Research Article

iMedPub Journals
www.imedpub.com

Journal of Animal Sciences and Livestock Production
ISSN 2577-0594

2020
Vol.4 No.1:2

DOI: 10.36648/2577-0594.4.1.2

Comparison of the Growth and Economic Values of Maize and Yam Peel Based Supplement Fed to West African Dwarf Rams

M K Adegun*

Department of Animal Science, Ekiti State University, Ado-Ekiti, Nigeria

***Corresponding author:**
Maria Kikelomo Adegun

patrickkikelomo@yahoo.com

Department of Animal Science, Ekiti State University, Nigeria

Citation: Adegun MK (2020) Comparison of the Growth and Economic Values of Maize and Yam Peel Based Supplement Fed to West African Dwarf Rams. J Anim Sci Livest Prod Vol.4 No.1:2.

Abstract

The prohibitive cost of conventional feedstuff such as maize has been one of the reasons to search for alternative feed resources in livestock diets. This study was undertaken to compare the growth and economic performance of West African Dwarf (WAD) rams fed graded levels of Yam Peels Meal (YPM) and maize-based concentrate diets. Thirty-two yearlings WAD rams weighing 13.9 ± 2.0 kg were assigned to a completely randomized design of 4 treatments with 4 replicates. The animals were fed a basal diet of Panicum maximum at 3% of their body weight, supplemented with 0% YPM based concentrate in treatment 1, treatment 2 (33.3% YPM), treatment 3 (66.7% YPM) and treatment 4 (100% YPM) as replacements for maize in the concentrate diets.

The result showed that there was a significant difference ($p<0.05$) between 100% maize (T1) and 100% YPM (T4) in terms of total weight gain and metabolic weight gain with T1 having higher values. However, animals fed 66.66% (T3) YPM had significantly higher metabolic weight gain compared to all.

On feed conversion ratio (FCR), T1 had significantly better value compared to T4 ($p<0.05$), although T3 had the best FCR at 8.25 ± 0.3. Linear body measurements also followed growth patterns in some parameters with rams on T3 having the highest value in height at wither gain, paunch girth gain and scrotal circumference gain at 7.30 ± 0.3, 4.70 ± 0.2, and 3.60 ± 0.3 cm respectively.

The cost of feed/ kilogram weight gain decreased linearly from N158.72 in animals fed T1 to N59.13 in animals fed T4. The highest value of average net return was obtained from the animals in T3 (N7, 440/ram).

Consequently, the yam peels meal could replace maize up to 100% in the diet of sheep with a reduction in the cost of production. But the optimum replacement for growth performance and average net return was at 66.7%.

Keywords: West African dwarf; Concentrates; Treatments; Weight gain; Feed conversion ratio

Received: January 14, 2020; **Accepted:** January 29, 2020; **Published:** February 02, 2020

Introduction

Small ruminants through their complex digestive system could subsist on native or cultivated pastures, but their productivity potentials are limited when fed alone on these feed resources [1]. Tropical grasses have low feeding values with high lignin and crude protein composition which rarely exceeds 12% but can be as low as 2% in the dry season leading to negative weight gain in animals. A number of strategies have to be developed to improve the utilization of basal diets using supplementation to correct nutrient imbalances for improved rumen function and increase energy availability to rumen microbes [2].

The prohibitive cost of conventional feedstuff most especially energy sources like maize has been one of the reasons to search for alternative feed resources that would confer the same or

better nutritional benefits to animals. There is, therefore, a need for a strategic low-cost supplementation using cheap feedstuff that is in abundance and appropriate [3].

Chemical compositions of crop residues and kitchen wastes like yam peels, cocoyam, cassava peels, pineapple waste, banana peels, and ripe plantain peels have revealed them as potential feed sources for livestock [4,5]. They are described as non-conventional feedstuff which is very cheap and useful to farming systems of subsistence farmers who cultivate crops and keep livestock [6,7]. The pragmatic use of these resources can add to the bio sustainability of feeding systems by balancing the nutrient needs of animals [2].

