Impact of Broiler Litter Waste and Urea Based Diets on Performance of Young West African Dwarf Goats.

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ABSTRACT

Eighteen young West African dwarf goats with an average body weight of 8.5kg were used in a 90-day feeding trial to determine the effect of broiler litter and urea supplemented diets on performance indices and nutrient digestibility. The goats were divided into 2 groups of 9 animals with each group further sub divided into 3 animals allotted randomly to one of the three dietary treatments comprising 3 varying levels of crude protein (10, 13 and 16%) of broiler litter (BL) and urea and fed a basal diet of *Panicum maximum* in a 2 x 3 factorial design.

The main effect of nitrogenous source on dry matter intake (g/day), nutrient intake (g/day) and weight gain (g/day) was significant ($P<0.05$) with goats fed urea diets significantly ($P<0.05$) recorded higher daily average gain of (34.74g) than the value of 25.21g obtained from their counterparts on broiler litter diets. Urea diets were better utilized than broiler litter (BL) on account of ($P>0.05$) higher DMI of 515.10gday-1 and feed utilization efficiency of 67.44 ($P<0.05$) of the fed goats. Incorporation of BL at 40% total ration (16% CP) and of urea at 3.6% (13% CP) supported improved goat performance and this can be used as a supplementary diet to available grass in the dry season.

(Keywords: broiler litter, urea, goats, dietary protein level)

INTRODUCTION

Small ruminants (sheep and goats) are complementary to cattle in their production cycles and generally do not compete directly with them for feed. Goats especially are known to be efficient browsers and will consume browses ignored by cattle and sheep on range land. They are owned by more production units in African farming systems than any other species of domestic livestock except poultry because of their lower feed requirement, their rapid reproduction cycles and the ease with which they can be handled (FAO, 1991). In spite of the high small ruminant population in developing countries particularly in Africa, their prolifically, cheap production cost and the indiscriminate demand for their products, goat production potential remains poorly exploited, due largely to neglect, diseases, lack of motivation on the part of decision makers and the conservative traditional management systems (Ajala,1998).

Economically, goat is ideally suited for poorer rural folk especially for marginal and landless laborers by its low cost maintenance, short-term return on capital with low risk capital investment. However, despite the wide distribution of goats across the tropical, its production is being hindered by inadequate nutrition occasioned by the prevalence of poor quality roughages especially during the dry season with little or no protein supplement partly due to the high cost of conventional protein sources vis-à-vis competition between human and animals constitute a nutritional menace to goat production enterprise (Bawala and Akinsoyinu, 2006).

Therefore, efforts must be intensified in the search of alternative feed resources of non-conventional source with no nutritional significance to man and incorporate into feed.

Poultry litter such as that from broiler production units and urea are non-conventional feed resources that can serve a good source of protein and or nitrogen, energy, and minerals in ruminants' feedstuff with realized value under many condition greater than with land application as fertilizers (Stephenson et al., 1990). Broiler litter comprises the poultry excreta, bedding materials, feather, and spilled feed. Contributions of these components vary considerably with production practices among and within regions of the world. The efficiency used of broiler litter as feedstuff is greatest when included at a low level only to provide needed ruminally degraded crude protein with low-protein forage (Goetsch and Aiken, 2000).

The rapid and extensive microbial degradation of nitrogenous compounds to ammonia in the rumen and low to moderate digestible or available energy concentration restricts broiler litter not been used of dietary levels greater than required as a crude proteins supplement. Nonetheless, because in part of relatively low cost, broiler litter is commonly used as a major dietary component for ruminants (Stephenson et al., 1990). Urea as a supplementary substitute protein in feedstuff is of great significant in ruminant nutrition. It is non-protein nitrogen produced from synthetic ammonia and carbon dioxide whose utilization in ruminant nutrition had been widely reported. Urea has the highest nitrogen content of all solid nitrogenous fertilizer of 47% N (Juhaz, 1972). It could be utilized as an ingredient to feed at levels between 1-5% which defines a safe utilization level (Onwuka and Akinsoyinu, 1989).

