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Nutritional manipulation in goats: Supplementation of high protein concentrate, effect on performance and resilience of internal parasites

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Abstract

Eighteen West African Dwarf Goats (WAD) were used in 77-days experimental period to test the efficacy of high protein levels on growth performance and parasite loads of WAD goat. The goats were grouped into three treatments of six animals each per group using their FAMACHA scores (C3-E5) in a completely randomized design. Concentrate diets of varying levels of protein were fed at 7.5 % (low protein, LP), 10.5 % (medium protein, MP) and 14.5% (high protein, HP) inclusion level, respectively while Megathyrsus maximums and water was providedad libitum. Data were collect on FAMACHA score, weight changes. oocyst count and egg per gram of the faeces. The result of this study indicated that the supplemented protein decreased the FAMACHA score from the onset of the experiment to the end of the experiment. Animals fed high protein diet displayed highest growth performance, followed by animals fed with medium protein diet while animals fed with low protein diets had a slight increase in their growth performance.Goats fed high proteinous diet (HP) had a reduced oocyst and egg per gram of the faeces compared to their counterparts fed medium and low protein diets. It can be concluded that feeding WAD goats up to 14% crude protein inclusion is quite adequate to cover their protein requirements and increase their growth performance.Feeding high proteinous diets to goats is an economic and cost effective way of controlling gastrointestinal parasite.

Keywords: Goats, growth performance, parasites and high protein

Introduction

Domesticated goats (*Capra hircus)* play a significant role in providing animal protein for the human population and they are found generally in every region of the world (Akinsoyinu, 1985). Goat meat is healthy and nutritious and is exceptionally low in fat and calories compared with other meats (Celik *et al*., 2003). They are generally kept in small herds on mixed farms, usually by women and children within rural households and provide their owners with a broad range of products and socio-economic services such as cash income, security, gifts and manure for their crops .Goats constitute a very important part of the livestock sub sector in the Nigerian agricultural economy (Lakpini *et al.,* 2002). The use of goats for religious and social ceremonies adds unquantifiable value to their economic importance in the lives of Nigerians. They fulfil almost all useful task in supplying human population with meat, milk, skin, hair and other products (Adeloye, 1998).

In a small-holder farming system, meeting up with the nutrient requirement of goats especially the crude protein (7%) is often impossible as they usually feed on house hold waste and available grasses. This is even worse during the off season when the available grasses are lignified (NRC, 2005). This necessitates adequate supplementation to achieve their optimum performance of the growing goats. Also, increase in the crude protein content in goats' diet through supplementation will help to mitigate against the effect of endoparasites especially gastrointestinal nematodes.

Internal parasite infestations of herds can cause major health issues, which has a major effect on the animal's performance and cause great economic loss to the producer (Eysker and Ploeger, 2000; Min *et al*., 2005). In fact, most of the economic losses caused by internal parasites are actually not due to mortality but production loss (Waller, 2004). The proper management of internal parasites is extremely important to the success of the goat producer. The ability to detect the clinical signs of a major infection, to properly treat the herd, and to effectively reduce the herds exposure to parasites are all very important aspects of internal parasite management (Van Wyk and Bath, 2002; Kaplan *et al*., 2004). As the goat producer faces issues like the rise of anthelmintic resistance among parasites, the knowledge of how to properly manage internal parasites becomes imperative for the survival and the economic viability of his or her herd (Knox and Steel, 1996; Coop and Holmes, 1996).

