BLOOD PROFILE OF WEST AFRICAN DWARF GOATS FED MICROBIAL TREATED MAIZE HUSK DIETS

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ABSTRACT
Neurospora crassa and *Lactobacillus debruickii* are the principal microbes utilized in biotechnology worldwide, due largely to its unique physiology, ability to degrade fibrous feed materials and associated key roles in many food fermentations and other industrial processes. In this project, these fungi were used to test their effectiveness in degrading maize husk and their nutritive potentials in ruminant nutrition. Maize husks were collected, screened, dried, milled, boiled at 100^{o}C for 30 minutes and ensiled anaerobically with microbes (*Neurospora crassa* and *Lactobacillus debruickii)* for five days. Thereafter, three diets were formulated such that untreated maize husk was replaced with 0, 40 and 60% microbial treated maize husk meals with other feedstuffs and fed to 18 goats for 56days to assess their intake and the concomitant effect on the blood samples of the animals. Results revealed that all parameters observed were significantly ($p<0.05$) and numerically influenced. At 60% replacement level of microbial treated maize husk, the dietary crude protein improved significantly compared to others. The goats accepted/tolerated the diets and the blood profiling of the goats showed that the animals are healthy as the packed cell volume, red blood cell, white blood cell, haemoglobin, serum total protein, globulin, aspartate aminotransferase concentrations were within the normal range for healthy goats. Summarily, the strategy could serve as a means of converting waste generated by crop farmers to wealth – "animal protein" to foster food security in Nigeria.

Keywords: Silage, ruminant, packed cell volume, *Neurospora crassa* and *Lactobacillus debruickii*

INTRODUCTION
The domestic goat (*Capra aegagrus hircus*) is a subspecies of goat domesticated from the wild goat of southwest Asia and Eastern Europe. There are over 300 distinct breeds of goat (Hirst and Kris, 2008). Goats are one of the oldest domesticated species, and have been used for their milk, meat, hair, and skins over much of the world (Coffey *et al.*, 2014). The importance of goats in achieving food and economic securities in developing country like Nigeria is increasingly being realized. Their production is a function of the level of feeding, in which feed constitutes about 70-80% of the total cost of livestock production under intensive system of management in Nigeria (FAO, 2001). Feed quality determines the performance of livestock in terms of weight gain, health status, meat production and feed conversion efficiency. Their nutrient requirement of livestock vary with age, body weight and stage of production. Inadequacy of quality feeds especially during the dry periods has necessitated the use of alternative feed resources. However, some of these feed resources contain anti – nutrients, are low in nutrient, digestibility and even unpalatable to animals (Olorunnisomo and Ibhaze, 2013). For instance, maize husk – crop residue, cheaply and abundantly available in the Nigeria but relatively poor in nutritive value (7.44% CP, 30.45% CF, 34.25% cellulose, 21.99% hemicellulose, 14.87% lignin as reported by Akinfemi *et al.* (2009). Thus, could be microbially-treated to nutritionally enhance this potential feed material to meet the nutrient requirement by these animals.
More so, blood is a bodily fluid in animals that delivers necessary substances such as nutrients and oxygen to the cells and transports metabolic waste products away from those same cells. Blood contains antibodies, nutrients, oxygen, regulates body temperature and pH, and removes waste such as carbon dioxide, urea, and lactic acid and thus, much more to help the body work. Consequently, blood has a direct and indirect impact on the health status of animal. In view of these, this study was conducted to evaluate the nutritive value of *Neurospora crassa* and *Lactobacillus debbruickii* treated maize husk diets; nutrient intake and blood profiles of WAD goats fed treated microbial maize husk diets.

MATERIALS AND METHODS

The experiment was conducted at the small ruminants unit of the Teaching and Research (T&R) Farm while the laboratory analysis was carried out at the Nutrition Laboratory of Animal Production and Health, Federal University of Technology, Akure (FUTA).

The maize husks were collected from Teaching and Research Farm of Crop Science and Pest, FUTA, screened, dried, milled and stored in plastic container until use. *Neurospora crassa* and *Lactobacillus debruickii* were cultured from the Microbiology Laboratory, FUTA while other feed ingredients were gotten from a reputable feed mill in Akure.