Protein is required in the diet to provide essential amino acids and nitrogen needed in synthesis of other biological matters (Snow and Ghaly, 2007). Protein is typically the principal and most costly component of an animal diet. The dried poultry manure has a protein content of 422 g/kg which exceeds the recommended dietary intake of animals (7.3-7.8 g/kg). It also exceeds the protein contents of all the forage crops (110-200 g/kg). However, its continuous utilization in ruminant diet is discouraged due to its toxicity which culminates into depression of some ruminal activities when incorporated in excess. Therefore, as unconventional feed resources, the nutritional importance of the two materials were compared with a view to assessing their effects on goat production under farm condition

MATERIALS AND METHODS

Area Depiction

The experiment was conducted at the livestock unit of FUNAAB Leventis, Agro-Allied Industries Limited, Kotopo, Abeokuta, Ogun State. The housing pattern was an open sided, naturally ventilated with concrete floor and raised platforms.

Collection and Preparation of Poultry Litter

Poultry litter was collected from the broiler production unit of S & D Farms Nigeria, Limited Abeokuta, Ogun State while urea was purchased at the Ogun State Agro Services Division of the Ministry of Agriculture, Asero, Abeokuta.

The broiler litter was air-dried by spreading in a large metal pan for a week before incorporation into the diets with a view to reducing moisture content, decreasing rate of deterioration from chemical and biological activities thereby minimizing the microbial count which leads to loss of soluble nutrient particularly nitrogen and Potassium (Blair, 1975) and removal of manure stickiness which allows for easier handling (Bernhart and Fasina, 2009).

Experimental Animal and Management

Prior to the arrival of the animals, the experimental house was disinfected with Morigard disinfectant (0.5ml per litre of water) against microorganisms. The surrounding of the building was kept clean. More so, the animals were quarantined for three weeks prior to the commencement of the feeding trial. They were routinely dewormed against endoparasites with Albendazole (Norm drench). Tetramycin long acting (TLA) injection was given as a prophylactic measures against disease. Also, ivomec injection was given subcutaneously to protect the animal against ectoparasite infestation. Diahot was administered against diarrhoea.

The goats were kept under intensive care for one week for adaptation to the environment likewise to concentrate diet. Animals were given a basal diet of *Panicum maximum* during the quarantine period before the experimental diets were gradually introduced.

Experimental Design

Two sources of nitrogen; broiler litter waste and urea were used at 3 levels of crude protein (10, 15 and 20 %) in a cassava flour based diet. These rations constituted the concentrate supplements to *Panicum maximum* which was fed *ad libitum* for a period of 90 days. Basal grass and concentrate supplement (Table 1) were fed in two separate feeders such that the daily dry matter requirement of 50g/kg Live weight was met. Quantity of feed served and remnant were weighted after 24hrs to determine the amount of feed consumed. Eighteen young West African Dwarf goats with average body weight of 8.5 kg were randomized into two (2) groups of nine (9) animals. Each group was further randomized into three (3) sub-groups of three (3) animals and fed one of the three levels of protein in a 2 x 3 factorial arrangements.

For easy data collection, each animal was kept in an individual pen while performance was monitored. Feeding was done twice daily, 0700 h in the morning and 1700 h in the evening throughout the 90 day experimental period.

Measurement of Weight

The weights of the animals were measured before the commencement of the experiment and weekly before morning feed was served for body weight changes. Each animal was placed in a sac and fixed on a hanging scale for weight determination.

Sample Collection

Collection of Fecal Samples: Collection of fecal samples from individual experimental animals was done during the last two weeks of the experiment for digestibility trial. The total quantity of feces voided for each 24hrs within the period was determined and 10% was taken for seven days. The pre weighed fecal samples were dried daily at constant weight to determine the percentage dry matter before keeping the dry samples for laboratory analysis.

Data Collection

The data collected were basically on nutrient intake: dry matter, crude protein, ash, crude fiber, and nitrogen free extract. We also collected data on % DM digestibility and body weight gained. Dry matter digestibility was calculated by the formula below:

$$\% \text{ DM Digestibility} = \frac{\text{Dry matter intake} - \text{Dry matter output} \times 100}{\text{Dry matter intake}}$$

Table 1: Gross Composition (%) of the Experimental Diets.

Ingredients	I	II	III	IV	V	VI
Urea	0.00	0.00	0.00	2.70	3.63	4.78
Broiler Litter	22.52	32.06	40	0.00	0.00	0.00
Cassava Flour	65.48	55.94	48	85.53	84.37	83.22
Vitamin/Mineral	1.00	1.00	1.00	1.00	1.00	1.00
Oyster Shell	0.50	0.50	0.50	0.50	0.50	0.50
NaCl	0.50	0.50	0.50	0.50	0.50	0.50

Chemical Analysis

The milled samples of concentrate diets, *Panicum maximum* and collected fecal samples were analyzed for their proximate components (A.O.A.C, 1990).