Peels of white yam (*Dioscorea rotundata*) is about 10% of the total root and can be used to meet part of the dietary needs of small ruminants in the developing world [4]. Nigeria is the largest producer of yam (*Dioscorea spp*.) and it accounts for over 65% of the world's production at 38.00 MT million in 2012 [8]. Yam contributes immensely to the socio-cultural life of the people of Ekiti state, whereby considerable quantity is being produced and consumed. It is a major contact for yam marketing in south-western Nigeria [9]. Yam peels are therefore abundant at no cost in the households, restaurants, yam flour (elubo) industry, poundo yam industry and on roadsides where roasted yams are sold in this area. Yam peels have fairly high nutritive value with a high amount of the much-needed soluble carbohydrate and fermentable nitrogen for the rumen [4]. Proximate analysis conducted by some author's revealed varied nutritional composition in terms of crude protein from 3.4% to 12.86% [10-12]. Even though in most households, yam peels are served to sheep and goats fresh, it can be sundried and mixed with other ingredients to enhance its utilization.

The effect of feeding yam peels to animals has been elicited in some studies; it was revealed that similar weight gain, feed efficiency and dressing percentage with lower feed costs were observed when yam peels replaced 50% of maize in the diet of juvenile snails [11]. The work of Uchewa et al. [12] also revealed that yam peel can replace maize completely with reduced cost without adverse effect on weaner rabbits. In the broiler diet, an inclusion level of 15% yam peel meal did not have any deleterious effect on finisher broiler chicks [10].

In spite of the usefulness of yam peels as non-conventional feeding stuff, there is the paucity of information on the nutritional value and economic viability of yam peels based concentrates on growing rams in south-western Nigeria. This study is undertaken to evaluate the response of West African Dwarf (WAD) rams in terms of growth performance and cost-benefit when yam peels meal is fed as supplements to a basal diet of *Panicum maximum* grass.

Objectives

1. To analyze the nutritive and anti-nutritive values of yam peels obtained in Ekiti state
2. To determine the growth performance and feed efficiency of WAD rams fed yam peels meal-based diets
3. To analyze the economic viability of feeding yam peel meal diets to WAD rams

Materials and Methods

Experimental location

The experiment was conducted at the small ruminant section of the Faculty of Agricultural Sciences' Teaching and Research Farm, Ado-Ekiti, Nigeria. It is a tropical climate with a temperature range of 20°C-28°C and a bimodal rainfall distribution between April and October with a peak in June and September. The dry season is between November and March. The average precipitation in the area is 1367 mm.

Experimental animals and management

A total of 32 growing WAD rams were purchased from a ruminant market in Otun Ekiti, Moba Local Government Area, Ekiti State. Each of the pen houses were cleaned before the arrival of the experimental animals. The experimental unit was partitioned into pens and the floor was covered with wood shavings for easy faeces and urine absorption. The animals were quarantined for acclimatization to the new environment. Routine vaccination and medication were administered for 28 days according to the method described by Napri [13].

The animals were weighed and randomly assigned to four dietary treatments with four replicates of two animals per replicate in a Completely Randomised Design (CRD).

Experimental diets

The basal diet of *Panicum maximum* grass was obtained daily from established paddock within the Teaching and Research Farm.

Yam peels were obtained from kitchens, restaurants, and farmsteads. The peels were dried for 4-7 days, milled using a hammer mill and were taken for proximate analysis and anti-nutrients determination.

Locally available feed ingredients: maize, palm kernel cake, groundnut cake, bone meal, vitamin-mineral premix, and salt were purchased from an agro-allied shop in Ado Ekiti and were milled together incorporating the yam peels in graded levels as shown in **Table 1**.

Table 1: Ingredients composition of the concentrate diets.

Nutrient/Ingredient	Treatment (% YPM Replacement)			
	0	33.33	66.66	100
Yam peel	0	20	40	60
Maize	60	40	20	0
PKC	22	22	22	22
GNC	8	8	88	8
Bone meal	1	1	1	1
Wheat offal	7.5	7.5	7.5	7.5

Vitamin/min premix	1	2.5	1	1
Salt	0.5	0.5	0.5	0.5
Total	100	100	100	100
Chemical composition				
DM	78.2	79.6	80.5	82.6
Crude protein	13.3	14.1	14	14.4
Ether extract	4.6	4.4	4	4.1
NFE	41.6	42.8	42	44
Ash	8.6	9.6	10.81	9
Crude fiber	20.4	17.5	17.19	15.3
Energy Kcal/kg	3003.2	2996.2	3100.2	3035.7
PKC: Palm Kernel Cake; GNC: Groundnut Cake				