Parasitic nematodes of the digestive tract remain one of the main constraints to goat production both in temperate and tropical countries. The usual mode of control of these gastrointestinal nematodes (GIN) based on the repeated use of anthelmintics, which is now strongly questioned because of the increasing development of resistance to these molecules (Kenyon *et al.,* 2009). Among the alternative methods to anthelmintics currently available, the manipulation of host nutrition in order to improve the host resistance and/or resilience to parasitic infections seems to represent one of the most promising options to reduce the dependence on conventional chemotherapy and to favour the sustainable control of gastrointestinal nematode infections (Knox, 2000). The manipulation of protein nutrition to improve the host response to nematode infection appears most attractive issue to reduce the reliance on chemotherapy to control parasitism (Hostel *et al.,* 2015). Also, with the development of FAMACHA chat, its very easy to practice a selective treatment rather than general treatment of the herd. It is hypothesize that supplementation of high protein in the goats' diet will improve the growthperformance and and reduce faecal egg count of WAD goat. Hence, this study

Materials and methods

Experimental site

The experiment was conducted at the Directorate of University Farm, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria. The farm lies within latitude 7°10'N longitude 3° 2'E and altitude 76mm. It is located in climate with the derived savannah zone of South-Western Nigeria. It has a humid climate with mean annual rainfall of 1037mm and temperature of about 34.7°C as recorded in (Google Earth, 2014).

Experimental animal and management

Eighteen WAD goats with FAMACHA score between C3 -E5 were selected from herd of goats at the Directorate of University Farm, Federal University of Agriculture, Abeokuta for selective treatment. The goat was housed individually in a pen made of corrugated iron sheet with a raised floor. The animals were allowed two weeks adjustment period to the experimental diet. The pens were washed and clean with Dettol disinfectant, they were equipped with plastic feeding and drinking troughs. Routine management practice was done on daily basis throughout the experimental period.Animals were fed the concentrate diets at 4 % of their body weight while *Panicum maximum* was fed *ad libitum*.

Experimental diets

Concentrate diets (Table 1) of varying crude protein were compounded from maize,

maize bran, wheat offal, oyster shell, bone meal, fillers, premix, salt, methionine, and PKC which were compounded and milled at different levels to contain (7.5 % LP, 10.5 % MP, and 14.5 % HP) crude protein. Water and *Panicum maximum* were fed *ad libitum* throughout the period of the experiment.

Table 1: Ingredient composition of the experimental diets (%)

Ingredients	Diet I (HP)	Diet II (MP)	Diet III (LP)
Maize	25	60	55
PKC	35	25	0
Wheat offal	25	5	5
Maize bran	10	5	25
Oyster	2	2	2
Premix	0.5	0.5	0.5
SALT(Nacl)	0.3	0.3	0.3
Methionine	0.2	0.2	0.2
Bone	2	2	2
Fillers	0	0	10
Total	100.00	100.00	100.00
Determined analysis			
Crude protein (%)	14.21	11.03	8.11
Metabolizable energy (MJ/kg)	12.98	9.37	8.51

Experimental design

The eighteen (1) WAD goats were grouped into three (3) treatments group (low, medium and high protein diets) of six (6) animals per treatment. Each group was replicated thrice with two (2) animals per replicate and were randomly allotted to one of the experimental diets in a completely randomized design.

Data collection

Goats were weighed at the onset of the experiments and subsequently at a week intervals to determine their weight gain throughout the experimental period. Famacha scores of the goats were taken at the onset of the experiment and subsequently at a week intervals to monitor theimprovement in their anaemic levels.Faecal samples were collected directly from the rectum of experimental WAD goats at the commencement of the experiment to determine the faecal egg count (FEC) as a measure of initial parasite infestation. Afterwards, samples were collected twice in a month. The samples were taken to the Veterinary and Parasitological Laboratory of Federal University of Agriculture, Abeokuta for analysis using Wisconsin salt floatation technique (Dryden *et al.,* 2005; Todd *et al*., 1972).

Statistical analysis

Data were subjected to descriptive statistics analysis as contained in Microsoft Excel 2010.

Results and discussion

Figure 1 shows the changes in Famacha score of the experimental goats fed varying levels of protein. The famacha score decreased from the onset of the experiment to the end of the experiment. The average FAMACHA score was 4.0 at the onset of the experiment, this reduced from the beginning of the experiment to an average of 2.0 indicating that the supplemented protein progressively reduced the FAMACHA score as well as the anaemic level in the experimental goats. Katunguka-Rwakishaya *et al.* (1997) reported that

supplementary feeding reduced severity of anaemia. This fact was further buttress by the report of Tham (2015) who reported that increased level of dietary protein and / or improved plane of nutrition resulted in improvement of severity of the anaemia.