Statistical Analysis

Data generated were subjected to 2 x 3 factorial experimental layout in a Completely Randomized Design (CRD). Significant differences among treatment means were resolved by Duncan's Multiple Range Test (Duncan, 1955) as contained in SAS (1999). Statistical significance was established when probability was less than 0.05 level of significance.

RESULTS AND DISCUSSION

The results of the proximate composition (g/100gDM) of the experimental diets is presented in Table 2. The test ingredients constituted (%) 78, 86, 88, 69, 79,, and 84 of the dietary crude protein contents of diets I II, III, IV, V, and VI, respectively, indicating significant proportions of dietary protein constitution of the experimental diets. Crude protein levels of the two test diets ranged from 10 – 16%.

The crude fibre contents of diets decreased as the levels of crude protein increased. Crude fibre contents of the diets were quite high due to their contents of cassava flour. Broiler litter however is also a source of dietary fibre. Higher ash content (2.57 – 3.10) of the broiler litter diets could be attributed to the relatively high levels of ash in the broiler litter which Goetsch and. Aiken (2000) suggested could form an excellent source of dietary minerals. Metabolizable energy (kcal/kg) contents, of the diets (2.55 to 3.45) which were nutritionally adequate for the growing goats.

The results of the main effect of nitrogenous source and dietary protein level on performance characteristics of West African dwarf goats is presented in Table 3. Though statistically similar ($P > 0.05$) goats fed urea diets had numerically higher Mean DMI value of 515.10 than 487.01 obtained for those on broiler litter (BL) diets. This is in accordance with the work of Huston *et al.* (1994) who reported that DMI of ruminant animals are affected by several factors which include age, sex, physiological state and nature of feed. The DMI was considerably higher than values reported by Akinyemi *et al.*(2010) Mean DMI (g/Day/Kg $BW^{0.75}$) of goats reveals highest value of 93.30 for those fed BL compared to 88.05 obtained for those fed Urea diets. The main effect of Broiler litter and Urea on weight gain (g/day) was significant ($P< 0.05$). Urea fed goats however, had highest ($P < 0.05$) weight gain of 34.74 than those on Broiler litter diet (25.21), with attendant highest feed efficiency (FE) of 67.44.

Table 2: Proximate Composition (%) of the Diets.

Parameters	I	II	III	IV	V	VI
Dry Matter	87.20	88.50	85.00	88.20	88.65	86.40
Crude Protein	10.00	13.00	16.00	10.00	13.00	16.00
Crude Fibre	25.90	24.06	21.60	30.05	25.30	23.15
Ether Extract	3.55	3.76	3.82	2.10	2.16	2.14
Nitrogen Free Extract	54.98	58.29	58.48	54.91	54.53	54.72
Ash	2.57	2.89	3.10	1.94	2.07	1.99
Metabolizable Energy (Kcal/Kg)	3.28	3.43	3.45	2.55	2.67	2.89

Table 3: Main effect of Nitrogenous Source and Dietary protein Levels on Performance characteristics of West African Dwarf Goats.

	Test Ingredients			Dietary Crude Protein Levels (%)			
Parameters	**BL**	**Urea**	**SEM**	**10**	**13**	**16**	**SEM**
Initial Weight (Kg)	7.94	9.00	1.12	8.00	9.50	7.92	0.73
Final Weight (Kg)	10.22	12.33	2.24	10.50	12.33	11.00	0.77
Weight Gain (g/day)	25.21	34.74	10.12	26.57	30.17	33.20	2.71
DMI (g/day)	487.01	515.1	29.19	478.31	531.53	496.33	23.19
DMI 9g/day/Kg $WB^{0.75}$	93.30	88.05	6.05	90.00	89.18	92.77	5.15
Crude Protein (g/day)	76.17	74.84	1.42	47.53	79.62	99.26	21.33
Crude Fibre (g/day)	37.06	165.50	36.23	100.26	106.28	99.30	3.73
Ether Extract (g/day)	18.72	10.13	9.11	12.73	14.44	16.11	1.38
Ash (g/day)	21.39^{a}	10.62^{b}	11.42	13.20^{b}	12.33^{c}	22.09^{a}	4.33
NFE (g/day)	335.79^{b}	360.96^{a}	26.70	322.14^{c}	350.20^{b}	372.80^{a}	20.72
Feed Efficiency	51.77^{b}	67.49^{a}	14.48	55.90^{b}	56.76^{b}	66.89^{a}	9.87

$^{a,\,b,\,c}$: Means on the same row having different superscript were significantly different (P< 0.05)
BL: Broiler Litter NFE: Nitrogen Free Extract DMI: Dry Mater Intake
SEM: Standard error of Means.

