

## Fenbendazole efficacy in lambs: a comparison of oral dosing and feed block additive modes of administration

E.A. Okewole.<sup>1</sup>, S. S. Abiola.<sup>2</sup>, A. A. Aderinto<sup>3</sup> and A. O. Oladele<sup>3</sup>

<sup>1</sup>Department of Veterinary Medicine University of Ibadan, Ibadan, Nigeria

<sup>2</sup>Department of Animal Production and Health, University of Agriculture, P. M. B. 2240, Abeokuta

<sup>3</sup>Ministry of Agriculture and Natural Resources, Ibadan, Nigeria

### Abstract

Twenty-four, 3-month old West African Dwarf (WAD) Lambs were divided into 3 groups of 8 each. Each group was given free access to a common pasture by day, but housed separately in concrete-floored and netted pens provided with varied but equal supplements by night. Two of the groups were treated with 2.5% Fenbendazole suspension at a dose rate of 10mg/kg body weight administered orally once a month for 3 consecutive months for one group, dissolved in molasses mixed with Brewer's grains in 5 divided daily doses per month for 3 consecutive months for the second group, while the third 3<sup>rd</sup> group was left as untreated control. The mean haematocrit values, mean percentage egg reduction and mean liveweight gains were higher at the end of the trial for the single monthly dosed group than for the untreated control group, while the same measurements were insignificantly different ( $P>0.05$ ) for the two treated groups. Significant appreciation in the mean haematocrit values, mean percentage egg reduction and mean liveweight gains were proofs of the effectiveness of treatment and molasses supplementation, while the insignificance of the difference of the same measurements in the two treated groups implied equal efficacy of the two different schedules of administration. The in-feed scheme was easier and convenient for use on weak and pregnant ewes that could abort on rough handling.

**Keywords:** Fenbendazole efficacy, lambs, feed-block additive

### Introduction

Administration of anthelmintics in feed-blocks is a convenient, safe and cheap method of treatment for sheep, especially the pregnant ewes kept under semi-intensive system. The method has been experimentally supported by McBeath *et al.*, (1979) and Bogan and Marriner (1983). For the benzimidazole (BZD) anthelmintics, the administration of a therapeutic dose in divided volumes over a

number of days is more effective in the removal of parasites than administration of a single dose (Richard *et al.*, 1978). The choice of fenbendazole (FBZ) from the BZD series as the in-feed anthelmintic was informed by the following factors: its wide safety margin, palatability and insolubility in water; hence durability in open feed troughs (McBeath *et al.*, 1979). It has efficacy both on adult and immature nematodes (Thomas, 1978), cestodes

and trematodes (Corba *et al.*, 1979), its sulfoxide metabolite (oxfendazole) also has anthelmintic activity (Marriner and Bogan, 1980).

McBeath *et al.* (1979) emphasized two essential considerations for the successful use of the in-feed methods of anthelmintic treatment viz: the need to acclimatize the animals to block-feeding before block medication and the variable intake of feed blocks as influenced by the availability of alternative grazing and other supplementary feeding.

This paper reports a comparative study on an in-feed anthelmintic treatment trial and the traditional oral drenching method, using fenbendazole-in-molasses mixed with the brewer's grains in a local lamb unit in Ibadan, Nigeria.

## Materials and methods

### *Animals and management*

Twenty-four local lambs of the West African Dwarf (WAD) breed and of 3 months of age housed at the Urban Project Farm, Ibadan, Nigeria were selected for the study in the months of October, November, and December. During the day, all lambs were grazed on natural pasture dominated by *Andropogon*, *Festuca* and *Pennisetum* grass mixed with *Trifolium semence* legumes. In the evening, the animals were returned to their respective pens and provided with water and feed supplements. These included non-medicated brewer's grains (obtained from Nigerian Breweries Limited, Ibadan, Nigeria), molasses (Molasses syrup, Nigerian Sugar Company, Bacita, Nigeria), and dry cassava (*Mannihot esculenta*) peelings, specially provided to compensate for the low pasture quality during the dry season of the year when this study was carried out. These additional supplements served to acclimatize the lambs to regular feeding on the brewer's

grains and molasses, as recommended for the trial and also provided information on the dry matter intake (DMI) per lamb of the unmedicated grains.

