

Effects of different levels of worm control on meat production of Deccani sheep in shepherds' flocks in Maharashtra, India

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Abstract

Gastrointestinal nematode infection (GIN) is a major constraint to sheep productivity worldwide, particularly in more humid regions. In this experiment, the benefits for sheep meat production from deworming of ewes in shepherds' flocks in a semi-arid (mean annual rainfall 525 mm) area of Maharashtra State, India were assessed. The experiment was conducted over 18 months (July 2000-December 2001), in four shepherds' flocks in Phaltan county. Adult breeding ewes in each flock were divided into three groups. A Control group (n=103) remained untreated, a Drenched group (n=95) was treated with oral albendazole when average faecal worm egg count (FEC) exceeded 500 eggs per gram of faeces (epg) and a Capsule group (n=40) was treated serially with a slow release intra-ruminal albendazole capsule to suppress worm infection totally. All ewes and lambs were individually identified and were weighed, and sampled for FEC monthly.

The traits analysed were number of pregnancies per ewe per year, number of lambs born and weaned per ewe per year and annual weight of lamb produced per ewe. Flock and treatment were fitted as fixed effects and age of ewe at the start of the experiment and days up to first lambing from the start of the experiment were fitted as covariables.

All anthelmintic treatments were fully effective. Overall mean FEC for the three treatments was 1200 epg for Control, 500 epg for Drenched and 0 epg for Capsule groups respectively. Two out of the total of 238 ewes in all flocks died of frank GIN. The primary infecting nematode was *Haemonchus contortus*. The number of drenches required to keep the average FEC of the Drenched group below 500 epg ranged from 2-3 in 2000 and 1-3 in 2001 (between July and November in both years).

Treatment had a significant effect on the annual weight of lamb produced per ewe but not on any of the other traits. The least squares means (\pm s.e.) for the Control, Drenched and Capsule groups were 14.4 \pm 0.7, 15.2 \pm 0.7 and 17.7 \pm 1.0 kg respectively. The difference between the Control and Drenched groups was not significant.

From this work we conclude the following. A) Uncontrolled GIN causes significant sub-clinical production loss (22.2%) in Deccani sheep in semi-arid Maharashtra. B) Tactical control of GIN using an effective but short acting broadspectrum anthelmintic at the conservative intervention level of 500 epg had limited impact in ameliorating this production loss. These results suggest strongly that deworming of ewes two to three times a year, which is the usual practice among shepherds of this area, is unlikely to control worm infection sufficiently to increase profits earned by shepherds from the sale of lambs.

Keywords: Deccani sheep, grazing flocks, lamb production, sheep productivity, worm control.

Introduction

Gastrointestinal nematode infection (GIN), mainly from *Haemonchus contortus*, is perceived to be one of the major constraints to profitable sheep production in India. There are about 3 m Deccani sheep on the semi-arid Deccan plateau in the state of Maharashtra. The climate of Phaltan county, situated at latitude 18 degrees north and longitude 74 degrees east is dry (mean annual rainfall 525 mm) and is conducive to GIN for 4 to 6 months every year. Grazing areas are shared by many flocks and sheep are repeatedly grazed in the same areas until available feed resources are completely finished. This pastoral practice increases greatly the possibility of drenched sheep becoming reinfected from pasture contamination. In Maharashtra State, the use of anthelmintics in sheep used to be negligible 30-50 years ago mainly because of lack of awareness of shepherds and availability of products. However, the practice of using short-acting anthelmintics two or three times a year – typically before and during the rainy season – is now common amongst shepherds. Many shepherds are illiterate and for this reason the doses of dewormers used are not always as required. There is a danger that such inadvertent practices may not provide effective worm control and may hasten the development of anthelmintic resistance.

The experiment reported here was conducted with the objectives to assess sheep production losses due to GIN under traditional sheep management systems and to evaluate the benefits for sheep meat production from deworming of ewes in shepherds' flocks.