This can be interpreted to mean that urea diet was better utilized than those of Broiler litter. This is in accordance with the previous reports (Mba *et al.,* 1982) that Urea is more efficiently utilized by goats than the nitrogen in proteins- rich concentrates. However, lower body weight gain of broiler litter fed goats could be due to its increasing levels which Goetsch and Aiken (2000) reported to decrease efficiency of nitrogen usage with attendant lower animal performance. The differences in the weight gain values obtained may indicate differences in the absorption, partitioning and utilization of nutrients from the two nitrogenous sources.

The main effect of broiler litter and urea on (g/day) crude fibre, ether extract, nitrogen free extracts (NFE), and ash were significant (P < 0.05) while goats fed Urea diets had highest (P< 0.05). Crude fibre (165.50) and NFE intakes (360.96) corresponding goats on broiler litter had highest value for fat (18.72), ash intake (21.39). Effect of nitrogen source on fat intake was significantly (P <0.05) with goats on broiler litter having high value of 18.72 g/day. This could have been due to higher ether extract content of broiler litter which could have been derived from the poultry waste diets, unlike the Urea which was purely crystalline nitrogenous materials. Poultry manure (Broiler litter) is reported to be high in nitrogen, which ruminants can utilize as an energy source (Bernhart and Fasina, 2009). Effect of protein source on the Crude protein intake was not significant (P > 0.05), though goats on broiler litter diets had the highest crude protein intake. This shows the efficiency of use of broiler litter as a ruminant feedstuff in providing needed ruminally degraded CP with low-protein forages.

The main effect of dietary protein levels on Means values of the ash intake (g/Day) of the experimental goats were I3.60, 12.30, 22.09 for diets treatments containing 10, 13 and 16% CP respectively. Goats on 10% CP had least weight gained value of 26.57. The low body weight gain (g/day) of animals on diets I (10%) could be due to the nature of feed which resulted into lower DMI recorded for these group of goats. This also agrees with the work of Mba *et al* (1982) who showed that increased dietary energy density reduced DMI with increased dietary protein. Mean Dry Matter intakes (DMI g/Day) of the experimental goats fed diets containing 10, 13 and 16% crude protein levels were (P < 0.05) 475.31, 531.53, and 496.33, respectively. Goats on diet containing 16% CP had highest DMI (g/Day/$KgBW^{0.75}$) of 92.77. Crude protein intake (g/Day) of goats increased with dietary crude protein level with those on 16% significantly (P < 0.05) had highest value of 99.26. This indicated that goats consumed more proteins as the dietary protein level increases. Fat intake (g/Day) of goats followed similar trend with that of crude proteins as it increased with increasing protein supplementation (P< 0.05).

Crude fibre intake of goats was highest (P < 0.05) for diets containing 13% CP (106.28) and declined to 97.30 g/day as the dietary protein level increased to 16%. Ash and NFE intakes increased with dietary protein levels with highest value recorded for goats fed 16% crude protein level.

Interactive effect of Nitrogenous source and dietary protein level on performance characteristics is presented in Table 4. The interaction had significant (P<0.05) effect on most performance indices considered except final weight and ether extract which ranged from 8.33 to 18.19%. The interaction of the treatment adopted did impose significantly (P< 0.05) on weight gain (g/day), and nutrient intakes DM, crude protein, crude fibre, and ash intakes with exception of ether extract intake (P > 0.05), which ranged from 8.33 to 18.19% (Table 4).

Table 5 shows the main effect of broiler litter and urea on dry matter, crude protein, crude fibre, ash and NFE digestibility values were not significantly (P > 0.0.5) affected across higher treatment. DM, Crude protein and Nitrogen free extract digestibility values increased (P > 0.05) as the dietary protein levels increased. Goats fed Urea diets showed superior digestibility value than those broiler litter diet with exception of ash digestibility. The interactive effect of Broiler litter and Urea diets in apparent nutrient digestibility of goats is presented in Table 6 with the exception of ash values; the interaction of the adopted treatments did not impose significantly (P > 0.05) on the nutrient digestibility. The crude protein digestibility values ranged from 50.74 to 93.61%.