The maize husk were which were subjected to boiling at 100^{o}C for 30 minutes and ensiled anaerobically with microbes (*Neurospora crassa* and *Lactobacillus debruickii)* for five days and thereafter air-dried for two (2) days. The three diets were formulated such that untreated maize husk was replaced with 0, 40 and 60% microbial treated maize husk meals with other feedstuffs as indicated in Table 1.

Table 1: Gross and nutrient composition of *N. crassa* and *L. debruickii treated maize husk-based* diets

	Diets (%)		
Ingredients	**DT1 (0%)**	**DT2 (40%)**	**DT3 (60%)**
Untreated maize husk meal	50.00	30.00	20.00
N. crassa + L. debruickii treated maize husk meal	0.00	20.00	30.00
Brewer dried grain	11.00	11.00	11.00
Palm kernel cake	24.00	24.00	24.00
Molasses	10.00	10.00	10.00
Bone meal	1.00	1.00	1.00
Salt	3.00	3.00	3.00
Premix	1.00	1.00	1.00
Total	***100.00***	***100.00***	***100.00***
Analyzed nutrients			
Dry matter	80.63	83.92	81.82
Crude protein	5.47	6.46	8.56
Crude fibre	20.90	19.01	17.55
Ether extract	3.47	5.46	7.56
Ash	9.08	10.68	10.58

A total of eighteen goats selected from the flock available on FUTA T & R, Farm were used in the trial. They were balanced for weight and randomly assigned to the three (3) diets of 6 goats per replicate/treatment in a Completely Randomized Design experiment. The goats were managed under an intensive system/condition. A pen was allocated each to each goat with a feeder and drinking bowl. The animals were vaccinated against *Pesté-Petit dé Ruminanté* (PPR / kata), prophylactically treated against ecto-parasite using Diasuntol® and were also treated against infections by using oxytetracycline LA® at the rate of 1ml per 10kg body weight per animal. This preventive practice was carried out before the commencement of the experiment. The goats were fed daily (2-4% of their body weight) early in the morning (8:00 am) and fresh potable water was given (*ad libitum*) throughout the experimental period of 8 weeks. The feed intake was determined by deducting the left over from the quantity offered.

The goats were routinely weighed weekly in the morning before feeding, to observe weight change using the spring-balance (hanging scale).

At the termination of the experiment, blood samples of about 5-10ml was collected with aid of a syringe from the external jugular vein of each goats from each animal at the end of the experiment. The blood samples were collected into two different EDTA bottles (one with and other without anticoagulant) for haematological and serum biochemical assay.

Feed samples collected were analyzed for nutrient composition while the blood samples were analyzed according to AOAC (2002) procedures. All data generated were subjected to one-way

analysis of variance and Duncan Multiple Range Test was used to separate the means at $p<0.05$ using SAS (2008).

RESULTS AND DISCUSSION

From Table 1, dry matter (DM) ranged from 80.63 to 83.92 %, the highest value was observed in the DT2 (40% microbial treated maize husk meal), while the lowest was observed in control diet (DT1). The crude protein (CP) of the diets ranged from 5.47 to 8.56%, DT3 had the highest crude protein (8.56%). The least crude fibre (CF) content was observed in DT3 and highest is in DT1 (20.90%). The DM and CF were adequate to support the rumination in the goats and digestion of the diets by the rumen microbes.

Table 2: Nutrient intake, haematology and serum biochemical indices of goats fed *N. crassa* and *L. debruickii treated maize husk-based* diets

