Trop. Anim. Prod. Invest. 26 (01):9-15 (2023)
ISSN: 1115-2540
http://animalsci.agric.ui.edu.ng/TAPI/index.php/tapijournal/index

ORIGINAL RESEARCH ARTICLE

Effect of Treated Rice Husk (RH) as a replacement of Wheat bran on the Carcass characteristics of West African Dwarf Goat

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ABSTRACT

The study was conducted to evaluate the effects of treated rice husk as a replacement for wheat bran on the Carcass characteristics of West African Dwarf (WAD) goats. Twenty (20) WAD goats were subjected to five dietary treatments in a completely randomized design with 4 animals per treatment. The treatments were: 0% RH (T1), 25% RH (T2), 50% RH (T3), 75% RH (T4) and 100% RH (T5)in replacement for wheat bran. The animals were fed their respective diets at 5% of their body weight for 90 days. The results showed that T2 and T1 were relatively high in crude protein, low in crude fiber, moderate in crude fat and high in carbohydrate. They equally had the lowest values of ADF, ADL and NDF among the treatments. Live weight, slaughter weight, carcass weight and dressing percentage were all significantly (P<0.05) influenced by the dietary treatments. The values were highest in goat fed T1, followed by those on T2, then T3 and then by those on T4, while the goats fed T5 had the least values for live weight, slaughter weight, carcass weight and dressing percentage, respectively. The carcass yield parameters were observed to decrease as the inclusion level of treated rice husk increases. All the prime cuts were significantly (P<0.05) influenced by the dietary treatments. The relative weight of all the prime cuts decreased as the inclusion level of treated rice husk increases. Among the goats given the treated rice husk, T2 and T3 appeared to have more carcass characteristics. It is concluded that diet with 25% (T2) and 50% (T3) rice husk replacement level gave more carcass characteristics as carcass weight, dressing percentage, organ weight and prime cuts recorded more improvement. Thus, treated rice husk as a replacement for wheat bran at lower inclusion level (up to 50% at 5% body weight) is recommended to give appreciable performance on WAD goat.

Keywords: Rice husk, wheat bran, treated, West Africa dwarf goat, carcass

INTRODUCTION

Goat production is an important venture in Nigeria as it substantially contributes to household food and income. It plays a significant role in poverty reduction, food security and improved livelihoods. Among the most prevalent goats in West Africa sub-region is the West African dwarf goat. The West African dwarf goat is a household livestock owned by most rural families especially in the Southern part of Nigeria. The animal is noted for their ability to convert poor quality fibrous feed into useful animal products (Adebisi *et al.*, 2016). Meat is the major form in which goats are consumed in Nigeria (Ahamefule., 2005). Goat meat (Chevon) is widely accepted and consumed in Nigeria because there is no religious taboo against it (Anaeto, 2010). The demand for goat meat is high and usually commands higher market price than beef and pork in towns and villages. According to Idiong and Orok (2008), goat meat is highly preferred than other animal species because of its flavour, tenderness and palatability.

Their survival under harsh tropical environment together with their efficiency in feeds conversion and their ability to feed on variety of feeds as well as their relative resistance to diseases are some of the important

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characteristics responsible for profitable goat rearing by rural populace (Okoruwa*et al.*, 2012)**.** In spite of the production of small ruminant animal in developing countries such as Nigeria is largely constraints by inadequate nutrition (Ahamefule and Udo, 2010). However, due to seasonal variations which are characterized by abundance of feed during the rainy season and scarcity of feed both in quantity and quality during the dry season, necessitated the need for supplemental diets with readily available unconventional materials to enhance goat production with high weight gain and dressing percentage at a cheaper cost. To mitigate this problem of inadequate nutrition, the need to search for various alternative feeds that are less competitive for their use by man and other livestock could perhaps be one of the intervention areas needed to augment small ruminant's production (Adewumi and Ajayi, 2010). Consequently, animal nutritionists use unconventional feed resources such as agro-industrial wastes which are cheap, non-toxic and locally available which can meet the nutritional requirements for livestock. Hence the interest for utilization of low quality waste like rice husk as an animal feed have increased in recent time among researchers (Nwofoke, 2016; Ikpe *et al.*, 2019;Omotoso and Arilekolasi, 2019).

