

## The effect of housing and anthelmintic treatment on pre-weaning kid death rate and infestation with gastrointestinal helminthes

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### Abstract

The effects of type of goat housing and provision of anthelmintic treatment on kid mortality and the prevalence of internal parasites were investigated in this study. Thirty six flocks of goats, of multiple ages and mixed sexes, belonging to Rushinga Communal area farmers were selected from 3 flock sizes (1 to 5; 6 to 10 and >10 goats/flock) and were randomly allocated to 2 types of goat housing (i.e. pole walled and an improved housing) and to 2 anthelmintic treatments (untreated and de-wormed with Valbazen), over a two year period. The worm remedy was chosen on the basis of relative availability and affordability compared to other drugs. The dosage of the anthelmintic was done by following the manufacturer's instructions. Death rate of kids was low across all treatments ( $<15.36 \pm 6.36$  deaths/100 kids/first six months from birth) and was not affected by type of housing or the anthelmintic drug. Egg numbers, as low as  $1.45 \pm 1.09$  and  $1.91 \pm 1.10$  per gram of faeces, of *Strongyle* and occasionally *Moniezia* species were observed in the faecal samples. The most prevalent nematode larvae in the faecal cultures were *Haemonchus contortus* ( $70.05 \pm 1.85\%$  infestation rate), *Cooperia* ( $13.70 \pm 0.96\%$  infestation rate), *Trichostrongylus* ( $8.08 \pm 0.86\%$  infestation rate) and *Strongyloides* ( $2.84 \pm 0.57\%$  infestation rate). The prevalence of *Haemonchus contortus* was significantly affected by a three-way interaction of type of housing, anthelmintic treatment and season. It was concluded that kid death rate and the prevalence of internal parasites was low.

**Keywords:** *Cooperia*, goats, *Haemonchus*, improved housing, internal parasites, kid death rate,  
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### Introduction

Five types of goat housing have been identified in the communal areas of Zimbabwe (Monicat *et al.*, 1997). The majority of these houses have earthen floors with walls that consist of poles or bricks and have either open roofs or are roofed with thatch grass or corrugated iron sheets. The goat houses vary in shape, size and the type of construction materials used. Most of them are poorly constructed and, therefore, expose goats to predators, windy weather, cold, rain and muddy conditions. Exposure to these harsh conditions predisposes the goats to diseases such as pneumonia, foot rot, and internal parasites (Homann *et al.*, 2007).

Internal parasites are a major health problem in the livestock industry. They cause retardation in animal growth, poor reproductive performance, condemnation of goat carcasses at abattoirs and high kid mortality. This study was carried out to determine the effect of goat housing and anthelmintic treatment on the diversity and predominance of nematode infestation and pre-weaning kid mortality of goats reared in Rushinga communal area in Zimbabwe.

### Materials and Methods

The study was done in Kamanika Ward, Rushinga East District of Zimbabwe. Kamanika ward lies between  $27^{\circ}$  S and  $33^{\circ}$  E latitude and longitude, respectively. The area has erratic rainfall patterns with a mean annual rainfall ranging from 400-600 mm per annum, which is received during the months of November to April. The mean monthly minimum and maximum temperatures are  $14.1^{\circ}$  C and  $28.6^{\circ}$  C,

respectively. The vegetation is characterised by sparse baobab trees and thorn bushes scattered on the communal rangelands.

Thirty-six flocks of indigenous Mashona goats belonging to 36 local smallholder farmers who were willing to participate were used in this study over a two year period. The flocks were randomly selected from three flock sizes (1 to 5; 6 to 10 and >10 goats/flock). The experimental flocks were then randomly allocated to the 2 housing and 2 anthelmintic treatments at the rate of 3 flocks per type of housing per anthelmintic treatment per flock size group. All the goats were ear-tagged for identification and the kids were closely monitored from birth until they attained six months.

