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Carcass yield of West African dwarf goats fed graded level of millet husk – based diets

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Abstract

The study evaluated the effect of replacing wheat bran with millet husk on the carcass traits of West African dwarf (WAD) goats under. Twenty weaner goats were randomly allocated to five dietary treatments (T1 – T5 in a Completely Randomized Design, with 4 animals per treatment. T1 serves as the control with 0% millet husk, while T2, T3, T4, and T5 contained 6.25%, 12.5%, 18.75 and 25% millet husk inclusion levels as a replacement for wheat bran respectively. The feeding trial lasted 90 days and carcass characteristics were assessed. The results revealed that goats on T1 exhibited superior growth and carcass characteristics compared to those on T2 –T5 ($p<0.05$). However, goats fed diets containing up to 50% millet husk replacement maintained appreciable live weight and carcass traits, indicating that millet husk and serve as a viable partial substitute for wheat bran. The inclusion of millet husk also promotes the utilization of an agricultural waste, reduce environmental pollution, and adds economics value to millet husk. Additionally, it provides a practical alternatives to mitigate feed scarcity during the lean period of the year. It is therefore concluded that millet husk can replace wheat bran at up to 50% in the diets of WAD goats without compromising growth and carcass performance.

Keywords: *WAD goat, millet husk, wheat bran, carcass traits and feed scarcity*

Introduction

In Nigeria, goat farming is majorly on the indigenous breed of West African dwarf (WAD) goat in the forest zone, Sahel and red Sokoto goats in the drier parts of the northern country. These breeds have adapted to the environment and their reproductive traits are not compromised. WAD goats are known for their high prolificacy and have an average of 1.7kg at birth. They often give birth to multiple litters of twins, triplet and even quadruplet and, under traditional system they kids three times in two years (Mamabolo and Web, 2005). In this vein, the flock size grow fast and give returns to the keeper. They support income generation through sale of live animals, and their products of meat, milk, and manure which is used to promote crop production (Alilo *et al.*, 2018).

Most importantly, WAD goats could be maintained on low cost feed resources like grasses, browse leaves, farm wastes, kitchen wastes and industrial by-products (Ogunbosoye, 2012). Goetsch et al. (2011) and Wang et al. (2014) reported that feeding concentrate –based diets improves the growth rate, dressing percentage and carcass characteristics of goats compared to grass-fed goats. Similarly, Bambou et al. (2021) concluded in their research that the feeding mode and the age at slaughter greatly influenced the carcass traits of goat.

Millet husk (or hull) is a byproduct from the millet crop and constitute an important roughage source for ruminants in many areas. The husk is the scaly protective casings of the millet that is dehulled to obtain the grain parts. The husk is indigestible by humans, but livestock can eat it and used as fodder feed materials (Jones, 2006). Million tons of millet husk are wasted in Nigeria after threshing of millet in the farms. The proximate composition of millet husk was reported to be 5.2% CP (Maidala and Bakoji, 2016). These waste materials can be harnessed and used as a source of fibre or energy for ruminant animals, most especially when it is carefully combined with other ingredients that are of high quality to produce a least cost feed for ruminants, for maximum profits.

In the feed industry, maize, soybean, and wheat are the main feed sources from grain that are in competition with humans. Competition with humans on millet is limited owing to wide usage of millet as raw material in food industry. During the processing of these feed materials, tons of by-products, such as straw, hull, and husk are produced. The use of these by-product in animal nutrition especially ruminant nutrition could greatly lower the cost of production while also serving as back-up feed materials in case of scarcity of forages especially during the dry season. Their utilization by the animal would also help to reduce environmental pollution that characterized their disposal and increase feed availability to mitigate feed shortage and to enhance ruminant productivity. Hence, the objective of this study is to investigate the carcass traits of WAD goat fed millet-based diet in replacement of wheat bran at graded level.

Materials and methods

Collection and Processing of Millet Husk

Millet husk was obtained from milling industries in Niger State. The husk was transported to the Teaching and Research Farm of Kwara State University, Malete. All unwanted materials were removed from the husk, the husk was dried properly and then made ready for use.

Experimental Animals

The experimental animals comprised of twenty (20) growing WAD goats of average 8 months with average weight of 7.5kg sourced from Ajase Ipo Cattle market, Kwara State. They were quarantined upon arrival at the Small Ruminant Unit of the Teaching and Research Farm and administered with Rinderpest Tissue Culture (RTCV) vaccine, subcutaneously at 1 ml/10 kg body weight against Peste de Petite Ruminant, Ivomectin (dewormer at 3 ml/10 kg body weight), dusted with ectoraid against ectoparasites and treated with oxytetracycline HCl (a broad spectrum antibiotics) prior to the commencement of the experiment. The animals were housed in their individual pen, supplied with a plastic container to offer experimental diets and have *ad libitum* access to clean water in their specific compartment throughout the entire feeding trial period.