Rice husk is an agro waste product generated during the milling of rice grain. Rice husk is currently produced in large quantity in Nigeria due to the increasing level of rice production in the country. Presently, heaps of rice husks have continued to rise in most milling locations as it is mostly either burnt or dumped as a waste in the majority of rice producing countries thereby constituting environmental hazards and pollution (Nwofoke, 2016; Haryana, 2018).Rice husk has long been identified as a feedstuff in animal nutrition but has been underutilized (Jacquie, 2015).The husk has been nutritionally reported to contain 92.5 - 96.4% of dry matter, 2.1 - 3.6% crude protein, 1 - 12% ether extract, 39 – 48.55% crude fibre, 15-18% silica and 15 - 22% ash (Aderolu *et al.*, 2007, Omotoso and Arilekolasi, 2019). However, due to high fibre content, high silica/ash content and abrasive characteristics of rice husk, it is not easily digested by animals. Thus, the need arises for the husk to be properly treated to increase its utilization by the animal. Several studies have been conducted on the use of treated agro-industrial by-products in ruminant nutrition (Fasuyi and Olumuyiwa, 2012; Adama *et al.,* 2017; Ikpe *et al.*, 2019). However, there is paucity of information on the use of treated rice husk based diet on carcass yield of WAD goats. Therefore, this study is aimed at investigating the effect of treated rice husk as a replacement for wheat bran on the carcass quality of WAD goats.

MATERIALS AND METHODS

This research work was carried out at the Small Ruminant Unit, Teaching and Research Farm, Faculty of Agriculture, Kwara State University, Malete, Nigeria. Rice husk was obtained from a reputable rice milling industry within the study area. 500g of the husk was introduced into a cooking pot containing 3 liters of boiling water. The mixture was allowed to boil for 150 minutes with continuous stirring to obtain a homogenous mixture. The cooked rice husk was strained to remove excess water and dried to 35% dry matter. After which the rice husk was packed inside an air-tight polythene bag and it was allowed to ferment for 20 days after which it was dried, packed and weighed to formulate experimental diets.

Twenty (20) WAD goats with an average weight of 8.6 kg used in this study were randomly allocated into five treatments with four animals per treatment with rich husk replacing wheat bran in a completely randomized design. The treatments were (T1, 0% rice husk), (T2, 25% rice husk), (T3, 50% rice husk), (T4, 75% rice husk) and (T5, 100% rice husk). The feeding trial covered a period of 84 days during which the experimental diets were served at 5% of their body weight and clean water was provided *ad libitum* daily. At the end of the experiment, three (3) goats were randomly selected from each of the treatments, weighed and slaughtered. They were bled by severing both the carotid arteries and jugular veins on both sides as well as trachea, using a sharp knife without stunning. After slaughter,

Table 1: Composition of the experimental diets (%)

Parameters (%)	Treatments				
	T1 (0%RH)	T2 (25%RH)	T3(50%RH)	T4(75%RH)	T5(100%RH)
Rice husk	0.0	12.5	25.0	37.5	50.0
Wheat bran	50.0	37.5	25.0	12.5	0.0
Cassava peel	30.0	30.0	30.0	30.0	30.0
SBCW	10.0	10.0	10.0	10.0	10.0
PKC	5.0	5.0	5.0	5.0	5.0
Bone meal	3.0	3.0	2.8	2.6	2.4
Lime stone	1.0	1.0	1.0	1.0	1.0
Salt	1.0	1.0	1.0	1.0	1.0
Urea	-	-	0.2	0.4	0.6
Total	100.0	100.0	100.0	100.0	100.0

SBCW = Soybean cheese waste, PKC = Palm kernel cake, RH = rice husk.

the live weight was determined and then the skin was removed (flayed) followed by the removal of legs, heads, and the intestinal organs which were also weighed. Thereafter, carcass weight and dressing percentage were determined. The animals were dissected as described by Byanet *et al.* (2008).The whole carcass was weighed before the prime cuts.

