MILK YIELD AND COMPOSITION OF CROSSBRED GOATS FED CASSAVA PEEL MEAL SUPPLEMENTED WITH FORAGES AS REPLACEMENT FOR MAIZE OFFAL.

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ABSRACT
This study was conducted to evaluate the replacement value of cassava peel meal (CPM) for maize offal supplemented with forage on milk yield and composition of crossbred goats. Four diets (A - D) were formulated containing CPM at 0, 60, 80 and 100% replacement levels designated $T_{1,}$ $T_{2,}$ T_3 and $T_{4,}$ respectively. Four lactating crossbred does in their second parity, with average weight 18.25 ± 0.96 kg were used to carry out the study in a 4 x 4 Latin Square design. The experiment lasted 56 days which was divided into four periods of 14 days each. Data were collected on milk yield and composition. The analyzed composition of the experimental diets indicated that the dry matter, crude protein, crude fibre, ether extract, ash, and nitrogen free extract contents of the diets ranged from 88.93-90.96%, 9.75-12.50%, 13.81-16.33%, 1.87-1.94%, 9.07-10.58%, and 51.80-53.61%, respectively while CPM contained (86.60%) dry matter, (4.27%) crude protein, (12.61%) crude fibre, (1.61%) ether extract, (8.14%) ash and (59.95%) nitrogen free extract. Milk yield of the group fed diet D (196.84 g/d) was significantly ($p<0.05$) higher than for the groups fed diets A (129.62), B (143.02) and C (140.18g/d). Total solids, ash, lactose and solids-not-fat (%) were also significantly ($p<0.05$) higher in the diet D group than in the other groups. The groups fed diets A, B, and C had significantly ($p<0.05$) higher milk energy and fat-corrected milk than the diet D group. Milk yield was negatively correlative with total solids, while total solids and butter fat, total solids and milk energy were positively correlated. The relationship between yield and total solids; total solids and butterfat; and total solids and energy were positively and significantly correlated ($p<0.05$). Replacing maize offal with100% cassava peel meal promoted milk yield with adequate milk constituents in lactating crossbred goat. Therefore 100% CPM as replacement for maize offal in lactating goats is recommended for optimal yield and adequate milk constituents.
Keywords: Cassava peel, maize offal, forage, goats, milk

INTRODUCTION

One of the major food problems in Nigeria is the gross deficiency in protein intake, both in quantity and quality. The low protein intake has been responsible for reduced human productivity with high incidence of infant mortality, severe malnutrition and high general weakening of human body which pre-dispose people to diseases, low health status, and shorter lifespan (Mbanasor, 2002). Nigeria has been observed to consume more of plant protein, which has been found to be of lower quality than animal protein, hence the need for more animal protein sources.

Dairy products provide the most important amino acid required for body building as well as tissues repairs in human beings. It is also essential for the synthesis of certain hormones, enzymes and body products for both man and animals (FAO, 1988). The small scale dairy milk processing industry cannot meet the challenges of improving the consumption of animal protein by the teeming population as well as supply those nutrients, which are deficient in staples such as cereals, roots and tubers (FAO, 1988).
In Nigeria, cattle are the primary source of milk for human consumption. Indigenous cattle continue to dominate the traditional dairy sub sector in spite of their low potential for milk production (RIM, 1992). This has led to massive importation of milk and milk products, hence increased cost. Although there is an affinity for milk products in the country, the high cost of milk puts these products beyond the reach of the average Nigerian, hence the need for alternative source of milk for local consumption.

Goats are important in the low input system. They contribute significantly to improve family nutrition and health, and sales of animal and their products help to stabilize household income. The animals are regarded as savings since they can easily be exchanged or sold in case of need. They are widely distributed throughout the sub-humid area from Senegal to Central Africa. Goats in the country are kept mainly for meat production; their milk is rarely used for human consumption (Butswat *et al.*, 2002). However, preliminary information indicates that milk production is more important in goat than in sheep. Goat can be milked as often as required, preventing milk storage problem. Its milk is easily digestible due to the presence of smaller size fat globules making softer curd. It also has less allergic problem than milk of other species of livestock. According to Desjeux (1993), the lactose content of goat is lower.

The mineral content is likely higher than that of cow due to the presence of relatively higher amount of calcium, phosphorus, and chlorine contents. However, the iron value is lower (Banerjee, 2013). Unfortunately, feeding is currently posing a great challenge to goat production in Nigeria under the semi-intensive and intensive systems of production. There is need therefore to identify feedstuffs that are readily available and has the potentials of sustaining production and milk yield of goats.