Experimental Design and Diet Formulation

The animals were randomly allotted to five dietary treatments in a completely randomized design (CRD) with four (4) goats in each of the treatments. The five experimental treatments administered are:

Treatment 1: Basal diet at 0% millet husk (Control).
Treatment 2: Basal diet at 25% millet husk
Treatment 3: Basal diet at 50% millet husk
Treatment 4: Basal diet at 75% millet husk
Treatment 5: Basal diet at 100% millet husk

Table 1: Composition (%) of the Experimental Diets at Graded Level of Millet Husk

Ingredients	*Treatments*				
	T1 (0%) MH	T2 (25%) MH	T3 (50%) MH	T4 (75%) HM	T5 (100%) RMH
Wheat bran	25	18.75	12.5	6.25	0
RMH	0	6.25	12.5	18.75	25
SBMW	10	10	10	10	10
Cassava Peel	45	45	45	45	45
Palm Kernel Cake	10	10	10	10	10
Maize	2.5	2.5	2.5	2.5	2.5
Urea	4	4	4	4	4
Bone meal	2	2	2	2	2
Oyster Shell	0.5	0.5	0.5	0.5	0.5
Salt	1	1	1	1	1

MH = raw millet husk, SBM = soybean waste

Chemical Composition

Crude protein, crude fibre, ether extract and ash concentrations of the experimental diets were estimated. The moisture content of the diets was determined by drying in a forced-air oven at 60^0C until constant weight was achieved. After drying, samples was ground to pass a 2mm sieve and then subjected to proximate analysis according to AOAC, (2005). Neutral detergent fibre (NDF), Acid detergent fibre (ADF), Acid detergent lignin (ADL) and Hemicelluloses and cellulose were analyzed according to Van Soest *et al.* (1994) procedure.

Carcass Evaluation

At the termination of the feeding trial, the animals were fasted for 24 hours (Kalio and Amadi 2018), weighed and three animals per treatment were slaughtered. They were bled by severing both the carotid arteries and jugular veins on both sides, using a sharp knife without stunning. After slaughter, they were skinned and then washed thoroughly. The warm carcass weight (WCW) was then determined. The carcasses were eviscerated to separate the various internal organs (stomach, intestine, liver, kidney, etc). The warm carcasses (WCs) were carefully split into two halves along the vertebral axis and subsequently separated into the various cuts using a sharp machete.

The separation into the cuts comprised the head, hind and fore leg, lion, flank, breast, rack, shoulder, neck and tail. The method of separation of the carcass to their primal parts was according to the procedures described by Kalio and Amadi (2018). The shoulder was separated between the 5th and 6th vertebrae perpendicular to the back line, 1.25cm above the elbow joint. The breast, shank and flank were separated from the face of the leg parallel to the back line and perpendicular to the first cut. Leg removal was at the tip of the ilium perpendicular to the back

line, while the loin and rack were cut along the back of the 13th rib perpendicular to the backline. The carcass weight and relative prime cuts weights were determined pre-chilled. The relative weights were calculated by expressing the weights of the cut parts as percentage of the dressed carcass weight. Each primal cut was weighed and its proportion relative to the carcass determined.

Organ Weight Determination

After dissection, the internal organs such as the liver, kidney, lung, heart, and spleen, abdominal fat, intestine, both left and right testes and oesophagus were weighed (using a sensitive digital weighing balance).

Data Analysis

Data collected for all determined parameters were subjected to Analysis of Variance (ANOVA) and differences between treatment means were separated by least significance difference using General Linear Model procedure of Statistical Analysis System (DSAASTAT, 2011).

Results and Discussion

Carcass Yield of WAD Goats Fed Graded Levels of Millet Husk as a Replacement of Wheat Bran

The results of the carcass yield of the goat fed graded levels of millet husk in replacement of wheat bran **is** presented in Table 2. There were significant variations ($p<0.05$) between the experimental treatments in the parameters investigated (live weight, slaughtered weight and carcass weight). Goats fed the control diet had superior live weight (11.20 kg), slaughter weight (10.80 kg) and carcass weight (8.20 kg) compared to those on millet-based diets. This suggests wheat bran was more effective in supporting weight gain and carcass yield. It can be observed that the live weight and slaughter weight of goats on T2 and T3 were statistically the same but were better than those goats on T4 and T5. The carcass weight of goats on T2, T3 and T5 were statistically the same and were better than those goats on T4. Nonetheless, these parameters were not too low for the animals fed millet-based diets. The carcass yield of WAD goat in this study is comparable to that obtained by Kalio and Amadi (2018) in WAD goat fed unconventional feed materials.

