

EFFECTS OF AGRO-INDUSTRIAL BY-PRODUCT SUPPLEMENTATION ON THE GROWTH PERFORMANCE AND HEMATOLOGY OF DJALLONKÉ SHEEP

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ABSTRACT

This study was carried out to determine the effects of agro-industrial by-products on the growth and hematology of Djallonké sheep. A total 12 animals with an average initial weight of 13.8 ± 2 kg were randomly assigned to three different dietary treatments. The treatments were T0 (Control), T1 and T2. Animals on T1 and T2 were supplemented with 200g and 400g/head/day respectively of a mixture of shea nut cake (SNC) rice milling waste (RMW) and waste from the corn mill (CMR). Animals on the control (T0) did not receive any supplementation. All the animals were released at 9.00hrs for grazing and were led back to the pen at 17.00hrs. The supplement was offered in the morning at 6.30hrs and was left in the cage till the following day. Animals on T1 were more efficient in terms of their feed intake in relation to the amount of feed offered. Final weight gain and average daily weight gain were significantly lower for the non-supplemented animals. There was however no difference between T1 and T2 in terms of weight gain. Packed cell volume (PCV), Hb and RBC compared favorably with results reported in other similar studies. Feeding 200g/head/day of the supplementary diet enhanced growth of Djallonké sheep in the dry season

Keywords: Corn milling waste, Haematology, Rice milling waste, Sheanut cake, Supplementation, Sheep, growth performance

INTRODUCTION

The Northern part of Ghana is naturally noted for its long period of dry season. This period always leads to a reduction in both the quality and quantity of forage which serves as the main source of feed to sheep and other ruminants. This leads to loss of weight and low productivity among the animals.

To address this unhealthy phenomenon, supplementary feeding could be considered particularly during the dry seasons. There is some evidence that the use of protein feedstuffs such as whole cotton seed, shea nut waste, and soya bean cake among others improved the voluntary intake and utilization of crop residues by ruminants (Ansah et al. 2011; Konlan

et al. 2012). The extent of mixed farming system and the processing activities prevailing within the Northern Region provide an opportunity for crop residues and agro-industrial by-products (AIBP) to be harnessed for the purpose of proper feeding of livestock. Rice milling waste (RMW), shea nut cake (SNC) and other milling wastes generated from the corn mills (CMR) are some of the agro-industrial by-products (AIBP) generated in relatively large amounts in the northern regions. Most local people send their grains and/or cereals such as cowpea, groundnut, maize, millet, etc. to the corn mill for milling, and after milling a lot of waste is generated. This could be used as feed ingredient in the diet of animals. Atuahene *et al.* (1998) reported a CP of 16.24% and metabolizable energy (MJ/kg) of 7.12 for SNC. There is also evidence that SNC contains tannins, theobromine and saponins (Okai *et al.*, 1995; Atuahene *et al.*, 1998). Dietary tannins, theobromine and saponins at certain concentrations regardless of the source are deleterious to animal growth (Clarke and Clarke, 1967). Higher levels of silica in rice waste similarly limit intake and digestibility (Agbagla-Dohnani *et al.*, 2003; Van Soest, 2006). Esonu *et al.* (2001) stated that the hematological constituents reflect the physiological responsiveness of the animal to its internal and external environment, which include feeds and feeding.

The objective of the study was therefore, to determine the effects of 2 levels of AIBP-based supplements on the growth performance and hematology of Djallonké sheep.

MATERIALS AND METHODS

Study area

The study was carried out at the University for Development Studies sheep experimental farm, Nyankpala campus, in the Tolon-Kumbungu District. Nyankpala is approximately 16 km W of Tamale. The area is part of the Guinea Savanna Zone with an average annual rainfall of about 1060mm. It has a unimodal rainfall pattern with a temperature range of 28-35°C.

Experimental animals and design

A total of 12 Djallonké sheep with an average weight of 13.8±2kg were assigned to three different dietary treatments in a completely randomized design (CRD). The experiment lasted for 56 days. All the twelve (12) sheep were dewormed with Albendazole before the start of the experiment.

Housing and Feeding

The sheep were kept in individual cages but in the same pen which was roofed with corrugated asbestos sheets and was built with cement blocks.

The twelve (12) sheep were divided into three groups of four animals each and were subjected to the 3 treatments labeled T0, T1 and T2. The control group (T0) did not receive any supplemental feed. Animals on T1 were given 200g/head of the supplemental feed daily while T2 sheep were given 400g/head of the same feed. All the animals were given water *ad-libitum*. The three ingredients (corn mill residue, shea nut cake and rice milling waste) were thoroughly mixed in the proportion of 50%, 25% and 25% (Table 1). Corn mill residue (CMR) in this study refers to the residue left after various food crops have been milled at the corn mill. The residue is collected and dried in the sun in order to prevent it from going mouldy during storage. The animals were allowed access to natural rangeland daily between 9.00hrs to 17.00pm while the supplemental diets were given at 06.30hrs till the following day.