	Diets (%)			
Ingredients	**DT1 (0%)**	**DT2 (40%)**	**DT3 (60%)**	**SEM**
Nutrient intake (g/d)				
Dry matter	168.85^{c}	218.97^{a}	196.64^{b}	8.73
Crude protein	11.45^{c}	16.86^{b}	20.57^{a}	0.72
Crude fibre	43.77	49.60	42.18	0.77
Ether extract	7.27^{c}	14.25^{b}	18.17^{a}	0.52
Ash	19.01^{b}	27.87^{a}	25.43^{ab}	0.18
Heamatology				
Pack Cell Volume (%)	21.67^{b}	21.76^{b}	25.67^{a}	1.32
Red Blood Cell ($\times10^{6}$ µl)	2.47^{b}	5.50^{ab}	9.77^{a}	0.71
White Blood Cell ($\times10^{6}$ µl)	6.12^{c}	10.05^{b}	14.13^{a}	0.78
Haemoglobin (g/100ml)	4.00^{b}	5.90^{ab}	8.57^{a}	0.45
Lymphocytes (%)	64.67^{a}	64.33^{a}	62.67^{b}	0.23
Serum indices				
Total protein (g/l)	87.41^{c}	91.73^{b}	97.53^{a}	5.52
Albumin (g/l)	37.93	48.43	44.62	6.72
Globulin (g/l)	50.78	43.20	52.92	2.53
Aspartate aminotransferase (u/l)	123.52^{a}	84.00^{b}	48.00^{c}	8.04
Alanine transferase (u/l)	33.33^{a}	14.00^{b}	9.60^{c}	2.21

a b c = means within the same row with different superscripts are significantly different ($P < 0.05$)

From Table 2, DMI by goat fed DT2 was the highest (218.97g/day) while the least was observed in goat fed DT1 (168.85g/day). The highest crude protein intake (20.57g/d) was obtained for goats fed DT3. The least CF intake was observed in goat fed DT1 (43.77g/d) and the highest in DT2 (49.60g/d). Though, values are not statistically ($p<0.05$) influenced. Ether extract in goats fed DT3 was the highest (18.17g/d) compared to other goats. Ash intake ranged from 19.01g/d (DT1) to 27.87g/d (DT2). The relatively high DMI value might be related to protein quality and acceptability of the diets as well as pre-fermentation of the maize husk meals. Thus, enhance the "gut fill" of the goats and rate of passage from rumen.

The results revealed that the determined haematological indices were significantly ($P<0.05$) influenced by the varied inclusion of microbial treated maize husk in the experimental diets.

The PCV value ranged from 21.67 to 25.67% and falls within the normal range recommended for healthy goat (22 % to 38 %). Thus, implied that the goats were not stressed and anaemic. The RBC count in goats fed DT3 was the highest (9.77 $\times10^{6}$µL) while goats fed DT1 had the lowest RBC count (2.47 $\times10^{6}$µL). White blood cell (WBC) values observed ranged between 6.12 and 14.13 ($\times10^{6}$µL). Haemoglobin (Hb) values observed ranged between 4.00 and 8.57 (g/100ml). Lymphocyte contents ranged from 62.67 and 64.67%. The WBC values reported especially those fed DT 3 (60% replacement level of microbial treated maize husk) indicated that the goats had good immunity to fighting against diseases in the body but the low haemoglobin values is indicative of poor oxygen on blood circulation. However, the goats didn't shown unhealthy status. The total protein values observed ranged between 87.41(DT1) and 97.53g/L (DT3). This implied that the diet were high in crude protein because total serum protein is an indicator of quality feed. Albumin concentration

ranged from 37.93 to 48.43g/L. Albumin helps to hasten blood clot during injury thereby reducing loss of blood. The low globulin values could pose danger to the proper functioning of the liver of the animals, as this enzyme biomarkers are for liver diagnosis. The values for the AST ranges from 48.00 IU/L in DT3 to 123.52 IU/L in DT1. Elevated AST level are usually a sign of liver infarction i.e. the toxicity as a result of the diets.

CONCLUSION AND RECOMMENDATION

From foregoing, the synergistic effect of *N. crassa* and *L. debruickii* improved the nutritive value of the maize husk/diets. As a consequence, nutrient intake were enhanced and positively influence the blood profile and health status of the goats. Replacement of microbial treated maize husk in ruminant diet at 60% improved nutrient composition (protein), nutrient intake and supported the wellbeing of the goats as there is no indication of disease(s) or compromised immunity. With the strategy to optimize the use of maize husk in ruminants' diet, it would be of great help to convert "waste to wealth".

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