Article — Artikel

Effect of feeding urea-molasses blocks with incorporated fenbendazole on grazing dairy heifers naturally infected with gastrointestinal nematodes

R M Waruiru[a*], C O Onyando[b] and R O Machuka[b]

ABSTRACT

Between June 1999 and August 2000, the effects of feeding medicated urea-molasses supplement blocks on the growth of dairy heifers in a marginal area of central Kenya were assessed by comparing the live-weight gain of supplemented and unsupplemented heifers grazing the same pasture. Thirty-nine heifers with an average age of 9.6 months were initially treated orally with albendazole (10 mg/kg body weight) and assigned to 3 groups: group I was fed urea-molasses blocks with incorporated fenbendazole (MUMB), group II was fed urea-molasses blocks (UMB) and group III heifers (control) received no block supplementation (NBS). Body weights of the heifers and faecal egg counts (FECs) were measured monthly and larval cultures were made of positive faecal samples of each group. The mean cumulative live-weight responses of the MUMB and UMB groups were significantly greater than the NBS group ($P < 0.05$). However, at the end of the experimental period, the mean weight gain of the MUMB group did not differ from that of the UMB group ($P > 0.05$). The FECs were moderate to low in all groups and decreased progressively with increasing age of the animals; FECs for the urea-molasses-supplemented groups remained significantly lower than those of the NBS group throughout the experimental period ($P < 0.05$). *Haemonchus* and *Trichostrongylus* were the predominant nematode genera found in the heifers, but *Cooperia, Bunostomum* and *Oesophagostomum* were also present. These results indicate that feeding of urea-molasses blocks substantially reduced production losses attributable to nematode infection of young grazing cattle, and confirms previous observations that well-fed animals are better able to overcome the effects of helminth infections.

Key words: cattle, fenbendazole, gastrointestinal parasitism, Kenya, urea-molasses blocks.

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INTRODUCTION

Gastrointestinal (GI) parasitism is a major constraint in cattle production, especially in marginal lands of Kenya where haemonchosis causes extensive losses[13,20]. These areas are characterised by wide fluctuations in nutrient availability in pastures throughout the year and cattle often rely on low-protein, hay-based diets for their feed supply. Owing to the limited application of grazing management systems at present, control of parasitic helminths of cattle relies primarily on the use of anthelmintics to remove the parasites.

Productivity of cattle in marginal areas of Kenya is severely constrained by inadequate nutrition and GI parasitism which interact to restrict growth, reproduction rates and may contribute to high mortality in some herds[19,20]. To increase productivity of cattle, alternative nutritional practices should be developed and these should include feed supplementation by use of multinutrient blocks containing fermentable nitrogen and other microbial growth factors which enhance digestibility of crop residues and hay by manipulation of rumen functions[8]. Multinutrient blocks have found ready acceptance in Africa by pastoralists as well as by small-scale milk producers[15].

The anthelmintic efficacy of benzimidazole (BZ) anthelmintics is increased by prolonged low-level administration[1]. Fenbendazole (FBZ) is an anthelmintic that is highly effective against all major adult and developing parasitic nematodes of cattle at 7.5 mg/kg body weight in a single dose[6]. Self-medication of cattle using FBZ incorporated in feed blocks to deliver daily therapeutic doses has been studied and found to be effective[5]. Similarly, administration to cattle and buffalo of low and sustained levels of FBZ incorporated into urea-molasses blocks (UMB) was also effective therapeutically and prophylactically[16,17]. The purpose of this study was to evaluate the effects of UMB with incorporated FBZ on GI parasitism and weight gain of grazing heifers raised in a marginal area of central Kenya.

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MATERIALS AND METHODS

Experimental area

The present experiment was conducted at Iganjo farm in the Ruiru Division of Thika District, central Kenya, about 40 km north of Nairobi (Fig. 1). The area lies at an altitude of 1500 m above sea level and is semi-arid with an annual bimodal rainfall of 500 mm to 1500 mm. The long rains occur between March and May, and the short rains between October and December. The mean monthly minimum temperature varies from 8 °C to 15 °C and mean maximum temperature from 20 °C to 30 °C[3]. The farm has permanent, non-irrigated pastures comprising mainly Kikuyu grass (*Pennisetum clandestinum* that is grazed each year by weaner calves and replacement heifers. Problems related to gastrointestinal parasites have been reported and anthelmintics are used regularly[20,21]. The meteorological data were recorded on the farm.