Cassava peel is a major by-product of the cassava tuberous root processing industry. In parts of Nigeria where cassava is grown and the tubers processed, the peel is either wasted or largely underutilized as a livestock feed. In Nigeria, the average annual yield of cassava tuberous roots is 21.1 t/ha. Since the peel constitutes 20.1 percent of the tubers (Hahn *et al*., 1986), it follows that about 4.2t of cassava peel per ha are available annually for feeding ruminants, especially goats. Fresh and processed cassava peel contains 27.7 to 89.7 % DM, 8.7 to 11.3 % CP, 4.7 to 6.9 % CF, 3.0 to 3.5 % EE, 2.0 to 4.9 % Ash and 48.8 to 68.8 % NFE depending on method of processing (Okah *et al*., 2017). The mineral content of cassava peel range from 0.07 to 0.12 ppm Ca, 0.04 to 0.21 ppm K, 0.12 to 0.15 ppm P, 0.03 to 0.09 ppm Mg, 0.06 to 0.18 ppm Na depending on method of processing (Okah *et al*., 2017). The mineral and proximate constituents of cassava peels exhibit some levels of variability. This is due to strain, varietal differences, location, soil type, other environmental conditions, method of processing and analysis. Processing is the most important factor responsible for variation in composition. Cassava has high energy yield 13 times more per hectare than maize and guinea corn. The energy value of cassava peels varies with the amount of flesh retained during peeling process. The energy is as high as 1.84 Kcal/kg. It is highly digestible; with reported values of 78 % and 81 % in DM and OM total tract digestibility, respectively (Smith, 1988). Cassava peel is rich in metabolisable energy and very well degraded in the rumen (Smith, 1988). It has high and variable fibre content. Protein content is low (4.2 - 6.5%) (Adegbola, 1980) compared to cassava leaf (25.1%). Cassava contains two cyanogenic glycosides, linamarin (80% of total glycosides) and lotaustralin (20%) (McDonald *et al.,* 1981), which on hydrolysis liberates hydrogen cyanide (HCN) that is lethal to animals. HCN concentrations depend on cultivar, environmental conditions, plant age, number of harvest (for the foliage) and on the plant component that is being considered. Different processing methods including sun drying, ensiling, and soaking (Salami and Odunsi 2005; Okah *et al*., 2017) or boiling (Okah *et al.,* 2017) have been used in order to reduce the cyanogenic glucoside and phytate content, and to improve their nutritive quality (Salami and Odunsi, 2005; Okah *et al.,* 2017). The flesh tuber is deficient in fat, minerals and vitamins but will be useful as energy source. It is noted that high moisture levels predisposes cassava products to spoilage.

Substantial quantities of cassava (*Manihot esculenta* Crantz) peels that could provide carbohydrate for livestock are generated annually from the processing of cassava into starch, chips and gari.

Therefore, in order to explore the benefits of cassava as ruminant feed resource as well as increase the use of cassava and also reduce the effect of hydrocyanic acid, sun drying could be exploited. There is a continuous gradient of HCN content between varieties, which are usually divided into two groups:

(1) Bitter varieties with roots containing 0.02 - 0.03 % HCN (DM basis) and leaves containing up to 0.2 % HCN (fresh basis). These have to be processed before being used as feed.

(2) Sweet varieties with roots containing less than 0.01 % HCN (DM basis) and leaves 0.1 % HCN (DM basis) (Peroni *et al*., 2007). These can be fed raw. Most commercial varieties belong to this group. Bitter varieties have often longer and thicker roots than the sweet varieties, but there is no simple and safe method to assess HCN content. However, HCN can be easily removed from cassava and its by-products by processing.

Maize offal is a by-product of maize milling processes, second to wheat offal as the most preferred and utilized conventionally in livestock feeds in Nigeria (Babatunde *et al.,* 2002). Maize offal contains about 110 to 120 g/kg crude protein and 80 to 90 g /kg crude fibre (Onifade and Babatunde, 1998; Makinde, 2006). The relatively low crude fibre content compared to other by-products could be an advantage in fibre nutrition whereas the low protein content appears to be a limitation. However, it is costly when compared with cassava peel meal. This study was aimed at evaluating the effect of dietary replacement of maize offal with cassava peel on the yield and composition of milk of (WAD x RS) crossbred goats.