The lambs were vaccinated against "kata" (pestes des petit ruminats PPR) infection using the tissue culture rinderpest vaccine, provided by the National Veterinary Research Institute (NVRI), Vom, Nigeria.

### *Experimental design, haematology and worm egg counts*

*Experimental design:* The 24 lambs were weighted on day 1 and subsequently every week on Salter (Butcher) scale machine, Model 253 of sensitivity 0.05kg. Clinical examination of the flock was done to evaluate the pre-trial health status and this was followed by a sex- and age-matched randomized division into 3 groups-A, B and C of 8 animals each. Each group was kept separately on concrete-floored and netted pens provided with potable water and feed supplements.

*Haematology:* From each lamb in the 3 groups, 5ml of blood was taken into a bottle containing disodium salt of ethylene diamine tetraacetic acid (EDTA) as anti-coagulant for haematology on days 2, 30, 58 and 91 of the trial. Packed cell volume (PCV), haemoglobin (Hb) concentration, erythrocyte (RBC) and total leucocyte (WBC) counts were carried out as described by Jain (1986). The mean corpuscular volume (MCV) and mean corpuscular haemoglobin concentration (MCHC) were calculated (Jain, 1986).

*Worm egg counts:* Rectal faecal samples were collected with gloved hand on day 2 and subsequently every 2 weeks to determine the initial worm burden profile as well as the egg counts for the flock using the saturated sodium chloride (NaCl) solution for the nematodes and cestodes, and the saturated zinc sulphate

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(ZnSO<sub>4</sub>) solution for the trematodes (flukes) using the modified McMaster techniques (Whitlock, 1948). This was considered necessary because the flock had not been treated since weaning in anticipation of the trial.

Group A, the control group, consisted of 4 males and 4 females that were grazed on the above common pasture by day and fed the regular unmedicated molasses-brewer's grain paste (MGP) and cassava peels by night for the 3-month trial. Group B consisted of 5 males and 3 females. They had equal access to the common pasture, cassava peels and the unmedicated MGP. However, the group was orally drenched with 2.5% ready-to-use aqueous suspension of Fenbendazole (Panacur<sup>R</sup>, Hoechst, AG/D-6230, Frankfurt 80) at a dose rate of 3.4ml per lamb, based on the manufacturer's dosage recommendation of 10.0mg/kg (2.0ml. to 5.0kg) body weight for the treatment of cestodes on days 25, 55 and 85 of the trial. Group C had 4 males and 4 females that had equal access to the pasture and the supplementary cassava peels. Additional supplement for the 8 lambs consisted of 27.2ml of the 2.5% Panacur<sup>R</sup> suspension thoroughly dissolved in 4,500ml. (1 gallon) of molasses syrup, pasted with 2.35kg of the brewer's grains. Preliminary trial put the dry matter intake (DMI) for the brewer's grain at 0.29kg per lamb of 8.4kg body weight, i.e. 3.5% live weight. This medicated brewer's grains were exclusively fed on the last 5 days of the months of October, November and December, i.e. days 25, 26, 27, 28, 29; 55, 56, 57, 58, 59; 85, 86, 87, 88 and 89 of the trial respectively in 5 evenly-spaced feed troughs. Unmedicated MGP were fed on the other days.

### *Statistical analysis*

Data were analyzed using the student's t-test, while means were separated using Duncan's multiple range test (Gomez and Gomez, 1984).

## Results

### *Clinical pre-trial health assessment*

The lambs were emaciated and lean, some frail with starring hair coat and watery faeces. There was general inappetence in the flock with slight pallor of the visible mucosae in some. Ten of the flock had variable degree of submandibular oedema (bottle jaw) and anasarca.