Materials and methods

The experiment was conducted over 18 months (July 2000-December 2001), in four shepherds' flocks. Adult breeding ewes in each flock were allocated at random to one of three treatment groups. A Control group (n=103) remained untreated, a Drenched group (n=95) was treated with oral albendazole (5 mg/kg liveweight) when average faecal worm egg count (FEC) exceeded 500 eggs per gram of faeces (epg) and a Capsule group (n=40) was treated serially with a slow release intra-ruminal albendazole capsule to suppress worm infection totally. All ewes and lambs were individually identified and were weighed, and sampled for FEC monthly. None of the lambs were dewormed up to the age of five months since their FEC were negligible (<100 epg). A supervisor visited all flocks once a week to record and eartag lambs born and to record lamb sales and lamb or ewe deaths. Shepherds usually sell male lambs and keep females for replacement. Shepherds participating in the experiment agreed not to sell any adult ewes or administer additional drench treatments for the duration of the experiment. In recognition of this assistance, NARI ensured that all sheep were vaccinated, had access to a veterinarian and were insured.

The traits analysed were number of pregnancies, number of lambs born and weaned per ewe per year and annual weight of lamb produced per ewe. Weaning for male and female lambs was defined as the average age at which male lambs were sold and was calculated for each flock separately. The range of average sale age was 99 to 109 days for the different flocks. The annual weight of lamb produced per ewe was calculated from the addition of, (a) the sale weight of a male lamb; (b) the weight of a female lamb at the average sale age of male lambs and (c) the final weight of lambs younger than sale age at the end of the experiment. All flocks were monitored once a month after the experiment ended and ewes that lambed within 5 months were considered to have become pregnant during the experiment.

A fixed model was fitted with deworming treatment and flock as fixed effects and age of ewe at the start of the experiment and the number of days up to first lambing from the start of the experiment as covariables. The covariable 'days up to first lambing' was fitted because shepherds usually let breeding rams remain with the ewes throughout the year and ewes lamb in all seasons. As a consequence of this, there was a high probability that ewes would be at different stages of pregnancy at the start of the experiment and this may unfairly affect the dependent traits. For ewes

that did not lamb at all during the experiment, total duration of the experiment was taken as the number of days up to first lambing. The data was analysed using Harvey's least squares LSMLMW computer program [1]. The analysis was done with all data from the start to the end of the experiment and also using a subset of this data, excluding all records for the first five months from the start of the experiment. The subset was analysed to restrict records to only those where the deworming treatment would have influenced all stages of ewe reproduction. Results of significance of fixed effects were the same for both sets of data analysed and therefore, means from the entire data set are presented.

Results

All anthelmintic treatments were fully effective. This was verified with a faecal egg count reduction test after every drench treatment in each flock [2]. Overall mean FEC for the three treatments was 1200 epg for Control, 500 epg for Drenched and 0 epg for Capsule groups respectively. Two out of the total of 238 ewes in all flocks died of frank GIN; one from the Control and one from the Drenched group. The primary infecting nematode was *Haemonchus contortus*. The number of drenches required to keep the average FEC of the Drenched group below 500 epg ranged from 2-3 in 2000 and 1-3 in 2001 (between July and November).

The least squares means (LSM) of number of pregnancies, number of lambs born, lambs weaned and weight of lamb produced, per ewe per year, for treatment and flock effects, are presented in Table 1. Deworming treatment had a significant effect ($P=0.032$) on the annual weight of lamb produced per ewe but not on any of the other traits although the LSM of these traits were greater for ewes from the Drenched and Capsule groups. The LSM of annual weight of lamb produced per ewe for the Control, Drenched and Capsule groups were 14.4, 15.2 and 17.7 kg respectively. The difference between the Control and Capsule groups was highly significant ($P=0.009$) while that between the Drenched and Capsule groups was slightly significant ($p=0.049$). There was no significant difference between the Control and Drenched groups.