Experimental design

The experiment was conducted from 5 June 1999 to 28 August 2000. Thirty-nine Friesian/Ayrshire crossbred heifers originating from the farm were weighed and treated with albendazole (Valbazen®, Novartis East Africa Ltd., Nairobi, Kenya; 10 mg/kg) suspension administered orally, and maintained as a group. The heifers were divided into 3 equal groups on the basis of age and weight; the mean (±S.D.) weight and age of the heifers were 118 ± 4.3 kg and 9.6 ± 0.7 months, respectively. Group I heifers were fed urea-molasses supplement blocks with incorporated FBZ at a rate of 0.5 g/kg in conjunction with unmedicated urea molasses blocks (1 week MUMB, 4 weeks UMB) daily[11] while, group II was fed UMB only. This was preceded by an adaptation period of 2 weeks with unmedicated UMB for the 2 groups. All blocks were weighed daily from day zero to the end of the 7-day treatment period. Group III heifers (control) received no block supplementation (NBS). All the heifers grazed together during the day but were housed separately at night for supplemental feeding. Owing to drought, similar amounts of hay were offered from January 2000 onwards to each group of heifers. The urea-molasses blocks were provided by the Helminthology Section, National Veterinary Research Centre, Muguga and were prepared as outlined by Sansoucy[14] and Bain[4]. Weight gains were assessed by weighing each animal at monthly intervals.

Parasitological methods

Rectal faecal samples were collected at the start of the experiment and at monthly intervals thereafter. A modified McMaster technique was used to determine the number of nematode worm eggs per gram (epg) of faeces[2]. Group-bulked faeces were cultured and infective nematode larvae (L_3) identified and expressed as the percentage of genera recorded[2].

Statistical analysis

The differences in live-weight gain and faecal egg counts (FECs) between groups were analysed by repeated measures analysis of variance, using the general linear model procedure in SAS (SAS Institute Inc., 1989–1996)[18]. The FEC data were log-transformed ($\log_{10}$ (count + 50) to stabilise the variance. Geometric group means were calculated.

RESULTS

Meteorological data

During the present experiment, the period between January and August 2000 was unusually dry. Only sporadic, small amounts of rain were recorded, with wet days being fewer than 5 each month. The recorded rainfall was below the expected long-term average for the area (Fig. 2). The mean relative humidity ranged from 73.5 to 98.8 % in the wet months, and from 69.1 to 84.6 % in the dry months. Minimum temperatures ranged between 9.7 and 17.5 °C, while the maximum temperature range was 21.7–28.6 °C.

Faecal worm egg counts

The geometric mean strongylid FECs for the 3 groups are given in Fig. 2. The mean FEC for the NBS group rose from 0 in July to reach a level of 500 in December 1999, with a 2nd peak of 280 in April 2000. The main peak occurred during the short rains while the smaller peak coincided with the unusually low rainfall in March and April. The mean FECs from urea-molasses-supplemented groups were significantly lower than those from the NBS group ($P < 0.05$) and reached a maximum of 75 and 140 eggs for the MUMB and UMB groups, respectively, in December 1999. There were no significant differences in FECs between supplemented groups although the mean FEC for the MUMB group was lower than that of the UMB group from September 1999 to May 2000.

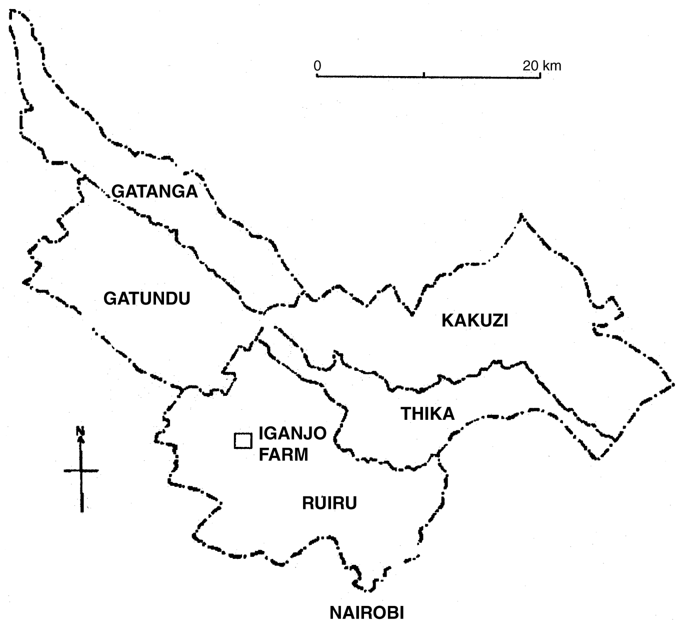

Fig. 1: **Map of Thika District showing administrative divisions and location of the experimental farm.**