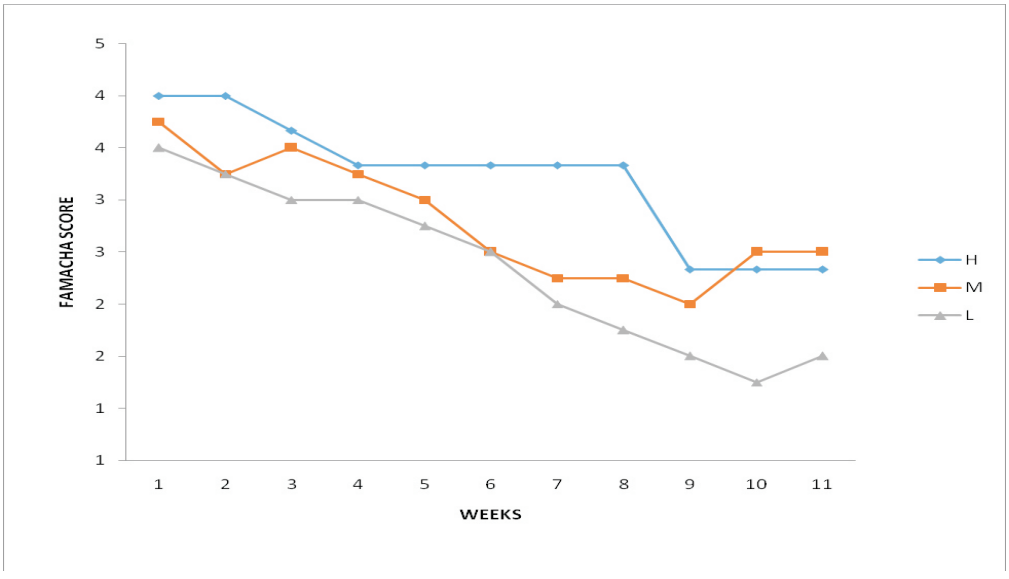

Figure 1: Changes in famacha score of goat fed varying levels of protein

Figure 2 shows the growth performance of the experimental goats fed varying levels of protein. The growth performance increased from the onset of the experiment to the end of the experiment.Animals fed high protein (HP) diet have the highest growth performance from week 1 to the last week of the experiment, followed by animals fed with medium protein diet which has increase in growth performance from week 2 to week 3 of the experiment and later decreased in week 4 and maintain it till week 6 of the experiment and the highest performance was seen from week 6 to the last week of the experiment. Animals fed with low protein diets had a slight increase in their growth performance from week 2 and maintain it till week 6 and later increased from week 6 to the end of the experiment.

Adequate supply of protein and well balanced amino acids are very crucial factors for proper growth (Abdelrahmanand Aljumaah, 2014). This study is in line with the report of Shahjalal *et al*. (2000) in black Bengal goats where higher live body weight gain was recorded with increasing dietary protein. Zundt *et al*. (2002) also reported a linear effect of different protein level on average daily gain. In contrast, Nuno *et al*. (2009) reported that the protein levels in the diet (14, 16 and 18%) had little or no effect on the performance of Dorper or Pelibuey lambs during fattening. This disagreement may result from breed, feed type, stage of growth and environmental factors (Negesse *et al*., 2001). From this study, it can be inferred that feeding WAD goats 14% crude protein as recommended by NRC (2002) is quite adequate to cover their protein requirements and increase their growth performance.