Data collection

The experimental diet was supplied twice daily at 8:00 am and 4:00 pm. The animals were fed the basal diet at 3% of their body weight while 200 g of the concentrate was given to each of the treatments as supplements per day. Feed intake was measured daily by subtracting the leftover of the *Panicum maximum* and concentrates from the feed given. Bodyweight and linear measurements of each of the animals were taken weekly. Weekly weight gain was calculated as the difference between the weight gain at the end and the beginning of every week during the experimental period until the end of the growth trial. The linear measurements such as height at wither, heart girth, tail length, ear length, scrotum circumference were taken using a centimeter graduated tape. Average daily feed intake and average daily weight gain were calculated over the experimental period of 84 days. Water was supplied ad libitum. The animals were under feedlot management.

To calculate the economic viability of production, the total production costs and income were considered. Expenses included the cost of procurement of animals, feed materials, cost of resources and services utilized in the course of the study. Income was calculated based on the prevailing price per kilogram of mutton.

Statistical analysis

All data collected were subjected to ANOVA using SAS statistical package [14]. Where significant differences exist in means, Duncan's Multiple Range test [15] was used as a means separator.

Results

Tables 1 and 2 show the proximate composition of the maize and yam peels meal (YPM) used in this study. The dry matter of YPM was analyzed to be 82.30 g-100 g^{-1} while that of maize was 78.51 g-100 g^{-1}. Higher crude protein and nitrogen-free extract were recorded for YPM (10.20 g-100 g^{-1}, 68.20 g-100 g^{-1}) compared with maize (8.92 g-100 g^{-1}, 61.56 g-100 g^{-1}), while the values for ash, crude fiber, ether extract, and energy were increased in maize (9.92 g-100 g^{-1}, 15.50 g-100 g^{-1}, 4.10 g-100 g^{-1} and 3251 kcal kg^{-} ME respectively) than those of yam peels (7.20 g-100 g^{-1}, 13.30 g-100 g^{-1}, 3.20 g-100 g^{-1}, 3020 kcal kg^{-} ME respectively).

Table 2: Proximate composition of test ingredients.

Nutrient	Yam peel	Maize
DM	82.3	78.51
Crude protein	10.2	8.92
Ash	7.2	9.92
Ether extract	1.2	4.1
Crude fiber	13.3	15.5
NFE	68.1	61.56
Energy Kcal/kgME	3020	3251
DM: Dry Matter; CP: Crude Protein; CF: Crude Fiber; EE: Ether Extract; NFE: Nitrogen Free Extract; GE: Gross Energy		

Table 3 shows the anti-nutrients present in YPM used in this study. The Tannin had a value of 0.16 %. The saponin, alkaloid and phenolic compound values were 0.64 mg/g, 0.35 mg/g and 9.51 mg/g respectively. Phytate and oxalate recorded values of 10.05 mg/g and 16.13 mg/100 g. While trypsin inhibitor and cyanide were 7.12 TIU/100 g and 8.67 mg/kg respectively.

Table 3: Antinutrients present in Yam Peels.

Parameter	Anti-nutrients
Tannin (%)	0.16
Phytate (mg/100 g)	10.05
Oxalate (mg/100 g)	16.13
Cyanide(mg/kg)	8.67
Alkaloid (mg/g)	0.35
Saponin (mg/g)	0.64
Trypsin Inhibitor (Tiu/100 g)	7.12
Phenolic compound (mg/g)	9.51

Results of proximate analysis of graded levels of YPM concentrate fed as a supplement to rams in this study are presented in **Table 3**. The Dry Matter (DM) of the concentrate ranged from 78.2 kg DM in 0% of YPM (Treatment 1) to 82.6 kg DM in 100% of YPM (treatment 4). The Crude Protein (CP) value varied from 13.3 kg in treatment 1 (T1) and 14.4 kg in treatment 4 (T4). The ether extract varied from 4.0 kg in 66.6% in T3 to 4.6 kg of 0% in T1. The Nitrogen-Free Extract (NFE) was not affected by the treatment the values of the Nitrogen-Free Extract (NFE) ranged from 41.6 kg to 44.0 kg from T1 to T4. The Ash varied from 8.6 kg in T1 to 10.8.1 kg in 33.3% YPM (T3). Crude fibre ranges from 15.3 kg in T4 to 20.4 kg in treatment T1. The Gross energy content ranged from 2996.2 kcal/ME in T2 to 3035.7 kcal/ME in T4.