Goats fed 16% CP broiler litter supplemented diet recorded highest (P > 0.05) digestibility values of DM (91.96%), crude protein (93.61%) and Ash (86.71%) while those on 16% CP urea diet had highest crude fibre values (89.38%).The digestibility of nutrients in all treatment groups were relatively high. This is perhaps an indication that more nutrients are absorbed and hence available for utilization. Higher values of digestibility of goats fed urea diets suggest that goat could better utilize urea diets that broiler litter diets. In contrast higher ash digestibility values of broiler diets could be due to its higher content of ash.

Table 5: Interactive effect of Nitrogenous Source and Dietary Protein Levels on Performance characteristics of West African Dwarf Goats.

Nitrogenous Source	**BL**			**Urea**			
Dietary Protein Levels (%)	**10**	**13**	**16**	**10**	**13**	**16**	**SEM**
Initial Weight (Kg)	8.00	9.00	6.83	8.00	10.00	9.00	0.22
Final Weight (Kg)	9.33	10.33	11.00	11.67	14.33	11.00	0.41
Weight Gain (g/day)	14.33^{d}	14.80^{d}	46.40^{a}	38.70^{b}	45.53^{a}	19.99^{c}	6.39
DMI (g/day)	394.95^{e}	483.76^{c}	582.33^{a}	555.67^{b}	579.29^{a}	410.34^{d}	35.99
DMI 9g/day/Kg WB0.75	78.20^{c}	88.28^{b}	113.74^{a}	100.66^{a}	89.81^{b}	73.54^{c}	23.10
Crude Protein (g/day)	39.49^{f}	72.56^{d}	116.47^{a}	55.57^{e}	86.88^{b}	82.06^{c}	5.86
Crude Fibre (g/day)	33.82^{e}	43.25^{d}	34.11^{e}	166.70^{b}	169.30^{a}	160.50^{c}	0.79
Feed Efficiency	36.28^{c}	30.59^{c}	79.68^{a}	69.63^{a}	78.59^{a}	48.72^{b}	12.25
Ether Extract (g/day)	17.13	18.19	20.87	8.33	10.69	11.37	0.21
Ash (g/day)	16.41^{b}	13.98^{c}	33.77^{a}	10.78^{d}	10.68^{d}	10.41^{d}	2.24

$^{a, b, c}$: Means on the same row having different superscript were significantly different (P< 0.05)
BL: Broiler Litter NFE: Nitrogen Free Extract DMI: Dry Mater Intake
SEM: Standard error of Means.

Table 5: Main effect of Nitrogenous Source and Dietary Protein Levels on Nutrient digestibility of West African Dwarf Goats.

Parameters	Nitrogenous Source			Dietary Protein level (%)			
	BL	Urea	SEM	10	13	16	SEM
DMI	87.41	87.94	0.46	84.80	87.26	90.96	2.07
Crude Protein	76.01	84.70	7.52	65.33	82.30	93.31	9.35
Crude Fibre	74.69	86.19	9.96	79.86	77.75	83.70	2.01
Ash	60.93[a]	56.03[b]	38.90	35.29	30.50	49.61	6.63

[a, b, c]: Means on the same row having different superscript were significantly different ($P< 0.05$)
BL: Broiler Litter DMI: Dry Mater Intake SEM: Standard error of Mean.

Table 6: Interactive effect of Nitrogenous Source and Dietary Protein Levels on Nutrient digestibility of West African Dwarf Goats.

Nitrogenous Source	BL			Urea			
Dietary Protein Levels (%)	**10**	**13**	**16**	**10**	**13**	**16**	**SEM**
DMI	82.54	87.73	91.96	87.06	86.80	89.96	0.58
Crude Protein	50.74	83.67	93.61	80.17	80.92	93.00	3.00
Crude Fibre	70.75	75.30	78.03	89.00	80.20	89.38	1.11
Ash	64.58[c]	71.50[b]	86.71[a]	62.00[d]	59.50[e]	58.61[e]	4.65

[a, b, c]: Means on the same row having different superscript were significantly different ($P< 0.05$)
BL: Broiler Litter DMI: Dry Mater Intake SEM: Standard error of Means.