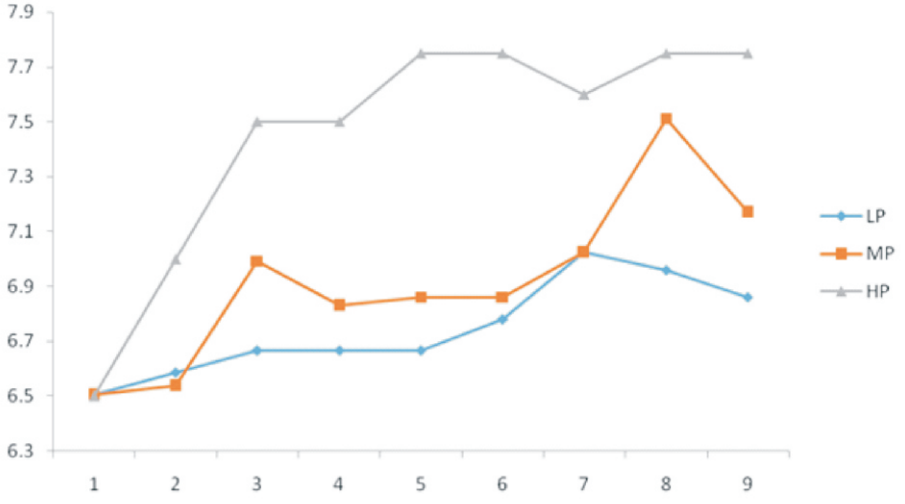

Figure 2: Growth performance of the experimental goats fed varying levels of protein.

Figure 3 presents the effect of varying level of protein on egg per gram of the faeces. Goats fed high protein diet (HP) had a reduced egg per gram of goat faeces decreased at a constant rate from the beginning of the experiment till the end of the experiment while those fed medium protein (MP) and low protein decreased slowly compared to those fed high protein diet. Worms represents the greatest and worst health problem in ruminant production and economically impedes goat production (Buzzullini *et al.,* 2007). High protein diet decreased the egg per gram of the faeces (Etter *et al*., 1999). This also in line with the report of Van Houtert and Sykes (1996) that protein diet as a supplement is an important factor to increase the resilience and resistance of goat against simple/mixed infection caused by gastrointestinal nematode. Diet with high level of protein provides enhanced immune response, especially to breeds naturally more resistant to worm infection (Bricarello *et al*., 2005; Wallace *et al*., 1998; Kambara *et al.*, 1993; Kambara and Mcfarlane, 1996; Chartier *et al*. 2000).

The effect of varying level of protein on oocyst per gram of goat faeces is shown in figure 4. Samples were collected twice every month throughout the period of the experiment. The oocyst per gram of the faeces in goats fed high protein diet (HP) reduced from the onset of the experiment till the end of the experiment while in goats fed medium protein (MP), it increased initially and dropped at almost the same rate then later increase till the end of the experiment. Furthermore, goats fed low protein diet (LP) slightly increased at first and later decreased. Goats on high protein (HP) showed reduced oocyst per gram compared to other diets. This might be due to the absorption of crude protein readily available in the diet by the goats which reduced the oocyst per gram (OPG) to the barest minimum (Knox, 2000).In agreement with this present study, a number of studies indicated that protein supplementation appears to be the most effective, in enhancing particular immune responses associated with later stages in the acquisition of host resistance (Van Houtert *et al.,* 1995; Coop and Holmes, 1996; van Houtert and Sykes, 1996; Knox, 2000). Hughes and Kelly (2006) also observed that well-nourished animals are usually more resilient against parasitic infections.

However, this was evident in the present study as animals fed high protein diet had a decrease in the oocyst per gram of faeces because, the high crude protein content of the feed at (14%) gave the host resistance and resilience against gastrointestinal parasite (Knox, *et al.,* 1994). Also, those fed medium protein (MP) also reduced with time. This result however, conforms to the report of Abbott *et al*. (1986a, 1986b). It is generally accepted that animals on elevated planes of nutrition naturally express better resistance/resilience to infection and to diseases, directly related to pathophysiological impairment (Wallace *et al*., 1995; Donaldson *et al* 1999; 2000). Again, goats given additional dietary protein at 14% inclusion were able to expel eggs of worms in faeces, thus relieving them of high worm burden (Brown *et al.*, 1991), thereby enhancing a better resistance to parasites (Houtert *et al.*, 1995; Kambara and Mcfarlane, 1996). Chartier *et al*. (2000) was of the opinion that resistance and resilience of high productive goats to gastrointestinal nematodes may be improved by a protein supplementation in the diet which is in strong agreement with this present study.