Table 4 shows the summary of the growth performance of WAD rams fed *Panicum maximum* supplemented with graded levels of YPM based concentrates. There were no significant differences ($p>0.05$) in the feed intake in all the treatments. The values were 595.00+23, 580.00+25, 570.00+28, and 573.00+22 g in T1 to 4 (0, 33.3, 66.7 and 100% YPM) respectively. Significant differences ($p<0.05$) exist in the total weight gain in all the treatments. Animals fed T1 and T3 had similar (5.5+0.3 and 5.8+0.3 kg) weight gain which was significantly higher than the values obtained in

animals fed T2 and T4 with weight gains of 4.4+0.4 and 4.6+ 0.3 kg respectively. However, the metabolic weight gain was increased in animals on T3 (3.73+0.3 kg) which was significantly higher ($p<0.05$) than the metabolic weight gains in T1, T4 and T2 (3.59+0.3, 3.14+0.3, 3.04+0.4 kg) respectively. There were significant differences ($p<0.05$) among the means of the feed conversion ratio in all the animals. The animals fed T3 had the best FCR at 8.25+0.3 compared with the other treatments which had 9.09+0.6, 10.46+0.5 and 11.07+0.4 in T1, T4, and T2 respectively.

Table 5 depicts the linear body measurement of WAD rams fed *Panicum maximum* supplemented with graded levels of yam peel meal based concentrates. There were significant differences ($p<0.05$) in the means of the value of some linear body measurements. Animals fed T1 had the highest value in height at wither gain, paunch girth gain and scrotal circumference gain at 7.30 ± 0.3, 4.70 ± 0.2, and 3.60 ± 0.3 cm respectively. The animals on T2 recorded the lowest values in the parameters with significant differences. These values were 6.80 ± 0.2, 4.10 ± 0.3 and 2.90 ± 0.3 cm respectively. However, there were no significant differences ($p>0.05$) in-ear length and tail length in all the animals.

Table 6 shows the cost and economic analysis of WAD rams fed *Panicum maximum* supplemented with graded levels of yam peel meal based concentrates. The cost of feed/kilogram weight gain increased linearly from N59.13 in animals fed T4 to N 158.72 in animals T1. However, the animals on the T3 diet displayed higher total body weight compared with other treatments. The highest value of average net return was obtained from the animals on T3 (N7,440), which reduced to N7,048, N6,885 and N6,146 in T4, T1 and T2 respectively.

Table 4: Growth Performance of WAD Rams fed graded levels of yam peel meal based Concentrates.

Parameter	Treatment			
	T_1 (0%)	T_2 (33.3%)	T_3 (66.7%)	T_4 (100%)
Initial weight (kg)	14.10 ± 1.5	13.90 ± 1.3	14 ± 1.4	14.40 ± 1.2
Final weight (kg)	19.60 ± 0.9^a	18.30 ± 1.2^c	19.80 ± 1.4^a	19.00 ± 0.8^b
Total weight gain (kg)	5.50 ± 0.3^a	4.40 ± 0.4^b	5.80 ± 0.3^a	4.60 ± 0.3^b
Daily weight gain (g)	65.48 ± 2.3^a	52.38 ± 3.3^b	69.05 ± 2.3^a	54.76 ± 2.2^b
Feed intake per day (g)	595.00 ± 23	580 ± 25	570.00 ± 28	573.00 ± 22
Metabolic weight gain ($kg^{-0.75}$)	3.59 ± 0.3^b	3.04 ± 0.4^c	3.73 ± 0.3^a	3.14 ± 0.3^c
FCR	9.09 ± 0.6^c	11.07 ± 0.4^a	8.25 ± 0.3^d	10.46 ± 0.5^b
Means with different superscripts a b c d along the same row is significantly different. FCR: Feed Conversion Ratio				

Table 5: Linear body measurement WAD Rams fed graded levels of yam peel meal based Concentrates.