MATERIALS AND METHOD

Experimental site:

The study was conducted at the sheep and goats units of the Teaching and Research farms of the Micheal Okpara University of Agriculture Umudike, Umuahia, Abia State. Umudike is located on latitude 05^o 29′ north and 75^o 32′ east and 122 meters or 400 feet above sea level. The environment is situated within the rainforest zone and characterized by an annual rain fall of about 2177mm. Relative humidity ranges from 50 – 95 % depending on seasons, and ambient temperature ranges from 22^o C - 36^o C (NRCRI, 2016).

Experimental diets

Cassava peel collected from the gari processing unit of the National Root Crop Research Institute

(NRCRI) Umudike was sun-dried on a concrete floor for at least 3-days to reduce the moisture content. The dried peel was milled and bagged for use in feed compounding.

Four experimental diets (A-D) were formulated such that cassava peel replaced maize offal at the rate of 0, 60, 80 and 100%, designated T_1, T_2, T_3 and T_4, respectively. The concentrate diets were offered *ad libitum* and forages (*Panicum maximum* and *Centrocema pubescens*) were given as supplementary feed.

Table 1: Composition of experimental diets containing different replacement levels of cassava peel meal for maize offal

Ingredients (%)	$T_{1(0\%)}$	$T_{2(60\%)}$	$T_{3(80\%)}$	$T_{4(100\%)}$
Maize Offal	60.25	24.10	12.05	_
Cassava Peel Meal	_	36.15	48.20	60.25
Palm Kernel Cake	29.5	29.5	29.5	29.5
Soya Bean Meal	7.00	7.00	7.00	7.00
Bone Meal	2.50	2.50	2.50	2.50
Salt (NaCl)	0.50	0.50	0.50	0.50
Vitamin/Mineral Premixes*	0.25	0.25	0.25	0.25
Total	100	100	100	100
Calculated Composition				
Crude Protein CP (%)	14.9	12.7	12.0	11.3
Metabolizable Energy ME(Kcal/Kg)	2336.875	2169.139	2113.227	2055.229

*Vit/Min Premix: Each 2.5kg Contains; Vit. A -10,000,000IU, Vit.D3-2,000,000IU, Vit. E- 20,000IU, Vit. K-2,250mg; Thiamine-1750mg; Riboflavin- 5,000mg; Pyridoxine-2,750mg; Niacin- 27,500mg; Vit. B12- 15mg; Pantothenic acid-7,500mg; Folic acid – 7,500mg; Biotin 50mg; Choline chloride- 400g; Antioxidant-125g; Manganese-80g; Zinc-50g; Iron-20g;Copper-5g; Iodine- 1.5g; Selenium-200mg and Cobalt-200mg

Experimental Animal and Management

Four lactating crossbred (WAD x RS) does in their second parity, with average weight 18.25 ± 0.96 kg from the University farm were used for the experiment. The goats were housed separately in 4 pens each measuring 2.5 m x 2.5m. The floor was covered with straw as letter material.

One doe was assigned to each of the four experimental diets in a 4x4 Latin Square design experiment. The animals were weighed at the beginning of the experiment and after every phase (14-days period) of the experiment. After each period of 14 days, the animals were changed to another diet until the four periods were completed, making a total of 56 days. The animals were offered the diets *ad-libitum* at 8.00 hr while the forages were offered at 12.00 hr daily. Data was collected on daily feed intake by measuring the quantity of feed on offer and refusal, and taking the difference. Milk yield was obtained by harvesting milk and weighing in the morning each day on the last 4 days of each period. Udder was sterilized prior to hand milking in the morning before feeding in each of the 4-days of milking.

Kid Management

Kids were separated from the dam in the evening each day at 16.00 hr. Twenty (20ml) of the harvested milk from each doe was taken for analyses, while the remaining was fed to the kids with the aid of feeding bottle. After milking the dams, the kids were allowed to suckle the dam till 16.00 hr before separating them again to milk the dam at 8.00 hr the next day.

Milk yield

Milk was harvested in the morning only. Milk yield per animal per day was recorded as the morning daily yield of the does. The daily milk yield was then estimated for each doe on assumption that actual daily production of does can be met if the animals were milked twice. Based on the concept of fixed milk yield responses to changing milking frequency (Erdman and Verner, 1995), the constant 0.6596 was used as a weighing factor on the morning milk yield. Each day's milk yield (S) was estimated as:

$S = M + 0.6596M$

Where;

M = Morning milk yield (once-a-day milking)

The quantity of milk harvested from each of the does was measured using graduated glass cylinder (200ml capacity). The weight of milk was measured in grams, using sensitive scale by subtracting the weight of glass ware from the weight of glass ware and the glass ware plus the milk. Five (5g) of the milk samples were taken out immediately for lactose determination and 15ml/day for each animal bulked in containers and stored in the refrigerator (-5^{o}C) for analyses of other milk constituents.