On the 20 occasions that pooled faecal samples were cultured for larval differentiation, *Haemonchus* was present in all (range 23–100 %), *Trichostrongylus* was present in 14 (range 10–77 %), *Cooperia* was present in 10 (range (0–52 %) and *Bunostomum* and *Oesophagostomum* each appeared at 7 % of the total egg count on 3 occasions. There were no significant differences in the generic composition of L_3 larvae between the urea-molasses-supplemented and NBS groups ($P > 0.05$).

Urea-molasses block consumption

The mean daily block consumption for MUMB and UMB heifers during the adaptation period was 0.36 kg and 0.38 kg, respectively. Mean daily block consumption for the same groups during the experimental period was 0.28 kg and 0.33 kg, respectively. With a mean body weight of 233 kg, the mean daily intake of

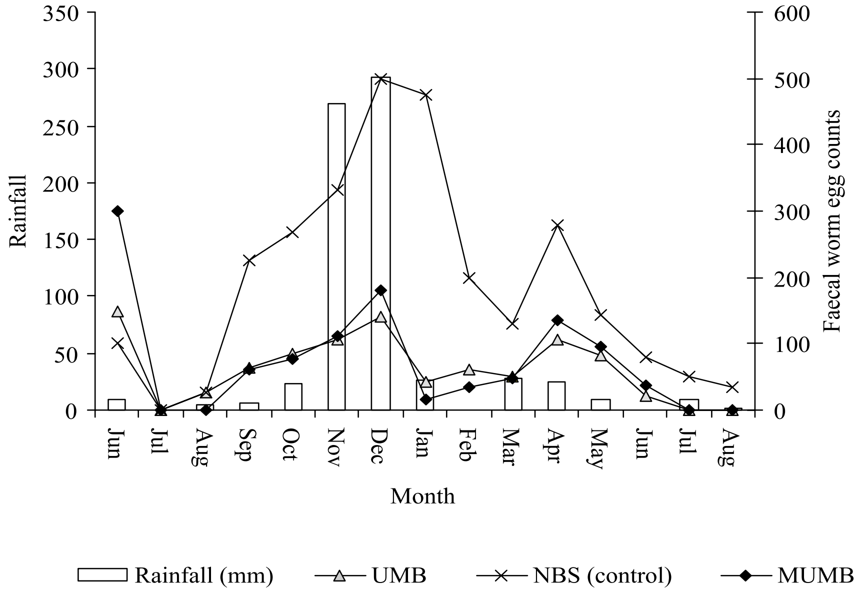

Fig. 2: **Geometric mean faecal egg counts for the MUMB, UMB and NBS heifers from June 1999 to August 2000 and total monthly rainfall figures.**