Data collection

Animals on the experimental diets were allowed a period of 7 days to adjust to the new feed after which data collection commenced. Parameters measured included average daily supplement intake and weekly weight gain. The blood parameters were analyzed using the methods described below:

Hemoglobin concentration was measured by the cyanmethaemoglobin method (Benjamin, 1961). White Blood Cells (WBCs) count was

Table 1: Composition of experimental diet (%) and Analyzed Chemical Composition (% dry matter)

Ingredients	Inclusion level (%)
Shea nut Cake (SNC)	25%
Corn Milling Residue (CMR)	50%
Rice Milling Waste (RMW)	25%
Dry Matter	51.3±0.7
Crude Protein	14±0.8
Ether Extract	8.3±2.4
Ash	7.5±0.1

determined using haemocytometer after mixing the blood with Turks solution in a proportion of 1:19 (Schalm *et al.*, 1975). Packed Cell Volume (PCV) values were read using a haematocrit reader after spinning the blood at a high speed of 5000 rpm for 5 minutes in a haematocrit centrifuge (Coles, 1980). WBC-differentials were determined as described by Turfery (1995).

Chemical Analysis

The supplement was analyzed for crude protein, ether extract, ash and dry matter contents according to the procedures of the AOAC (1997). The results presented are on dry matter basis.

Statistical Analysis

One way analysis of variance from Genstat 13th edition was used to analyze the data gathered and means were separated using Duncun Multiple range test.

RESULTS AND DISCUSSION

Animals on T1 were more efficient in their feed intake compared to T2 in relation to the total amount of supplement offered. Animals on T1 had an intake of 95.2% of the 200g/head/day compared to the 48.65% of the 400g/head/day offered. Shea nut cake (SNC) has been reported to contain theobromine and saponin while RMW contained silica (Clarke and Clarke, 1967, Agbagla-Dohnani *et al.*, 2003 and Van Soest, 2006). The relatively low feed intake by animals on T2 could be a mechanism used by the animals to reduce the intake of the anti-nutritional factors present in the supplementary diet.

Both final weight gain and daily weight gain were significantly lower for animals on T0 compared to the supplemented animals. This trend is similar to what was reported by Konlan *et al.* (2012) who fed two different levels of shea nut cake as supplement to semi intensively managed sheep and compared that to a non-supplemented group. The animals on the supplemented diets obtained a higher final weight gain compared to the non-supplemented. The high crude protein (14%) in the supplementary diet may have resulted in the higher final weight gain. The supplement may have supplied the required amount of rumen degradable protein which provided the conducive rumen environment for the digestibility of the forage the animal grazed when released. Rumen ammonium nitrogen is required by rumen microbes in order to enhance

Table 2: Feed intake and growth performance of Djallonké fed AIBP-based supplement

Parameter	Treatments			s.e.d
	T0	T1	T2	
Initial weight (kg)	13.00	14.50	14.00	2.47
Mean daily intake (Supplement) (g)	–	190.4 (95.2%) [†]	194.6 (48.65%)	7.52
Final weight gain (kg)	2.19 ^a	4.00 ^b	4.12 ^b	0.60
Final weight (kg)	15.19 ^a	18.50 ^b	18.12 ^b	2.20
Daily weight gain (g)	39.1 ^a	71.4 ^b	73.6 ^b	10.79

s.e.d: standard error of difference, ^{ab}-means in the same row for each parameter with different superscripts are significantly different ($p < 0.05$).

plant cell wall digestion. Satter and Slyter (1974) reported an optimum ammonia concentration value of 50-80mgNH₃-N/L of rumen fluid for optimal microbial growth. Orskov, (1982) also reported that the optimum NH₃-N required for fermentation of feed material in the rumen is approximately 235mg/L. One of the main sources of rumen ammonium nitrogen is rumen degradable protein which in this case the supplement may have provided. Dietary tannins have been reported to bind proteins in the rumen thereby reducing rumen protein degradability. The final weight gain obtained in this study for animals on the supplement could mean a lower effect of tannins on protein degradability in the rumen. The results on weight gain for the non-supplemented sheep could be an indication that free ranging or semi intensively managed animals without supplements in the dry season may not be getting enough dietary protein from the forage grazed, hence the need for supplementation.

The inclusion level of 25% for shea nut cake did not lead to a decrease in the weight gains of the sheep. This therefore disagrees with the findings of Essien (2003) and Issaka (2006) who reported a decreasing weight gain as shea nut cake inclusion levels increased from 15% to 30% in the supplemented diet of Djallonké sheep. The difference could be attributed to the complementary effect of the ingredients used. Essien (2003) and Issaka (2006) both used SNC with soya bean meal. This could

mean that SNC performs better when fed with other non oil extracted residues such as rice milling waste.

Table 3 shows that, there were no significant differences ($P>0.05$) among the treatments for the various blood profiles. The PCV and hemoglobin compares favorably with the findings of Konlan *et al.* (2012) but were slightly higher than what was reported by Olayemi *et al.* (2000) for extensively managed sheep. However the WBC reported in this study is far above that which was reported by Konlan *et al.* (2012).

CONCLUSION AND RECOMMENDATION

Feeding a mixture of SNC, CMR and RMW enhanced the growth of sheep in the dry season. The maximum level of supplementation for this diet should be 200g/ sheep/ day.

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Table 3: Blood profile of Djallonké sheep after being fed with agro-industrial by-products

Parameters	Treatments*			s.e.d
	T0(0g)	T1(200g)	T2(400g)	
Packed Cell Volume (%)	31.50	31.25	32.00	2.11
Hemoglobin (g/dl)	10.48	10.40	10.68	0.71
Red Blood Cell ($\times 10^6/\mu 1$)	4.08	4.05	4.17	0.29
Total White Blood Cell ($\times 10^9/L$)	22.00	22.10	21.10	3.70
Neutrophil (%)	44.20	46.20	47.20	3.23
Eosinophil (%)	4.50	5.75	4.00	2.18

*means in the same row for each parameter with without superscripts are not significantly different ($p<0.05$).

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