Parameter	Treatment			
	T_1 (0%)	T_2 (33.3%)	T_3 (66.7%)	T_4 (100%)
IEL	10.00 ± 0.6	10.10 ± 0.6	10.00 ± 0.7	10.20 ± 0.7
FEL	11.30 ± 0.6	11.20 ± 0.7	11.40 ± 0.7	11.30 ± 0.7
ELG	1.30 ± 0.3	1.10 ± 0.1	1.40 ± 0.2	1.10 ± 0.1
ITL	19.10 ± 1.1	19.20 ± 1.4	19.00 ± 1.4	18.70 ± 1.2
FTL	21.90 ± 1.2	21.90 ± 1.7	21.90 ± 1.5	21.50 ± 1.4
TLG	2.80 ± 0.3	2.70 ± 0.3	2.90 ± 0.3	2.80 ± 0.2
IHW	49.00 ± 1.8	48.60 ± 1.9	48.90 ± 1.7	47.20 ± 1.6
FHW	56.00 ± 1.9	55.40 ± 1.8	56.20 ± 1.5	54.00 ± 1.5
HWG	7.00 ± 0.4^b	6.80 ± 0.2^c	7.30 ± 0.3^a	6.80 ± 0.3^c
IPG	52.00 ± 1.5	51.60 ± 1.7	52.00 ± 1.6	51.20 ± 1.7
FPG	56.50 ± 1.7	55.70 ± 1.7	56.70 ± 1.7	55.40 ± 1.6
PGG	4.50 ± 0.2^a	4.10 ± 0.3^b	4.70 ± 0.2^a	4.20 ± 0.1^b
IBL	66.30 ± 1.9	65.80 ± 1.9	66.20 ± 1.9	66.20 ± 1.8
FBL	72.90 ± 1.9	72.00 ± 1.9	73.00 ± 1.8	72.60 ± 1.9
BLG	6.60 ± 0.3	6.20 ± 0.1	6.80 ± 0.3	6.40 ± 0.3
ISC	18.60 ± 1.5	19.30 ± 1.3	18.80 ± 1.4	19.00 ± 1.7
FSC	21.80 ± 1.5	22.20 ± 1.5	22.40 ± 1.5	22.00 ± 1.4
SCG	3.20 ± 0.2^b	2.90 ± 0.3^c	3.60 ± 0.3^a	3.00 ± 0.2^c
EL: Ear Length; TL: Tail Length; HW: Height at Wither; PG: Paunch Girth; BL: Body Length; SC: Scrotal Circumference. Means with different superscripts a, b, c along the same row as significantly different				

Table 6: Cost and Economic Analysis of WAD Sheep fed graded levels of yam peel meal based concentrate.

Parameter	Treatment			
	T_1 (0%)	T_2 (33.3%)	T_3 (66.6%)	T_4 (100%)
Average live weight	14.1	13.9	14	14.4
Average purchase price/ram (₦)	7,000	7,000	7,000	7,000
Operating cost				
Feed	873	634	468	272
Labour	1,200	1,200	1,200	1,200
Medication	312	312	312	312
Total operating cost (₦)	2,385	2,146	1,980	1,784
Average total cost (₦)/ram	9,385	9,146	8,980	8,784
Total body weight gain/ram	5.5^a	4.4^b	5.8^a	4.6^b
Average selling price(₦)/kg	1,400	1,400	1,400	1,400
Average gross return (₦)/ram)	16,270	15,320	16,420	15,832
Average net return (₦)	6,885	6,146	7,440	7,048
Feed cost (₦)/kg weight gain	158.72	144.1	80.7	59.13
Means with different superscripts a, b, c along the same row are significantly different				

Discussion

The Crude Protein (CP) content of Yam Peels Meal (YPM) used in the experimental study (10.20 g-100 g^{-1}) was higher than 9.59 and 9.14g 100 g^{-1} for Ekenyem et al. [10] and Yusuf et al. [16] but less than 12.76 g-100 g^{-1} obtained by Uchewa et al. [12]. This value was also higher than the crude protein value of maize (8.92 g -100 g^{-1}) used in the study. However, the CP obtained from the two sample ingredients fell below the expected value of crude protein (12-14%) for growing sheep [17]. The Nitrogen Free Extract (NFE) of YPM (68.10 g-100 g^{-1}) is comparable with the NFE value of 61.87 g-100 g^{-1} for YPM obtained by Akinmutimi AH, et al. [3]. It is also comparable to the NFE of maize (61.56 g-100 g^{-1}) obtained in this study. This suggests that both YPM and maize contain high NFE and moderate CP which indicates a high level of soluble carbohydrate that could enhance palatability and increase feed intake and digestibility. The Gross energy of YPM and maize were not significantly different, while maize had a higher value of gross energy (3251 Kcal/ME) and YPM recorded 3020 Kcal/ ME.