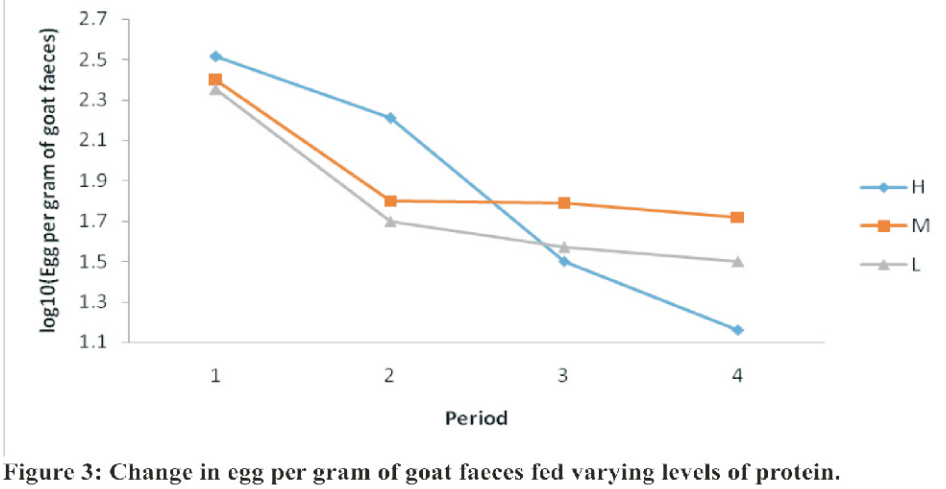

Figure 3: Change in egg per gram of goat faeces fed varying levels of protein.

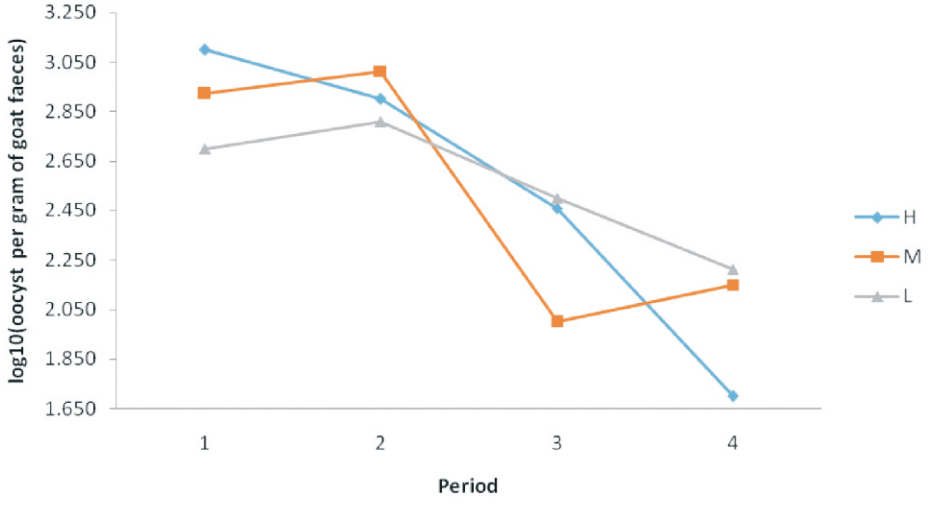

Figure 4: Change in oocyst per gram of goat faeces fed varying levels of protein.

Conclusion

The study showed that FAMACHA chat was a good tool that can be employed in selective treatment of internal parasites in WAD goats. Supplementation with high protein diet can be used tocounter internal parasitism in goats instead of the common chemotherapeutic treatment which usually have a residual effect on both animals and humans. It will also enhance improved performance and resilence of the WAD goats

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