### *Post-trial health assessment*

There were marked improvements in liveweight gains, visible mucous membranes were pink and feed intake improved especially in the treated groups B and C. However, 2 of the group A lambs died on days 64 and 67 of the trial, after a protracted clinical manifestation of frank diarrhoea and paper-white pallor of the visible mucosae and were pathologically confirmed of acute haemonchosis.

### *Haematology*

The haemoglobin concentrations were well correlated with the haematocrit values from days 2 to 91 in the three groups as indicated in Table 1. However, the haematocrit values were only slightly different in the three groups on day 2, but the same increased by day 91, especially in the treated groups B and C with a significant difference ( $P < 0.03$ ) between the control A and the treated group C. No significant difference ( $P > 0.05$ ) was observed between the values for the two treated groups B and C. Similarly, the MCV and MCHC values were well correlated in the three groups. Both the MCV and MCHC values were only slightly different from one another in the three groups on day 2, but by day 91, both values were significantly higher ( $P < 0.04$ ) in the treated group C than in group A. No significant differences ( $P > 0.05$ ) were observed in the MCV and MCHV values for groups B and C on day 91 (Table 1).

**Table 1** Changes in the haemogram on days 2 and 91 of the fenbendazole trial on local lambs

Measurement	Day 2			Day 91		
	Group A	Group B	Group C	Group A	Group B	Group C
Haemoglobin (%)	9.6±3.2	9.3±2.4	9.8±2.3	10.2±1.6	12.82±1.8	13.5±2.2 <sup>a</sup>
Haematocrit (%)	30.4±3.1	29.2±3.2	28.9±3.2	31.8±2.4	38.5±3.3	39.1±4.2 <sup>a</sup>
RBC counts (x10 <sup>6</sup> /mm <sup>3</sup> )	9.6±1.2	9.1±3.3	9.0±4.2	9.8±3.1	11.2±2.4	11.0±3.2
WBC counts (n/mm <sup>3</sup> )	4,400±1,005 <sup>ab</sup>	4,905±1,055 <sup>a</sup>	4,250±950 <sup>b</sup>	4,502±800 <sup>c</sup>	8,602±1,200 <sup>b</sup>	9,502±,020 <sup>a</sup>
MCV (%)	31.7±1.3	32.1±1.4	32.1±1.5	32.4±1.2	34.4±1.3	35.5±2.0
MCHC (%)	31.6±2.1	31.8±2.3	33.9±2.3	32.1±2.0	33.2±2.2	34.5±0.5

Data are expressed as mean standard deviation.

<sup>a,b,c</sup>Means in the same row with different superscripts are significantly different (P<0.05).

#### Worm egg counts

Table 2 shows the worm burden profile as well as mean worm egg counts on days 2 and 91 of the trial. The trichostrongylids were the major strongylate (79.0%) nematode infection for the flock while *Fasciola* (11.9%) and *Moniezia* (8.6%) species, respectively represented the minor trematodal and cestodal burdens of the flock. Treatment effects reduced significantly (P<0.04) the egg counts in the treated group C as compared with group A on day 91. However, the reduction in egg counts was statistically insignificant (P>0.05) between the treated groups on day 91.

#### Liveweight changes

Table 3 shows the mean liveweight changes on days 2 and 91 of the trial. The treated group C had their liveweights increased when compared with the untreated group A. However, the difference in weight gains was not significant (P>0.05) among the treatment groups.

#### Discussion

This study has again confirmed that helminthosis in general, and trichostrongylosis in particular, is one of the major health constraints to the small ruminant production in the hot humid tropical zone of the world. This observation, though corroborative of those of Adejinmi and Harrison (1996), also brought out the relevance of what apparently was thought to

be a constraint of large commercial holdings to even the semi-intensively managed small holdings of our flock type.