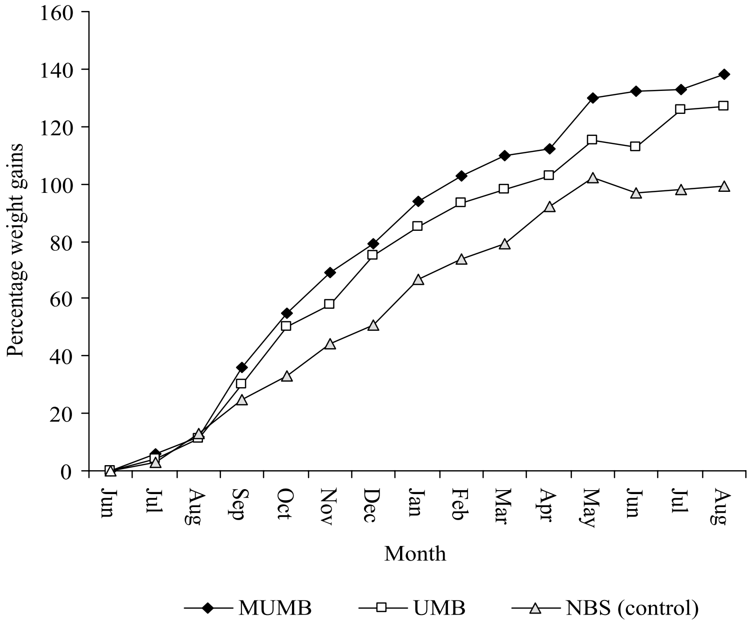

Fig. 3: **Mean live-weight changes** (percentage of initial weight) **for the MUMB, UMB and NBS heifers from June 1999 to August 2000.**

FBZ in the MUMB group was 140 mg, equivalent to 0.60 mg/kg body weight.

Live-weight gain

The mean live-weight changes, expressed as percentages of the starting weights, are shown in Fig. 3. At the start of the experiment there were no differences in mean weights among groups. Growth rates in the 3 groups were similar until the end of August 1999 when the NBS group started to show a reduction in performance compared to the MUMB and UMB groups, which continued to grow steadily. At the end of the experiment, the supplemented groups had gained significantly more weight than the NBS group ($P < 0.05$). Body-weight differences between the MUMB and UMB groups were not statistically significant at any time throughout the observation period ($P > 0.05$).

DISCUSSION

The trend of FECs in the NBS group indicated low to moderate worm burdens, *i.e.* subclinical nematodosis, throughout the experiment. This result is similar to the observations of Waruiru *et al*.[21]. The FEC showed a seasonal pattern that was related to the rainfall distribution. This was particularly evident in the NBS group in which FECs reached a peak in December during the short rains. The FECs declined from January, reaching very low levels in August 2000. This decline may be attributed mainly to drought as the expected long rains between March and May failed. The rise in FECs observed in April may have been due to the occasional rains that fell in March. These resulted in enough moisture to stimulate the development and translation of L_3's on the pastures, leading to increased pasture infectivity.

Significantly lower FECs were observed in the MUMB and UMB groups during the greater part of the experiment. These findings are in agreement with reported data showing that urea supplementation generally resulted in lower FECs for sheep with mixed nematode infections in both pen and field situations[7]. However, there was no significant difference in FECs between the MUMB and UMB groups indicating that MUMB had minimal effect on the nematode parasite population apart form that provided by the nutritional supplementation with UMB. This was probably due to: 1) insufficient drug being present in the blocks to provide therapeutic efficacy during the 7-day 'dosing' period. Since the dose in the present experiment (0.6 mg/kg/day) was within the range normally recommended for continual low-dose delivery of FBZ (0.5–0.75 mg/kg/day for cattle)[5], this may indicate the early development of BZ resistance in this population of nematodes. As BZ anthelmintics are frequently used on the experimental farm[21], this aspect merits further investigations; and 2) variable intake of MUMB within the treatment group and hence variation in the response to treatment. This might have had considerable influence on mean FECs of 'shy' animals that might not have consumed adequate amounts of MUMB.

The results of differential larval counts indicated that *Haemonchus* and *Trichostrongylus* were the predominant nematode genera. Other genera found were *Cooperia*, *Bunostomum* and *Oesophagostomum*. Of these, *Haemonchus* is recognized as including the most pathogenic and important parasites of cattle in Kenya[10,20]. There was no significant difference in the generic composition of L_3 from faecal cultures between the urea-molasses-supplemented and NBS groups, which confirmed that supplementing the heifers with UMB at maintenance levels had no effect on the distribution of GI nematodes in the experimental heifers. These observations concur with earlier findings of Magaya *et al.*[9]

The urea-molasses-supplemented groups out-performed the NBS group with regard to live-weight gain. This suggests that UMB supplementation improved productivity of cattle on pasture with subclinical nematodosis, as measured by weight gain. In marginal areas of Kenya where nutritional deficiencies are likely to exacerbate the detrimental effects of GI parasitism[12,19], UMB can enhance the efficiency of feed utilisation and assist the animals to withstand infection. The use of UMB should be integrated into strategic worm control programmes in conjunction with minimal chemotherapy and appropriate grazing management practices to achieve increased productivity[7].

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