The following were the prime cuts made:
Hind and fore shank which were weighed differently; hind and fore legs were also weighed differently; shanks, brisket, neck, loins, ribs, flank and back were all weighed separately. The carcasses were eviscerated to separate the various internal organs such as the liver, kidney, lung, heart, and spleen, abdominal fat, intestine, both left and right testes. Each of these internal organs was removed and weighed accordingly using a sensitive digital weighing balance.

$$\text{Dressing \%} = \frac{\text{Warm carcass weight}}{\text{Live weight}} \times 100\%$$

Statistical Analysis
Data collected on carcass 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

Proximate compositions
The chemical compositions of the experimental diets used in this study were presented in Table 2. All the parameters examined were significantly different ($p < 0.05$) among the treatment groups except the cellulose and hemicellulose. The maximum value of crude protein (CP) was found in T2 (13.0%) and minimum in T5 (7.5%), while a greater crude fiber content was recorded in T4 (75%RH) than T3 (50%RH), T5 (100%RH), and T1 (0%RH). All the diets had (CP) values above the 6 - 8% CP minimum requirement for ruminants (NRC, 1985). The crude protein levels of the experimental diets were far above the 8% needed to provide the minimum ammonia levels required for microbial activity in the rumen. Faisal *et al.* (2017) reported that low cost of concentrate diets with more than 8% CP could be a good maintenance ration for ruminant animals during dry season. The crude fibre content of the experimental diets in the study was lower than (34.85%) reported by Oladotun *et al.* (2003). The contrast could be as a result of the treated rice husk inclusion in the diets. Ash content increases with increasing rice husk quantity, the same trend was observed in ADF. However, the carbohydrate content recorded a declining trend as the rice husk quantity increases. The crude protein, crude fibre, crude fat, ash and CHO values obtained for the experimental diets used in this study were similar to the values reported by Fasuyi *et*

Table 2: Chemical composition (%) of the experimental diets

Trtm	DM	CP	CFAT	CF	ASH	CHO	NDF	ADF	ADL	HMC	CELL
T1	96.15^{c}	12.23^{b}	3.55^{c}	11.62^{e}	10.03^{e}	58.81^{a}	39.62^{e}	20.18^{e}	14.05^{e}	19.44	6.13
T2	97.31^{a}	13.04^{a}	3.59^{b}	15.81^{d}	13.18^{d}	51.69^{b}	39.67^{d}	29.08^{d}	19.03^{d}	10.59	10.05
T3	96.13^{c}	9.12^{d}	2.88^{d}	20.55^{b}	14.86^{c}	48.69^{c}	43.76^{b}	34.38^{c}	21.93^{c}	9.38	12.45
T4	97.20^{b}	11.47^{c}	3.92^{a}	20.94^{a}	15.26^{b}	45.61^{e}	44.12^{a}	42.25^{b}	29.55^{a}	1.87	12.7
T5	97.31^{a}	7.59^{e}	2.42^{e}	19.50^{c}	17.15^{a}	50.64^{c}	42.12^{c}	42.34^{a}	27.95^{b}	0.22	14.39
SEM	1.52	5.77	4.47	5.38	1.55	4.94	5.37	5.38	5.28	0.01	5.38
p-value	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Trmt= treatment, WB=Wheat Bran, RH-Rice Husk, DM= Dry matter, CP= Crude protein, CFAT=Crude Fat, CF=Crude fibre, CHO= Carbohydrate, NDF= Neutral detergent fibre, ADF= Acid detergent fibre, ADL= Acid detergent lignin, HMC= Hemicellulose, CELL= Cellulose, T1 (RH0%), T2 (RH25%), T3 (RH50%), T4 (RH75%), T5 (RH100%).

al. (2010). The values of ADF, NDF and ADL for all the experimental diets were lower than the values 62.29% NDF, 47.83% ADF and 20.25% ADL reported by Oladotun *et al.*, (2003). According to Robert (2013) ADF is used to produce energy content of feed which goes with the T5 (100%RH) having the highest ADF with higher energy content.