The poor health of the flock as evidenced by the lower level of haematocrit values, pale visible mucosae, emaciation and anasarca on day 2 and the remarkable improvement in health observed in groups B and C after treatment were consistent with the effective treatment of parasitic gastroenteritis with the fenbendazole suspension. Okon and Akinpelu (1982) and Fagbemi and Dipeolu (1982) have earlier incriminated *Haemochus. contortus*, *cooperia*, *punctata*, *Oesophagostomum columbianum*, *Trichostrongylus columbriformis*, *Strongyloides papillosus*, *Trichuris ovis* and *Gaigeria paschycelis* for such debilitating gastroenteritis as observed in this flock. Okon and Akinpelu (1982) blamed their high prevalence in the southern rain forest belt on an almost all year-round rainfall that allows the all-year-round survival and development of the pre-parasitic stages of these worms.

The lower haematocrit values, MCV and MCHC in the flock on day 2 and their significant appreciation on only the treated groups suggested an initial microcytic and hypochromic type of anaemia, which responded to the fenbendazole therapy by the two methods. Dargie and Allonby (1975) have

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incriminated the blood-sucking habit of *H. contortus*, abomasal haemorrhage and the resultant serum iron depletion by these two factors for this type of anaemia. Under such severe parasitism by *H. contortus*, protein retention is depressed (Kimambo *et al.*, 1988) and the synthesized ones are diverted away from muscle and bone towards replacement, mucous production and plasma/whole blood loss (Steel *et al.*, 1980). These might be responsible for the emaciation and hypoproteinaemia in the group A lambs. However, protein absorption is not depressed (Anindo *et al.*, 1998), a situation that probably explained the liveweight gains in the treated groups B and C that were fed some supplementation.

The respective mean liveweight gains of 4.99%, 8.31% and 8.67% for the groups A, B and C lambs were impressive for the short period of trial, considering the poor pasture quality during these dry months of the year. Such gains were attributed to effectiveness of the two treatment schedules employed and also on the remarkable supplementation attribute of the molasses syrup since even the untreated group A lambs had some weight gains. According to Anindo *et al.* (1998), molasses increase food intake through improved palatability, in addition to improving ruminal nitrogen supply. It also furnishes a cheap source of energy and elemental sulphur (S). Wool break and depressed growth have been observed in parasitized animals (Barger *et al.*, 1973) while sulphur amino acids have been identified as the first limiting amino acids for wool synthesis and lamb growth (Poppi *et al.*, 1990). It is plausible that parasitized lambs have a higher demand for S-amino acids and the rich sulphur content of molasses contributed to increased ruminal synthesis of S-amino acids which might have influenced host ability to impede larval development as Kimambo and MacRae (1988) earlier observed.

The success of the "periodic" (as opposed to the strategic) deworming schedule adopted for the group B lambs as clearly evident by the liveweight gains (Table 2) might not be unconnected with the broadness of the Fenbendazole anthelmintic spectrum which arrested both the developing and inhibited stages of the larvae during these dry months and so reduced the pasture contamination the following rainy season as Adejinmi and Harrison (1996) had earlier reported. This schedule also reduced the number of necessary control treatments in the following rainy season (Chiejina and Emehele, 1986). The group C lambs, on the other hand, had a 5-monthly serial in-feed treatment schedule which proved to be highly effective, at least in terms of liveweight gains (Table 2). However, the success of the serial in-feed schedule hinged on a number of factors *viz.*: (a) the unique attribute of the benzimidazole series of anthelmintics to exert their full anthelmintic effect even in time-spaced divided doses as opposed to single administration of fenbendazole (Prichard *et al.*, 1978); (b) the slow intestinal absorption of fenbendazole also enhanced by its in-feed administration prolonged its toxic concentration on the gastrointestinal worms as earlier observed by Borgesteede and Reid (1982); (c) provision of adequate number of feed troughs which facilitated the average consumption of therapeutic level of fenbendazole per lamb per month; (d) the monthly feeding period of the medicated brewer's grains which did not exceed the 4 to 14 days suggested by Thomas (1978) and Bogan and Marriner (1983) to avoid the failure of anthelmintic and the emergence of benzimidazole - resistant strains of helminths; and (e) the in-feed medicament which was probably too bulky to be divided to the oesophageal groove and therefore went through the rumen for a much prolonged action and efficacy as Marriner and Bogan (1979) had observed.