The anti-nutritional factors values obtained for YPM except for saponin from the present study were similar to those obtained by Akinmutimi AH, et al. [3] and Yusuf KO, et al. [16]. A high level of saponin in the present study may be a result of the processing method. The anti-nutritional factors present in YPM were within tolerable limits, for example, the tolerable concentration of tannin was less than 4% which is the tolerable maximum for ruminants because of high levels of tannins are more resistant to microbial attack and harmful to some rumen microorganisms [18].

The non-significant differences in the feed intakes in all the treatments in this study did not agree with other authors. Feed intake was less than the control in quails when YPM replaced maize [19]. Feed intake increased as the level of YPM increased in broiler chicks [20]. The reason for these may be due to differences in the species of the animals. The similar weight gain n treatment 1 (0% YPM replacement) and treatment 3 (66.7% YPM replacement) despite the different percentages of feed ingredients may be due to the fact that maize and yam peel supply similar nutrients and one can be used as a replacement for each other. This is similar to the result obtained with weaner rabbits [21]. Ekenyem et al. [10] achieved a live weight increase with an increasing level of yam peels as a replacement for maize in finisher broiler diets but in this study, 33.3% and 100% replacement had reduced weight gain and feed conversion ratio. Kume et al. [22] also reported that there was no effect on the performance parameters measured when YPM completely replaced maize offal in the feed of red Sokoto bucks. However, the replacement of maize for YPM at 66.7% performed better than the control in this study in terms of metabolic weight gain and feed conversion ratio.

The similarities in the body linear measurement gains with the overall body weight gain, average daily gain and feed efficiency in animal fed 66.7% yam peel meal correlates with the works of literature that body linear measurement can be useful in defining performance in many cases [23-26].

The high cost of feed of the animals fed maize can be attributed to the high cost and scarcity of maize in the market [27]. Feed costs reduced with increasing levels of yam peels thereby reducing the production costs because the commercial value of YPM is lower than that of maize. Also, the average net returns show that the animals in T3 recorded the highest value. The resulting lower feed costs as the level of yam peels increased is in line with the result obtained by Jiwuba PC, et al. [28]) with fufu sievate meal-based diets as a non-conventional feedstuff for WAD goats. This further lay credence to the low cost associated with locally sourced alternative ingredients. This makes YPM a potentially effective alternative source for maize.

Conclusion

Yam peels meal can replace maize up to 100% in the diet of sheep with a reduction in the cost of production. But the optimum replacement for growth performance and average net return is at 66.7%.

References

1 Tedeschi LO, Molle G, Menendez HM, Cannas A, Fonseca MA (2019) The assessment of supplementation of grazing ruminants using nutrition models. Trans Anim Sci 3: 811-828.

2 Morales AR, Galina MA, Jimenez S, Haenlein GFW (2000) Improvement of bio sustainability of a goat feeding system with key supplementation. Small Rumin Res 35: 97-105.

3 Akinmutimi AH, Anakebe OC (2008) Performance of Weaner rabbit fed graded levels of yam and sweet potato peels in place of maize base diets. Pakistan J Nut 7: 700-704.

4 Kalio GA, Ayuk AA, Agwunobi LN (2013) Performance and economics of West African Dwarf (WAD) bucks fed crop by-products as sole feed in Cross River State, Nigeria. World J Agri Sci 1: 81-87.

5 Ukanwoko AI, Nwanchukwu J (2017) Nutrient and antinutrient composition of crop residues and kitchen wastes fed to small ruminants in Choba, Port Harcourt. Greener J Agri Sci 7: 54-59.

6 Henning S, Pierre G, Tom W, Vincent C, Maurico R, et al. (2006) Livestock long shadow. Environmental Issues Options. FAO, Rome, Italy. 390.