Table 2: Carcass Yield of WAD goats Fed Graded Levels of Millet Husk as a Replacement of Wheat Bran

	Treatments					
Parameters	**T1**	**T2**	**T3**	**T4**	**T5**	**SEM**
Live Weight (kg)	11.20^{a}	9.40^{b}	9.80^{b}	7.80^{c}	7.80^{c}	0.47
Slaughter weight (kg)	10.80^{a}	9.00^{b}	9.00^{b}	7.60^{c}	7.40^{c}	0.46
Carcass weight (kg)	8.20^{a}	6.80^{b}	6.80^{b}	5.60^{c}	6.80^{b}	0.33

$^{a,b,c,=}$means with different superscript letters across the rows indicate the significant difference (P<0.05); SEM =Standard Error of Mean. T1 = 0% millet husk (Control), T2 = 25% millet husk, T3 = 50% millet husk, T4 = 75% millet husk, T5 = 100% millet husk

Table 3 shows the carcass characteristics (primal cuts) of WAD goats fed graded level of millet husk in replacement of wheat bran. The carcass components observed varied ($p < 0.05$) among treatments with goats on T1 having the highest primal cut values and hence better carcass characteristics than the other treatment groups. This is followed by the goats on T2, and then those on T5 and T3 while those on T4 had the least values. It is observed that the goats on T2 had better primal cut after the control group. This indicates that the lower inclusion level of millet husk resulted in an improved muscle and bone structures which resulted in an appreciable development of various body parts of the goats. The prime cuts of WAD goat in this study is comparable to that obtained by Babale *et al.* (2019) in WAD goat fed groundnut haulms and cowpea husk.

Table 3: Prime Cuts of WAD goats Fed Graded Levels of Millet Husk as a Replacement of Wheat Bran

	Treatments					
Parameters	**T 1**	**T 2**	**T 3**	**T4**	**T5**	**SEM**
Neck (g)	0.37^{a}	0.37^{a}	0.29^{b}	0.32^{ab}	0.33^{ab}	0.02
Ribs (g)	1.07^{a}	0.71^{b}	0.61^{b}	0.64^{b}	0.76^{b}	0.08
Back (g)	0.54^{b}	0.42^{d}	0.50^{c}	0.42^{d}	0.59^{a}	0.01
Fore Shank (g)	0.83^{a}	0.59^{c}	0.64^{bc}	0.41^{d}	0.74^{ab}	0.04
Hind Shank (g)	1.01^{a}	1.01^{a}	0.84^{b}	0.57^{c}	0.70^{bc}	0.05

a,b,c,d=means with different superscript letters across the rows indicate the significant difference (P<0.05); SEM =Standard Error of Mean. T1 = 0% millet husk (Control), T2 = 25% millet husk, T3 = 50% millet husk, T4 = 75% millet husk, T5 = 100% millet husk

Organ Weight (g) of WAD goats Fed Graded Levels of Millet Husk as a Replacement of Wheat Bran

The relative organ weights (%) of the liver, kidney, stomach, heart, abdominal fat and large intestine were significantly (P<0.05) influenced by the experimental treatments (Table 4). The relative weight of liver, kidney, heart and abdominal fat were highest in goats on control diets (T1) compare to other treatments groups. However, goats on T2 also recorded highest values in heart and stomach while goats on T3 had the highest values in large intestine. Thus goats on T2 and T3 recorded an appreciable organ weight in this study, suggesting that millet husk at lower inclusion level improved the performance of the goats than inclusion at higher level. This may be attributed to the higher fibre content and abrasive nature of millet husk and the possible presence of anti-nutritional factors. It is a common practice in experimental trials to use weights of some internal organs like the liver or kidneys as indicators of toxicity because they should differ significantly if there was any serious health effect or effect of anti-nutritional factors on them being major detoxification organs (Lopez-Moreno *et al.*, 2020). The organ weight of WAD goat in this study is lower than what was obtained by Wuanor and Carew (2018) in WAD goat. The difference may be due to age, management system and nutritional differences.

