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Feeding practices and effects of gastrointestinal parasite infections on live weight gain of small ruminants in smallholder mixed farms in Kenya

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Abstract

The objective of this study was to quantify the effects of gastrointestinal nematodosis on live weight gain (LWG) of sheep and goats kept in smallholder farms in Kenya. A total of 307 sheep and goats from smallholder farms were sampled using a 2-stage cluster and systematic random approach. Sampled farms were visited once a month for nine months during which a health and production survey questionnaire was administered, animals weighed and fecal samples taken for fecal egg count. Descriptive statistics and a generalized linear mixed model were performed in SAS. The mean LWG of suckling kids and lambs was low (mean = 46 g/day). High fecal egg count and lack of feed supplementation were identified as the main factors limiting growth. Improved helminth control and nutrition are required to optimize production.

Keywords: Helminths; Nematodosis; Sheep; Goats; Weight gain; Smallholder

1. Introduction

With the rapid increase in human population and urbanisation combined with modest increase in incomes in developing countries, the demand for meat and other animal products continues to grow. The unprecedented growth in demand for livestock products has recently acquired the label of the 'livestock revolution' (Delgado et al., 1999, 2001; Mwangi and Omore, 2004). It is therefore becoming increasingly important to optimize agricultural production through improved management practices and the control of production limiting diseases such as helminth infections. The high potential areas of Kenya, of which the central highlands are part, are farmed predominantly by smallholders, who are a diverse and growing sector of agricultural community (Sloane, 1986; McDermott et al., 1999; Omore et al., 1999; Muraguri et al., 2004; Wabacha et al., 2004).

Gastrointestinal nematodosis is one of the major constraints to production of small ruminants under production systems heavily dependant on pasture grazing (Uriarte and Valderrabano, 1990). Clinical and sub-clinical gastro-intestinal infection, especially that caused by nematodes, is a major health and production constraint in small ruminants and accounts for large economic losses (Fabiyi, 1987; Radostitis et al., 1994; Gatongi et al., 1997). Production losses result from reduction of weight gains, milk yield, birth weights, carcass quality and reduced fertility of female animals (Gatongi et al., 1997). Losses due to haemonchosis alone may amount to approximately US$31 million annually in Kenya (Upton and Gathuma, 1992). In addition, the injudicious use of anthelmintics without due regard to

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the epidemiological characteristics of the nematodes is a major cause of economic loss (Wanyangu et al., 1996; Maingi et al., 1997).

Currently, there is lack of information on small ruminant production from smallholder mixed farming systems in Kenya. Whereas some information on health and productivity of sheep and goats in the range lands has been gathered (ILCA, 1979; Carles, 1980; Carles, 1986; Wilson, 1986), there are very few reports of any quantitative research that have investigated the specific health and production constraints of these animals on Kenyan smallholder mixed farms in the highland areas of the country. Nearly all the information available on the production of small ruminants is from studies conducted in pastoral arid and semi-arid areas, large scale commercial production systems and records from institutional farms and research stations (Carles, 1980, 1986; Coppock et al., 1987; Galaty, 1992; Gatongi et al., 1997; Ng'ang'a et al., 2004). Therefore, information on small ruminant production that would be used to help plan and prioritise livestock health interventions, research and give guidance in policy decisions in the highlands is lacking. In the central highlands of Kenya, in particular, no work has been done to assess the health and production levels of sheep and goats in smallholder farms, yet these have a good potential in this area. Moreover, little is known about the interaction of disease with other production factors like husbandry and nutrition because very few farm level studies have been carried out in the smallholder farms in the highlands. Therefore there is need to assess these interactions in the smallholder system in the highland areas of Kenya to inform animal health planning and intervention strategies.

The objective of this study was to investigate the impact of gastrointestinal nematode infections on live weight gain of sheep and goats kept under smallholder mixed farming systems in the central highlands of Kenya.

2. Materials and Methods

2.1. Study area

The study was conducted in agro-ecological zones (AEZs) 1 and 3 (Jaetzold and Schmidt, 1982) in the central highlands of Kenya. The humid AEZ 1 that receives an average rainfall of 1100–2700 mm/annum is believed to be a higher agricultural potential zone than the semi-humid AEZ 3 that receives 800–1400 mm of rainfall annually. The long rainy season runs from mid-March to the end of May and is followed by a relatively cool and dry spell which gives way to a hot and dry season from August to September. The short rains come in November to December. There is usually little or no rainfall from late December or early January to early March; this dry season is the hottest part of the year.

2.2. Sampling

The sampling frame for this study was derived from a dairy characterisation survey (KARI/MOALDM/ILRI, 1996). The above survey sampled households (smallholder mixed farms) from each of the 24 sub-locations in the study area. Survey maps of each of the 24 sub-locations were created in a Geographical Information System (GIS) using ArcInfo GIS software. The survey enumerators, who had previously been trained in the use of the survey instrument, visited their assigned sub-locations, and marked on the sub-location maps the main landmarks. A landmark was defined as any permanent feature such as a trading centre, a school, a church, or a factory (KARI/MOALDM/ILRI, 1996). Two pairs of landmarks were then selected at random for each sub-location, and line transects were drawn joining each pair. Sampling was thereafter done following as closely as possible the marked transects. Every fifth household on the left and on the right was included in the survey (KARI/MOALDM/ILRI, 1996). The study area had approximately 30 000 households and the dairy characterisation study sampled a total of 365 of these households.

A random sub-sample of the smallholder farms with sheep and/or goats in agro-ecological zones (AEZs) 1 and 3 from the above study was taken for inclusion in the current study. Smallholder farms were defined as those with less than 20 small ruminants. In order to include at least 30% of the sub-locations in the study area, a random sample of nine sub-locations was taken; 5 from AEZ 1 and 4 from AEZ 3. Sampling of sub-locations was necessary to be able to identify the local administrative bodies to be contacted for permission to conduct the study. Thirty three farms with sheep and/or goats were then randomly selected from each AEZ resulting in a total of 66 farms recruited in the study. The number of farms sampled per AEZ was decided upon based on two criteria: (a) logistical feasibility – this number would make it logistically possible to visit each farm every month for 9 months. We note that access to some of the farms was difficult during the wet months due to poor road conditions. (b) Statistical power – the sample size was deemed large enough to provide meaningful statistical comparisons of the two AEZs. All the animals in the sampled farms (households) were included in the study. The breeds of sheep and goats kept in this area are the East African Maasai sheep and the Small East African goats, respectively. Due to the lack of diversity of small ruminant breeds in the study area, within species breed differences is not expected to be a factor in either mature weight or live weight gains. Sampled farms (households) were visited monthly for 9 months. For the purpose of this study the first month was used to provide baseline data on weight of the animals upon which weight gain calculations were based. Therefore, results for only 8 months, with data on weight gains, are presented in the results section.

2.3. Data collection

Farms were visited monthly for 9 months starting from December 1996 to August 1997. Information gathered during December 1996 visit was used to provide baseline data