The design of the study was a 2 \* 2 factorial experiment in a randomized complete block design, where there were two housing treatments (improved and pole walled houses), two anthelmintic treatments (de-wormed and untreated) and flock size was used as the blocking factor. The pole houses were the original structures that were constructed by the farmers. These pole houses were built on earthen floors and had roofs that often leaked when it rained. The improved house (designed by the research team) had slated wooden floors, a grass thatched roof and well ventilated walls built from thin wooden poles. The goats were penned every evening. One half of the flocks in each housing type and flock size group were treated against internal parasites with Valbazen (manufactured by Pfizer, Registration Number 54/00781/07, South Africa) i.e. 3 flocks per housing type per flock size were de-wormed, and the other half was not treated. The anthelmintic drench was administered as per manufacturer's recommended dosage using a calibrated syringe once every six weeks during the rainy season (i.e. November to April) and once every three months during the dry season (i.e. May to October).

Farmers who owned the goats kept records of births, abortions, diseases and deaths as they occurred in the experimental flocks. The death rate of the kids was computed into incidence rates (Toft *et al.*, 2002). Rectal samples of faeces were collected from the goats and kids once every month. The faecal samples were placed in labeled plastic bags and stored at 4 °C until they were processed for nematode faecal egg counts (FEC), using the modified McMaster method (Nwosu *et al.*, 2007). Composite larval cultures were prepared from the faecal samples of each anthelmintic treatment for the determination of the composition of the genera of *Trichostrongylids* affecting the goats.

The data on eggs per gram (epg) of faeces was transformed to log (epg + 1) in order to normalise the data. The transformed data were analysed using SAS General Linear Models procedures (Proc GLM) (SAS, 2004). The results were back-transformed by taking anti- logarithms of the Least Square Means and presented as geometric means (Nwosu *et al.*, 2007). The General Linear Models procedure (Proc GLM) was also used to analyse the effect of type of housing and anthelmintic treatment on pre-weaning death rate. The linear statistical model used was generally as follows:

Variable = fixed effect + treatment + interaction + random residual error distributed as  $\sim N(0; 1\sigma^2e)$

Where, variable is faecal egg count; fixed effects include: season and flock size; treatment referred to type of housing and anthelmintic treatment; interaction includes: season\*type of housing\*anthelmintic treatment.

## Results

The pre-weaning death rate (Table 1) of the kids was low across all the treatments and was not affected by type of housing or the anthelmintic treatment ( $P > 0.05$ ). Thirty-five deaths were recorded. The causes of the deaths of the kids were predation (54%), diarrhea (29%), unknown causes (14%) and respiratory problems (3%).

The eggs of *Strongyle* and occasionally *Moniezia* species were observed in the faecal samples. The number of *Strongyle* eggs per gram of faeces was affected by the type of housing and the interaction of anthelmintic treatment by season ( $P < 0.05$ ). The mean number of *Strongyles* eggs per gram of faeces was  $1.45 \pm 1.09$  and  $1.91 \pm 1.10$  in goats housed in the improved and pole houses, respectively. The *Strongyle* egg per gram of faeces of goats sheltered in the improved housing were lower than those in the traditional pole houses ( $P < 0.05$ ).

The most prevalent nematode larvae in faecal cultures were *Haemonchus contortus*, *Cooperia*, *Trichostrongylus* and *Strongyloides*, respectively. Occasionally, *Oesophagostomum* and *Bunostomum* species were also found. The prevalence of *H. contortus* was affected ( $P < 0.05$ ) by a three-way interaction of type of

housing, anthelmintic treatment and season. The highest proportion of *H. contortus* larvae was in the faeces of untreated goats sheltered in pole houses and this occurred during the rainy season (Table 2). Conversely, the lowest proportions of *H. contortus* were obtained in the faeces of untreated goats in the improved houses during the rainy season (Table 2).