Carcass Characteristics

Carcass yield of the experimental animals

There were significant variations ($p < 0.05$) among the measured parameters: live weight, slaughter weight, hot carcass weight and dressing percentage as presented in Table 3. Goats given T1 (0%RH, 12.5kg) and T2 (25%RH, 12.30) had higher live weight, better carcass weight (12.1kg and 11.9kg), improved hot carcass weight (6.1kg and 5.88kg) and displayed a higher dressing percentage of 48.8kg and 47.8kg compared to other treatments. This suggests that the lower the inclusion level of rice husk in the diets, the higher the positive impact on the muscle and organ development of the goats. Also, higher inclusion of wheat bran in diet T1 may have resulted in better carcass yield compared to other treatments. The dressing percentage range of 44.57-48.8% reported in this present study is comparable to the values (40.39 – 53.40%) reported by Anya and Ozung. (2018) obtained in WAD goats and is slightly lower than 50.40 - 52.60% and 50.16 - 51.12% reported by Ahamefule (2005) and Ukenwoko and Onuoha (2011) respectively. It however, falls within the normal range of 38-56% for goats (Getahun, 2001). The variation in the dressing percentage of the various dietary treatments in this study may be attributed to nutrition, age and body conformation of individual goats (Onuoha, 2011).

Prime Cut yield of the experiment animals

Table 4 shows the relative meat cuts weight expressed as percentage of hot carcass weight and the primal cuts of WAD goats fed experimental diets. The legs, loin, neck, ribs, brisket, rand, fore shank and hind shank weight showed significant differences ($p < 0.05$) and linear increase with increasing level of the test decks.

Table 3: Carcass yield of West Africa dwarf goats fed the experimental diets.

Parameters	T1	T2	T3	T4	T5	SEM	*p*-value
Live weight (kg)	12.50^{a}	12.30^{b}	12.00^{c}	11.98^{c}	10.99^{d}	0.11	<0.01
Slaughter weight (kg)	12.10^{a}	11.90^{a}	11.63^{b}	11.51^{b}	10.56^{c}	7.69	<0.01
Hot Carcass weight(kg)	6.10^{a}	5.88^{b}	5.54^{c}	5.53^{c}	4.90^{d}	0.06	<0.01
Dressing percentage (%)	48.8^{a}	47.8^{a}	45.94^{b}	46.13^{b}	44.57^{c}	0.41	<0.01

SEM = Standard error of mean, T1 = 0% rice husk, T2= 25% rice husk, T3 = 50% rice husk, T4 = 75% rice husk, T5 = 100% rice husk.

^{abcd} means in the row with different superscript are significantly different ($P < 0.05$).

Table 4: Effect of the experimental diets on the primal cuts of WAD goat

Parameters	T1	T2	T3	T4	T5	SEM	P-value
Flank (g)	544[a]	490[b]	430.6[c]	385.67[d]	401.33[d]	5.39	<0.01
Head (g)	1320[a]	1306.67[a]	1184[b]	1087.67[c]	1039.67[c]	14.18	<0.01
Back (g)	546[a]	560[b]	456.33[c]	442[d]	401.33[e]	3.00	<0.01
Meat cuts as % of hot carcass weight							
Legs	12.8[a]	12.48[a]	11.13[b]	10.88[b]	11.08[b]	0.19	<0.01
Loin	14.57[a]	14.92[a]	11.48[b]	11.20[b]	11.38[b]	0.18	<0.01
Neck	14.59[bc]	14.77[b]	15.41[a]	14.19[c]	14.41[b]	0.15	<0.01
Ribs	16.28[a]	15.35[ab]	15.49[ab]	14.61[b]	12.85[c]	0.52	<0.01
Brisket	9.57[a]	8.93[b]	8.12[c]	7.59[cd]	7.37[d]	0.18	<0.01
Round	10.05[a]	9.19[b]	7.82[c]	7.00[d]	6.87[d]	9.90	<0.01
Fore shank	16.99[a]	16.65[a]	13.95[b]	11.85[c]	11.61[c]	0.28	<0.01
Hind shank	16.39[a]	16.89[a]	14.37[b]	12.3[c]	11.34[c]	0.34	<0.01

SEM = Standard error of mean, T1 = 0% rice husk, T2= 25% rice husk, T3 = 50% rice husk, T4 = 75% rice husk, T5 = 100% rice husk,

[abcd] means in the row with different superscript are significantly different (P < 0.05).