**Table 2** Worm burden profile and egg production rates in local lambs treated with fenbendazole

Worm Type	Infection Rate	Worm egg counts/gram of faeces									% change in egg counts		
		Day 2			Day 91			Day 91			Day 91		
		Grp. A	Grp. B	Grp. C	Grp. A	Grp. B	Grp. C	Grp. A	Grp. B	Grp. C	Grp. A	Grp. B	Grp. C
Strongyle worm spp.	79.0%	1705±410	1714±412	1714±318	2012±312 <sup>a</sup>	144±25 <sup>b</sup>	132±2 <sup>b,c</sup>	18.0±5	91.6±7	92.3±6	Addition	Reduction	Reduction
(Strongyle) Fasciola spp.	11.9%	256±38	255±16	256±33	313±42 <sup>a</sup>	34±8 <sup>c</sup>	42±9 <sup>b</sup>	22.3±6	86.7±5	83.6±8	Addition	Reduction	Reduction
Moniezia spp.	8.6	185±31	185±32	169±18	205±27 <sup>a</sup>	41±10 <sup>b</sup>	38±11 <sup>c</sup>	10.8±3	77.8±4	77.5±5	Addition	Reduction	Reduction

Data are expressed as mean standard deviation of eggs per gram of faeces.

<sup>a,b,c</sup> Means in the same row with different superscripts are significantly different (P<0.05)

**Table 3** Liveweight changes on days 2 and 91 of the fenbendazole trial on local lambs

Measurement	Day 2			Day 91			Day 91 (Mean liveweight gain (kg))		
	Grp. A	Grp. B	Grp. C	Grp. A	Grp. B	Grp. C	Grp. A	Grp. B	Grp. C
Liveweight (kg)	8.42±3.14	8.42±1.41	8.42±1.35	8.84±4.21	9.12±1.32	9.15±1.32	0.42±1.21 (4.99%)	0.70±0.32 (8.31%)	0.73±0.33 (8.67%)

Means in the same row are not significantly different (P>0.05)

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It is worthy of note that with about the same amount of fenbendazole suspension for each group, the efficacies of the two different treatment schedules were about the same haematologically and in terms of liveweight appreciation in the lambs. However, the in-feed schedule additionally reduced labour cost, as handling or restraint was unnecessary. It is particularly better for the pregnant ewes that are very much at risk of abortion or metabolic disorders on rough handling.