**Table 1** Least Square Means ( $\pm$  SE) effect of housing or anthelmintic treatment on pre-weaning death rate (Deaths/ 100 kids/first six months from birth)

Type of housing	Anthelmintic treatment	Flock size		
		1 to 5	6 to 10	>10
Improved	Untreated	5.04 <sup>a</sup> $\pm$ 7.80	0.00 <sup>a</sup> $\pm$ 11.04	0.00 <sup>a</sup> $\pm$ 7.8
Improved	De-wormed	12.96 <sup>a</sup> $\pm$ 6.36	14.4 <sup>a</sup> $\pm$ 6.36	1.20 <sup>a</sup> $\pm$ 7.8
Pole	Untreated	15.36 <sup>a</sup> $\pm$ 6.36	0.00 <sup>a</sup> $\pm$ 11.04	-
Pole	De-wormed	0.00 <sup>a</sup> $\pm$ 6.36	0.00 <sup>a</sup> $\pm$ 7.8	-

Row means with different superscripts differ significantly at ( $P < 0.05$ )

- Means that no value was obtained

**Table 2** Least Square Means ( $\pm$  SE) of the prevalence rate (%) by season of *Haemonchus contortus* in treated and untreated goats sheltered under pole and improved housing

Type of housing	Anthelmintic treatment	Dry season	Rainy season
Improved	Untreated	60.75 <sup>ac</sup> $\pm$ 5.23	57.70 <sup>ac</sup> $\pm$ 3.31
Improved	De-wormed	60.70 <sup>ac</sup> $\pm$ 5.20	70.25 <sup>cd</sup> $\pm$ 3.70
Pole	Untreated	60.50 <sup>ac</sup> $\pm$ 5.23	78.00 <sup>bd</sup> $\pm$ 5.23
Pole	De-wormed	60.00 <sup>ac</sup> $\pm$ 7.40	75.33 <sup>bd</sup> $\pm$ 4.27

Season affected ( $P < 0.05$ ) the prevalence of *Cooperia*, *Trichostrongylus* and *Strongyloides* species in the larval cultures. The faecal levels of these species were unexpectedly lower during the rainy season compared to the levels recorded in the dry season.

## Discussion

Kid mortality was low and not influenced by type of housing or anthelmintic treatment. Most of the deaths were due to predation by dogs and baboons and these occurred when the kids and their dams went to the communal rangeland for grazing unattended. Similar observations were made by Snyman (2010) who reported that lack of attention to kids immediately after birth, and before weaning, resulted in most of the kid deaths that were recorded. Such losses could easily have been avoided if young kids were retained at the homesteads until they were old enough to outrun predators. All the diarrhoea-related kid deaths (29%) that were recorded in this study occurred in one flock and were suspected to be a result of poor management by the farmer.

Although faecal egg counts (FEC) were generally low in all treatments, goats sheltered in improved housing had relatively lower FEC compared to those under the pole housing. This observation supports findings by Hassan *et al.* (2011) that goats maintained in hygienic housing had low levels of endoparasites. The raised and slated floors could have reduced chances of re-infestation by third stage larvae since faeces carrying the infective larvae were beyond the reach of the goats.

The prevalence of *Haemonchus contortus* was high in faeces voided during the rainy season. A similar pattern of helminthosis occurrence by season was noted by Bakunzi *et al.* (2011) who reported that rangeland conditions during the dry season destroyed free-living stages of internal parasites. Lack of moisture kills nematode eggs and larvae rapidly through desiccation (Zeryehun, 2012), unless they are protected by faecal crusts or if they migrate into the soil. *H. contortus* undergoes a period of hypobiosis during the dry season and the adult worm forms a long part of the parasite's life cycle, in order to ensure survival during adverse conditions (Hosseini *et al.*, 2012). The third stage of the infective larva was prevalent in the rainy season,

hence the high infestation rate recorded in this study. Either adverse dry season conditions or survival strategies resulted in low infestation rates by the parasite during the dry season.