CONCLUSION

The current scarcity and high cost of livestock feeds calls for research into locally available ingredients that could be used in livestock production. Broiler litter waste and Urea are readily available in Nigeria and their utilization in ruminant nutrition is gaining prominence by the day. Present findings reveal that:

- Broiler litter waste possesses the potential of being a feed resource for ruminant nutrition.
- Both broiler litter and Urea form good source of dietary nitrogen for ruminant production.
- Urea diet was utilized by goats than broiler litter diet in account of higher daily weight gain (34.74g), dry matter intake (515.10g/day), nutrient digestibility, feed efficiency of 67.44 observed in the fed animals. Incorporation of broiler litter as high as 40% total ration (16% CP diet III) had a similar effect with the utilization of Urea at 3.63% ration (13% CP diet V) in terms of average daily gain and feed efficiency.

Consequently, it can be recommended that both materials could be used in the nutrition of growing animals with moderation while 13% CP ration could support the growth performance of young WAD goats the use of broiler litter and Urea should be monitored such as to prevent any deleterious effect on animal health. More research studies are however recommended on the safety use of broiler litter in goat nutrition in account of its probable high microbial load with attendant health implication on ingested animal.

REFERENCES

1. AOAC. 1990. *Official Methods of Analysis*. Association of Official Analytical Chemist: Washington, D.C.

2. Akinyemi, A.F., A.A. Julius, and N.F. Adebowale. 2010. “Digestibility, Nitrogen Balance and Haematological Profile of West African Dwarf Sheep fed Dietary Levels of *Moringa oleifera* as Supplement to *Panicum maximum*”. *Journal of American Science*. 6(10).

3. Bawala, T.O. and A.O. Akinsoyinu. 2006. “Nutritional Evaluation of Rumen Epithelia Tissue Scrapings In Goats Nutrition”. *Nutrition and Food Science*. 36:414-418.

4. Bernhart, M. and O.O. Fasina. 2009. “Moisture Effect on the Storage, Handling and Flow Properties of Poultry Litter”. *Waste Management*. 29:1392-1398. PMID: 18990556.

5. Blair, R. 1975. “Feeding Value of Dried Poultry Waste”. *Nigeria Journal of Animal Production.* 8:140-149.

6. Duncan, D.B. 1995. “Duncan’s Multiple Range and Multiple F. Tests”. *Biometrics*. 11:1-42.

7. FAO. 1991. “Small Ruminant Production Small Ruminant Genetic Resources and Health”. Paper 88. FAO: Rome, Italy.

8. Goetsch, A.L. and G.E. Aiken. 2000. “Broiler Litter in Ruminant Diets- Implications for Use as a Low-Cost By-Product Feedstuff for Goats”. In: R.C. Merkel, G. Abebe and A.L. Goetsch (eds). *The Opportunities and Challenges of Enhancing Goat Production in East Africa*. Proceedings of a conference held at Dehub University, Awassa, Ethiopia. November 10 to 12, 2000. E(Kika) de la Garza Institute for Goat Research Langston University, Langston, OK. 58-69.

9. Huston, J.E, Taylor, C.A, Lupton, and T.D. Broks.1994. “Affection of Supplementation Intake, Growth Rate and Rangeland”. *Journal Animal Science*. 71:3124-3130.

10. Juhaz, F.E. 1972. “Utilization of Urea Based Diets in Small Ruminant Production”. *Journal Animal Science*. 101-120. Egypt.

11. Mba, A.H. 1982. “Mineral Nutrition of Goats in Nigeria Production”. 3rd International Conference Goat Disease. 109-112.

12. Onwuka, C.F.I. and A.O. Akinsoyinu. 1985. “Protein and Energy Requirement of West African Dwarf Goats Fed Browse Leaves Supplementation With Cassava Peels”. *Proc. National Conference On Small Ruminant Production (Abst)*. Oct 6-11 NAPRI, Nigeria. 351-354.

13. SAS. 1999. Version 8-1. Statistical Analysis System Institute: Carry, NC.

14. Snow, A.M. and A.E. Ghaly, 2007. “The Nutrition Value of Wastewater Grown Barley and it’s Utilization in Fish Feed”. *Am. J. Agric. Biol. Sci.* 2: 168-183. DOI:10.3844/ajabssp.2007.159.167

15. Stephenson, A.H, T.A. McCaskey, and B.G. Ruffin. 1990. “A Survey of Broiler Litter Composition and Potential Value as Nutrient Resources”. *Biol. Waste*. 34:1-9.

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