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### References

- Adejinmi, J. O. and Harrison, L. J. S.** 1996. Parasitic nematodes of domestic ruminants in Nigeria: Epidemiology, *Trop. Vet.* 14, 3-15.
- Anindo, D., Toe, F., Tembely, S., Mukasa-Mugerwa, E., Lahlou-Kassi, A. and Sovani, S.** 1998. Effect of Molasses-Urea-block (MUB) on dry matter intake, growth, reproductive performance and control of gastrointestinal nematode infection of grazing Menzroni lambs. *Small Ruminant Res.* 27, 63-71.
- Barger, I.A., Southcott, W. H. and Williams, V.J.** 1973. *Trichostrongylus* and wool growth: (2) The wool growth response of infected sheep to parenteral and duodenal cystine and cysteine supplementation. *Austr. J. of Exptl. Agric. & Anim. Husbandry* 13, 351-359.
- Bogan, J. A. and Marriner, S. E.** 1983 Uptake of Fenbendazole by grazing sheep with access to feed-blocks containing Fenbendazole. *Br. Vet. J.* 139, 223-227.
- Borgsteeds, F. M.H And Reid, J. F.S.** 1982. Oxfendazole efficacy in calves: A comparison of oral and intraruminal routes of administration. *The Vet. Quarterly* 4(3), 139-141.
- Chiejina, S. N. and Emehelu, C. O.** 1986. Evaluation of three strategic anthelmintic programmes for the prophylaxis of gastroenteritis in cattle in Eastern Nigeria. *Trop. Anim. Hlth. Prod.* 18, 55-63.
- Corba, J., Lietava, P., Duwel, D. and Reisenieter, R.** 1979. Efficacy of Fenbendazole against the most important trematodes and cestodes of ruminants. *Br. Vet. J.* 135, 318-323.
- Dargie, J. D. and Allonby, E. W** 1975. Pathophysiology of single and challenge infections of *Haemonchus contortus* in Merino sheep: Studies on red cell kinetics and the "self-cure" phenomenon. *Inter J. Parasitol.* 5, 147-157.
- Fagbemi, B. O. and Dipeolu, O. O.** 1982. Strongyle infections of small ruminants, *Vet. Parasitol.* 11, 347-353.
- Gomez, A. K. and Gomez, A. A.** 1984. Statistical Proceedings for Agricultural Research. Copyright by John Wiley and Sons Inc., p. 304.
- Jain, N. C.** 1986. Schalm's Veterinary Hematology. Jain, n. C., ed., 4<sup>th</sup> Edition, Lea and Febiger, Philadelphia.
- Kimambo, A. E. And Macrae, J. C.** 1988. Measurement *in vitro* of a larval migration inhibitory factor in gastrointestinal mucus

- of sheep made resistant to the roundworm, *Trichostrongylus colubriformis*, *Vet Parasitol* 28, 214-222
- Kimambo, A. E. Macrae, J. C., Walker, A., Walker, A., Watt, C. F. and Coop, R. L.** 1988. Effects of prolonged sub-clinical infections with *Trichostrongylus colubriformis* on the performance and nitrogen metabolism of growing lambs. *Vet Parasitol* 28, 191-203.
- Marriner, S. E. and Bogan, J. A.** 1979. Ruminal by-pass with benzimidazole anthelmintics (Letter). *Vet. Rec.* 105, 261.
- Marriner, S. E. and Bogan, J. A.** 1980. Pharmacokinetics of Albendazole in sheep. *Am. J. Vet. Res.* 41 (7), 1126-1129.
- Mcbeath, D. G., Preson, N. K. and Thompson, F.** 1979. Studies in sheep on the efficacy of Fenbendazole administered via a feed-block carrier. *Br. Vet. J.* 135-271-278.
- Okon, E. O. and Akinpelu, A. T.** 1982. Development and survival of nematode larvae on pasture in Calabar, Nigeria. *Trop. Anim. Hlth. Prod.* 14, 23-25.
- Poppi, D. P., Sykes, A. P. and Dynes, R. A.** 1990. The effect of endoparasitism on host nutrition: The implications for nutrient manipulation. *Proceedings of the New Zealand Soc. Of Anim. Production* 50, 237-243.
- Prichard, R. K., Hennessy, D. R. and Steel, J. W.** 1978. Prolonged administration: A new concept for increasing the spectrum of anthelmintics. *Vet parasitol.* 4, 309-312.
- Steel, J. W., Simmon, L. E. A. and Jones, W. O.** 1980. Effects of level of larval uptake on the productivity and physiology and metabolic responses of lambs infected with *Trichostrongylus colubriformis*. *Austr. J. Agric. Research* 31, 821-828.
- Thomas, R. J.** 1978. The efficacy of in-feed medication with Fenbendazole against gastrointestinal nematodes of sheep, with particular reference to inhibited larvae. *Vet. Rec.* 102, 394-397.
- Whitlock, J. L.** 1948. Some modification of the MacMaster helminth egg counting technique and apparatus. *Journal of the council for Scientific and Industrial Research (Australia)* 21, 177-180.

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