The flock effect was significant for number of pregnancies per year and annual weight of lamb produced per ewe (Table 1). Flocks 3 and 4 from the canal-irrigated area, produced higher annual weight of lamb per ewe compared to flocks 1 and 2 from the unirrigated area. Age of ewe at the start of the experiment was a significant covariate for the number of lambs born and lambs weaned per year ($P<0.05$) and for annual weight of lamb produced per ewe ($P<0.01$). Days to first lambing from the start of the experiment had a highly significant effect ($P<0.001$) on all the traits analysed. None of the interactions among the fixed effects or between the fixed effects and covariables were significant for any of the traits.

Discussion

The number of lambs weaned per ewe is an important determinant of a shepherd's income since more than 90% of the income from Deccani sheep rearing comes from the sale of lambs. There was no significant effect of the deworming treatment on pregnancies, lambs born or lambs weaned. In contrast, biannual anthelmintic treatments given to traditionally managed Djallonke sheep in the Gambia resulted in an increase in the number of lambs per lambing from 1.11 to 1.19 and the number of lambings per year from 1.04 to 1.22 [3]. The Capsule group ewes in this experiment, which were totally free of GIN, produced significantly higher (3.21 kg or 22.2%) weight of lamb per head than Control ewes which were not treated at all. However, sale prices of lambs are usually based on a visual assessment by buyers and therefore, an increase in lamb weights is likely to be converted into profit only if it is large enough to be readily discernible. It is probable that a 3.2 kg increase would result in a greater price per lamb. However, the use of anthelmintic capsules is neither a practical nor a cost-effective option for shepherds.

This study has shown that tactical control of GIN using an effective but short-acting broadspectrum anthelmintic at the conservative intervention level of 500 epg did not have a significant impact on the annual weight of lamb produced. The ineffectiveness of this treatment is likely to have been the result of a combination of factors such as communal grazing promoting rapid reinfection following treatment, there being average rainfall – as opposed to above average - in both years of the experiment, the seasonal rainfall pattern with a long dry season of 6-8 months during which time reinfection is minimal [4] and the apparent resilience of Deccani sheep to GIN within the range of 1200-500 epg. We conclude that, in this semi-arid area, the usual practice of drenching sheep two to three times a year using short-acting dewormers, recommended by government and private veterinarians and practiced by shepherds, is unlikely to control worm infection sufficiently, during years of average rainfall, to increase profits for shepherds from the sale of lambs and, therefore, requires careful examination.

References

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Table 1. Least squares means (LSM) and standard errors (s.e.) of number of pregnancies, lambs born and weaned and weight of lamb produced, per ewe per year, for treatment and flock effects.

Effect fitted	n	Pregnancies		Lambs born		Lambs weaned		Wt. of lamb (kg)	
		LSM	s.e.	LSM	s.e.	LSM	s.e.	LSM	s.e.
all traits measured per ewe per year									
Treatment									
Significance		P = 0.84		P = 0.52		P = 0.62		P = 0.032	
Control	103	1.22	0.04	1.12	0.04	0.78	0.04	14.44 ^a	0.65
Drenched	95	1.25	0.04	1.17	0.05	0.83	0.04	15.21 ^a	0.68
Capsule	40	1.25	0.07	1.20	0.07	0.83	0.06	17.65 ^b	1.03
Flock									
Significance		P = 0.02		P = 0.34		P = 0.72		P = 0.001	
1	51	1.23 ^a	0.06	1.20	0.06	0.83	0.06	13.61 ^a	0.95
2	72	1.12 ^{ab}	0.05	1.13	0.05	0.79	0.05	14.12 ^a	0.80
3	72	1.35 ^{ac}	0.05	1.09	0.05	0.78	0.05	16.97 ^b	0.80
4	43	1.26 ^a	0.07	1.23	0.07	0.86	0.06	18.37 ^b	1.00

^{a,b,c}Means not sharing a common letter or with a different second letter in the superscript are significantly different.