It is probable that the effects of worm burden were minimised by the low rainfall that was received in Rushinga, goat management systems and the availability of the browse component in the natural rangelands during the rainy season. The goats in this study spent most of their time feeding on *Acacia* leaves and other browse species. Kahiya (2003) reported that goats fed *Acacia karroo* and *Acacia nilotica* leaves showed low infestation levels when they were inoculated with *H. contortus*. The finding was attributed to the anthelmintic effect of condensed tannins present in the *Acacia* leaves. Therefore, nutrition might have contributed to low levels of infestation observed in this study.

### Conclusion and Recommendations

Pre-weaning death rate was low and was not influenced by type of goat housing. The major cause of kid deaths was predation when goats were allowed to forage unattended. *Haemonchus contortus* had higher rain season infestation rates across all treatments. The study also found low faecal egg counts in both treated and untreated goats. However, the mere presence of the internal parasites, in the study area, requires constant monitoring to ensure that they remain low as total eradication maybe difficult. It was recommended that strategic use of anthelmintics, combined with good grazing management and improved housing should be promoted. Smallholder farmers were, therefore, encouraged to construct cheap and appropriate shelters for their goats as well as allow them access to browse species.

### References

- Bakunzi, F.R., Mogapi, L.K., Dzoma, B.M., Motsei, L.E., Nyirenda, M. & Ndou, R.V., 2011. Effects of protein supplement and anthelmintic treatment of communally grazed Tswana goats naturally infected with gastrointestinal nematodes. *Life Sci. J.* 8 (2), 53-57.
- Hassan, M.M., Hoque, M.A., Islam, S.K.M.A., Khan, S.A., Roy, K. & Bann, Q., 2011. A prevalence of parasites in Black Bengal goats in Chittagong, Bangladesh. *Int. J. Livest. Res.* 2 (4), 40-44.
- Homann, S., van Rooyen, A., Moyo, T. & Nengomasha, Z., 2007. Goat production and marketing: Baseline information for semi- arid Zimbabwe. International Crops Research Institute for Semi- Arid Tropics 84 pp.
- Hosseini, S.H., Khazrainia, P., Zaemi, M. & Nematollahi, A., 2012. A comparative study on clinical pathology changes in experimentally infected sheep with active and arrested larvae of *Haemonchus contortus*. *Comp. Clin. Pathol.* 21 (3), 321-326.
- Kahiya, C., Mukaratirwa, S. & Thamsborg M., 2003. Effects of *Acacia nilotica* and *Acacia karroo* diets on *Haemonchus contortus* infection in goats. *Vet. Parasitol.* 15, 265-274.
- Monicat, F., Borne, P. & Maron P., 1991. Kid mortality in communal lands: study of housing used for small ruminants. *Goat Development in Zimbabwe: Prospects and constraints. Proceedings of a workshop held at Matopos Research Station 14- 15 November, 1991.* Ndlovu L., (ed). 76-96
- Nwosu, C.O., Madu, P.P. & Richards, W.S., 2007. Prevalence and seasonal changes in the population of gastrointestinal nematodes of small ruminants in the semi- arid zone of north- eastern Nigeria. *Vet. Parasitol.* 144 (1-2), 118-24.
- SAS 2004. SAS® Guide to Applications Development. Second Edition. SAS institute. Cary. NC, USA
- Snyman M.A., 2010. Factors affecting preweaning kid mortality in South African Angora Goats. *S. Afr. J. Anim. Sci.* 40 (1), 54-64.
- Toft, N., Agger, J.F., Houe, H. & Bruun, J., 2002. Measures of disease frequency. In: *Veterinary Epidemiology- From Hypothesis to conclusion*, Houe H., Ersbøll A. K., Toft N. and Agger, J.F.(Eds). Samfundslitteratur, KVL, Bogladen, Denmark. 79-95.
- Zeryehun, T., 2012. Helminthosis of sheep and goats in and around Haramaya, Southeastern Ethiopia. *J. Vet. Anim. Health* 4 (3), 48-55.