7 Iyayi EA (2008) Prospect and challenges of unconventional poultry feed stuffs. Nig Poul Sci J 5: 186-194.

8 FAO (2013) FAOSTAT database. [http;//bit.ly/NmQzZf].

9 Awoniyi AO, Omonona BT (2006) Production efficiency in yam based enterprise in Ekiti State, Nigeria. Central Europ Agric J 7: 627-636.

10 Ekenyem BU, Madubuike FN, Dike OF (2006) Effect of partial replacement of yam peel meal *Dioscorea* spp for maize Zea mays on performance and carcass characteristics of finisher broiler chicks. Int J Poul Sc 5: 942-946.

11 Omole AJ, Okpeze CN, Fayenuwo JA, Olorungbohunmi TO (2013) Effects of partial replacement of maize with yam peel (*Dioscorea rotundata*) in diet of juvenile snail (*Archachatina marginata*). Afr J Agric Res 8: 1361-1364.

12 Uchewa EN, Orogwu CE, Nwakpu PE (2014) Effect of yam peel meal (YPM) replacement for maize on the growth performance and carcass traits of weaner rabbits. Int J Agric Innov Res 2: 536-541.

13 NAPRI (1984) Highlights of research achievements on animal production science and technology briefing, Lagos. 3-17.

14 Statistical Analysis System (SAS Institute) (2002) Statistical Analysis Software. SAS. Inst. Cary North Carolina U.S.A.

15 Duncan DB (1955) Multiple range and multiple F tests. Biometrics 11: 1-42.

16 Yusuf KO, Ajeigbe OM, Oyebo AT, Aderinboye RY, Adelusi OO, et al. (2017) Nutrients and anti-nutrients content of some crop by-products and residues for ruminant feeding in Nigeria. J Animal Prod Res 29: 249-262.

17 Gatemby RM (2002) Sheep. Revised Edition. Tropical Agriculture Series. Macmillan Publishers Limited, pp: 8-9.

18 Waghorn GC, Tavendale MH, Woodfield DR (1990) Methanogenesis from forages fed to sheep. Proc New Zealand Grassland Asso 51: 171-175.

19 Edache JA, Yisa AG, Okpala EJ (2012). Effect of replacing maize with yam peel meal on short term laying performance of Japanese quails (*Coturnix japonica*). Pakistani J Nutrition 11: 614-617.

20 Inaku EN, Bawa GS, Olugbemi TS, Buba W (2011) Nutritive value of yam peel meal in broiler diets. Proceedings of the 35th Annual Conference of the Nigerian Society for Animal Production (NSAP). University of Abuja, Nigeria 13-16th March, 414-417.

21 Akinmutimi AH, Odoemelan VU, Obasiekong SF (2006) Effect of replacing maize with ripe plantain and yam peels on weaner rabbits. J Ani Vet Adv 5: 737-740.

22 Kume BA, Ayoade JA, Oloche J (2019) Effects of replacing maize offal with high levels of yam peels on the performance and nutrient digestibility of red sokoto bucks. Trop Anim Health Prod 51: 1-6.

23 Riva JR, Marelli RS, Cavalchini LG (2004) Body Measurement in Bergamasca Sheep. Small Ruminant Res 55: 221-227.

24 Janssens S, Winandy D, Tylleman A, Delmotte CH, Vandepitte W (2004) The linear assessment scheme for sheep in belgium: Breed averages and aslesor quality. Small Rumin Res 51: 85-95.

25 Atta M, El Khidir OA (2004) Use of heart girth, wither height and scapuloischial length for prediction of live weight of nilotic sheep. Small Rumin Res 55: 233-237.

26 Afolayan RA, Adeyinka IA, Lakpini CAM (2006) The estimation of live weight from body measurement in Yankasa sheep. Czech J Anim Sci 51: 343-348.

27 Ajayi HI, Olomu JM, Oyedeji JO (2008) Potential of African pear (*Dacryodes edulis*) as feedstuff for animals. Proceedings of the thirteen annual science association of Nigeria. September 15th-19th 2008 Zaria, Nigeria.

28 Jiwuba PC, Assam EM, Inyang EC (2018) Effects of feeding varying levels of fufusievate meal-based diets with *Panicum maximum* basal diet on the blood characteristics of WAD Goats. Sustainability Agric Food Envir Res 6: 1-10.