Table 4: Organ Weight (g) of WAD goats Fed Graded Level of Millet Husk as a Replacement of Wheat Bran

	Treatments					
Parameters	**T1**	**T2**	**T3**	**T4**	**T5**	**SEM**
Liver	0.18^{a}	0.12^{b}	0.10^{b}	0.12^{b}	0.13^{b}	0.005
Kidney	0.04^{a}	0.02^{b}	0.03^{ab}	0.02^{b}	0.01^{b}	0.005
Heart	0.05^{a}	0.05^{a}	0.02^{b}	0.03^{b}	0.03^{b}	0.003
Stomach	0.14^{b}	0.19^{a}	0.11^{c}	0.11^{c}	0.08^{d}	0.005
Abdominal Fat	0.09^{a}	0.02^{c}	0.04^{b}	0.01^{c}	0.01^{c}	0.003
Small intestine	0.13	0.11	0.12	0.13	0.11	0.007
Large intestine	0.05^{d}	0.11^{b}	0.22^{a}	0.07^{c}	0.11^{b}	0.005

$^{a,b,c,d=}$means with different superscript letters across the rows indicate the significant difference (P<0.05); SEM =Standard Error of Mean. T1 = 0% millet husk (Control), T2 = 25% millet husk, T3 = 50% millet husk, T4 = 75% millet husk, T5 = 100% millet husk

Conclusion

In conclusion, this study revealed that while T1 outperformed T2-T5, the inclusion of millet husk at up to 50% replacement of wheat bran yielded acceptable growth and carcass performance in WAD goats. Beyond this, this practice converts millet husk waste into valuable feed resources, minimizes environmental pollution, and offers a practical solution to seasonal feed shortages.

References

Alilo, A. A., Beyene, A. and Mola, M. (2018). Assessment of Sheep and Goat (SmallRuminants) Production System in Esera District, of Dawro Zone, Southern Ethiopia. *Advances in Dairy Research*, 6:4-10

AOAC. (2005). *Official methods of analysis*. 18th Edition. Association of Official Analytical Chemists Arlington, VA

Babale DM, Millam JJ1 and Gworgwor Z. (2019). Blood profile and Carcass Characteristics of West African Dwarf Goats Fed Groundnut Haulms and Cowpea Husk Supplemented with Brewers' Dried Grain. Biomedical Journal of Scientific and Technical Research, pp 11751-11754. DOI:10.26717/BJSTR.2019.16.002789.

DSAASTAT, ver.1 101. (2011). Excell macros to perform basic statistical analysis on routine agricultural experiments.

Goetsch AL, Merkel RC, Gipson TA. Factors affecting goat meat production and quality. Small Rumin Res. (2011) 101:173–81. doi: 10.1016/j.smallrumres.2011.09.037

Jones, D. (2006). *Peter Roach, James Hartman, Jane Setter*, ed. Cambridge Pronouncing Dictionary. Cambridge University Press

Kalio, G. A. and Amadi, E. E. (2018). Hematology and Carcass Characteristics of West African Dwarf (WAD) Goats Fed Diets Incorporated with Non-Conventional Feed Stuffs in Nigeria. *Direct Research Journal of Veterinary Medicine and Animal Science.* 3 (6): 48-53.

Lopez-Moreno, M., Garcés-Rimón, M. and Miguel, M. (2020). Antinutrients: Lectins, goitrogens, phytates and oxalates, friends or foe? *Journal of Functional Food*. 89:92-10

Maidala, A. and Bakoji, S. (2016) Nutritional Evaluation of Millet Hulls as a Source of Fibre in the Diets of Broiler Chickens. *IIARD International Journal of Biology and Medical Research* 2(1): 1-9.

Mamabolo M. and Webb E.C. (2005). Goat production survey-fundamental aspects to model goat production systems in southern Africa. Case-Agricultural commission-Witfor. http://www.witfor.org/2005/themes/documents/goat_production_servey.pdf.

Ogunbosoye, D. O. (2012) Assessment of the potential value of twelve browse legume trees using *in-vitro* gas production and coefficient of reference techniques. *African Journal of Livestock Extension* 10: 1-9

Van Soest, P.J. (1994). *Nutritional Ecology of the Ruminant*, 2nd (Ed). Comstock Publ. Assoc. Div. of Cornell University Press, Ithaca/London; p. 476.

Wang DF, Zhou LL, Zhou HL, Hou GY, Li M, Shi LG, et al. Effects of nutrition level of concentrate-based diets on growth performance and carcass characteristics of Hainan black goats. Trop Anim Health Prod. (2014) 46:783–8. doi: 10.1007/s11250-014-0565-x

Wuanor, A.A and Carew, S.N. (2018). Nutrient Digestibility, Carcass Yield and Production Economics of West African Dwarf Goats Fed Pleurotus Tuber Regium Biodegraded Rice Straw and Maize Offal -Brewer Yeast Slurry Mixture. *Journal of Animal Husbandry and Dairy Science* 2(1): 13-21.