tolerate high worm burdens. Such a hypothesis cannot be evaluated at present but is likely to be compatible with this breed evolving under the harsh environment of Botswana.

FECs were strongly negatively correlated with both liveweight and PCV (Table 2). These correlations indicate that these worms had a negative influence on productivity. More importantly, faecal egg counts in each season were lower than the critical level of 3.3 inferred to reduce production in small stock (Copland 1985). However, worm infestations can have latent deleterious effects on the hosts leading to loss in production. Therefore, in such cases strategic deworming is recommended during the warmer seasons and at the end of winter to prevent sudden multiplication of parasites when environmental conditions become conducive to their development.

Coccidial oocysts had strong positive impacts on productivity indicators (Table 2), which is nonsensical but this could be because the infestation level was below the threshold level that could cause damage to the host animals. There was a strong negative correlation between coccidial oocyts and FECs (Table 2). This probably means that there is competition between coccidial and nematodes in this study. Such a hypothesis cannot be evaluated at present.

CONCLUSIONS

The nematode faecal egg counts in the goats varied significantly with season, with the warmer seasons, viz spring, summer and autumn seasons having higher egg counts than the cooler winter, while no such trends in coccidial oocysts were obvious. Nematode faecal egg counts were strongly negatively correlated with both liveweight and PCV, in-

dicating that these worms had a negative impact on productivity of the animals. A further study should be conducted to quantify the effects of controlling internal parasites on productivity of goats during warmer seasons of the year.

ACKNOWLEDGEMENTS

The authors thank Messrs O. Japi, C. Ramakgala and T. Pitsane for handling the animals. The Botswana College of Agriculture is thanked for providing funds.

REFERENCES

BOTSWANA GOVERNMENT. 1970–1990. *Animal Production and Range Research unit: Twenty years of Animal Production and Range Research in Botswana.* [Gaborone]: Botswana Government.

BOTSWANA GOVERNMENT. 1993. *Botswana Agricultural Census Report.* Gaborone: Botswana. Ministry of Agriculture.

BOTSWANA GOVERNMENT. 1990–1996. *Botswana National Veterinary Laboratory Annual Reports.* Gaborone: Ministry of Agriculture, Department of Animal Health.

COPLAND, J.W. (Ed.) 1985. Goat production and research in the tropics. Proceedings of a workshop held at the University of Queensland, Brisbane, Australia, 6–8 February 1994. *ACIAR Proceedings* (Series no. 7): 7.

JAIN, N.C. 1993. *Essentials of Veterinary Haematology.* Philadelphia, USA: Lea & Febiger.

KIBIRIGE-SEBUNYA, T. & DITEKO, T. 1994. Diseases of small ruminants in Botswana, 1983-1992. Small ruminant research and development in Africa, edited by S.H.B. Lebbie & E. Kagwini. *Proceedings of the Third Biennial Conference of the African Small Ruminant Research Network, Uganda 5–9 Dec. 1994.* Nairobi, Kenya: International Livestock Research Institute: 163–164.

MACDONALD, P., EDWARDS, R.A. & GREENHALGH J.F.D. 1992. *Animal nutrition.* Singapore: Longman Singapore.

SAS INSTITUTE. 1988. *SAS® User's Guide*, 6.03. Cary, NC. USA: SAS Institute Inc.