The legs loin, neck, ribs, brisket, round and shanks weight of goats fed T1 (0%RH) gave the highest values (of 12.8, 14.57, 14.59, 16.29, 9.57, 10.05, 16.99, 16.39%) respectively but was statistically similar to the cuts in goats fed T2 (25%RH). Thus, goats fed diets T1 (0%RH) and T2 (25%RH) had significantly higher prime cut yield ($p < 0.05$) compared to those fed diets T3 (50%RH), T4 (75%RH) and T5(100%RH), respectively. This indicated that lower inclusion levels of rice husk in T1 and T2 (25%RH) in the diets of WAD goats enhanced the weight of their meat cuts. This is contrary to the findings of Dauda *et al.*, (2019) who reported as increase in weight of carcass traits as the inclusion level increases. Sultana *et al.,* (2018) had earlier reported that treated rice straw supplemented with Moringa foliage had no improvement on the carcass characteristics. The values obtained in this study were within the normal range as reported by (Ukanwoko and Odjuvwederhie, 2019). Animals fed T2 (25%RH) diet showed a superior ($p < 0.05$) shanks weight, while T3 (50%RH) showed a superior neck weight than other treatment groups. This suggests that T2 (25%RH) and T3 (50%RH) diets influenced the development of shank and neck weight, respectively, better than other treatment groups.

Organ weight of the experiment animals

The organ weight of WAD goats fed experimental diets is presented in Table 5.

Table 5: Organ weight (%) of West African Dwarf goat fed experimental diets.

Parameters (%)	T1	T2	T3	T4	T5	SEM	P-value
Liver	6.58[a]	5.76[b]	4.04[c]	3.56[d]	3.31[e]	2.34	<0.01
Kidney	4.50[a]	4.46[a]	3.28[b]	2.99[c]	2.81[d]	2.45	<0.01
Spleen	4.24[a]	4.12[b]	2.18[c]	2.25[d]	2.05[e]	2.01	<0.01
Lungs	5.38[a]	5.36[a]	3.45[b]	3.36[c]	2.98[d]	2.77	<0.01
ABF	4.16[a]	4.02[b]	3.15[c]	3.01[d]	3.11[c]	2.93	<0.01
Large intestine	5.38[a]	4.94[b]	2.57[c]	2.54[c]	2.53[c]	2.89	<0.01
Small intestine	7.38[a]	4.42[b]	2.57[c]	3.86[e]	3.96[d]	2.52	<0.01
Heart	4.65[a]	4.42[b]	2.54[c]	2.46[d]	2.36[e]	1.94	<0.01

ABF= abdominal fat, SEM = Standard error of mean, T1 = 0% rice husk, T2= 25% rice husk, T3 = 50% rice husk, T4 = 75% rice husk, T5 = 100% rice husk.

[abcd] means in the row with different superscript are significantly different (P < 0.05).

The relative organ weights (%) of the liver, kidney, spleen, lungs, abdominal fat, large intestine, small intestine and heart were significantly ($p < 0.05$) influenced by the experimental diets. The relative weight of liver was highest in goats fed T1 (0%RH, 6.58%) compared to the rest. The same trend was observed in the weights of kidney, spleen, lung, abdominal fat, large intestine, small intestine and heart, respectively. It is a common practice in experimental trials to use weights of some internal organ like the liver or kidneys as indicators of toxicity because they should differ significantly if there was any serious health effect of anti-nutritional factors on them being major detoxification organs (Sese *et al.*, 1996).Some level of similarity in the weight of these organs in this study proved that the treatment dosages have no serious negative health effects on their functions. This confirms the earlier exports by Landy, *et al.* (2011) and Nodu, *et al.,* (2016) that there were no significant differences in organ weight among the goat experimental diets.

CONCLUSION

The 25% treated rice husk replacement level of wheat bran nutritive value with less crude fire and high carbohydrate content which were utilized better by the goats among the diets. Diets with 25% and 50% rice husk replacement level had better carcass characteristics.It is recommended that goat farmers could use treated rich husk to replace wheat bran up to 50% replacement level to ensure improved growth performance of the animals to mitigate feed shortage during the lean period of the year.

CONFLICT OF INTEREST

The authors of this research topic, "Effect of Treated Rice Husk as a Replacement of Wheat Bran on the Carcass Characteristics of WAD Goat," declare that there is no conflict of interest in conducting this study. The research was solely conducted to investigate the potential benefits and impacts of incorporating treated rice husk as a substitute for wheat bran in the diet of West African Dwarf (WAD) goats. The authors have no financial or personal relationships that could influence the outcome of this research.

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