Analytical Procedure

Proximate analysis of the experimental diets was determined according to AOAC (2000). The milk samples were immediately analyzed for lactose, but total solids, butter fat; crude protein (N X 6.38) and ash were analyzed from the stored samples, while solids-not-fat and energy were calculated. Total solids were determined by drying 5g of milk sample to a constant weight at 105^{o}C for 24 hours. Lactose content of fresh milk was determined according to Marrier and Boulet (1959). Butter fat was analyzed by the Roese - Gottlieb method (AOAC, 2000). Milk protein (N X 6.38) was determined by the semi-micro distillation method using kjeldahl and Markhamps apparatus. Solids-not-fat was determined as the difference between total solids and butter fat. Milk energy was computed using the multiple regression equation.

Y = 0.386 F + 0.0205 SNF – 0.236 (MAFF, 1977)

Where F and SNF; are percentage of fat and solids-not-fat in milk, respectively.

Fat-Corrected Milk was calculated using the prediction equation of Gaines (1928). He proposed the formula for expressing milks of different fat contents in terms of 4 percent fat milk:

4 percent fat milk = 0.4M + 15F

Where M = weight of milk and F = weight of fat contained in it.

Solids-Corrected Milk was calculated using the prediction equation of Tyrrell and Reid (1965):

SCM (Kg) = 12.3 F + 6.56 SNF – 0.0752 M

Where SCM = Solids-Corrected Milk having 750 KcalKg^{-1}

F = Weight of fat contained in milk

SNF = Weight of Solids-not-fat contained in milk

M = Weight of milk (morning milk)

Statistical Analysis

All data collected were subjected to analysis of variance (ANOVA) applicable to Latin Square design (Steel and Torrie, 1980). Differences between means were separated according to Duncan Multiple Range Test (Duncan, 1955) using SAS (1999). Correlation coefficient was computed and simple linear regression used to assess the degree of relationships between various milk constituents.

RESULTS AND DISCUSSION

The results of the proximate composition the experimental diets are presented in Table 2. The crude protein content of the diets decreased progressively from diets A to D, and ranged from 9.8 – 12. 5 %. The crude fibre content of the diets ranged from 13.8 – 16.3 % in reversed order of the crude protein values. The ether extract was almost constant at 1.9 %. The ash content ranged from 9.1 -10.6 % without any definite order. Nitrogen free extract (NFE) ranged from 50.4 -53.7 %, and did not follow any trend. The cassava peel meal contained 4.3 % crude protein, 12.6 % crude fibre, 1.6% ether extract, 8.1 % ash and 60.1 % NFE. The lower CP content of diets with increased level of cassava peel was as a result of lower CP content of cassava peel compared with maize offal. The crude protein content of cassava peel (4.3%) reported in this study was lower than the range (8.7 – 11.3 %), but the crude fibre (12.6 %) was higher than the range (4.7 – 6.9 %) reported by Okah *et al*. (2017).

Table 2: Proximate Composition of Experimental Diets and Cassava Peel Meal

Constituents (%DM)	*T_1(0%CPM)*	*T_2 60%CPM)*	*T_3 (80%CPM)*	*T_4 (100%CPM)*	*CPM*
Dry Matter	91.0	90.1	89.7	88.9	86.7
Crude Protein	12.5	10.9	10.3	9.8	4.3
Crude Fibre	13.8	14.5	15.8	16.3	12.6
Ether Extract	1.9	1.9	1.9	1.8	1.6
Ash	10.3	9.1	9.9	10.6	8.1
Nitrogen Free Extract	52.5	53.7	51.8	50.4	60.1

The variations in proximate composition as compared with the reports by other authors might probably be due to differences in variety, the mineral composition of the soils where the plant was grown, the amount of flesh in the peel, and even the analytical techniques and the skill of the laboratory technologist (Okah *et al*., 2017).

Table 3 shows the milk yield and composition of WAD x RS goats fed different replacement levels of Cassava Peel Meal (CPM) for maize offal. The milk yield of animals fed diet D (100% CPM) was significantly ($p<0.05$) higher (196.84g/d) than those fed diets A (129.62g/d), B (143.03g/d) and C (140.18g/d). Total solids was higher ($p<0.05$) in the milk of goats fed diet D (100 % CPM) than in diets A (0 % CPM), B (60 % CPM) and C (80 % CPM). This seems to suggest that the CPM promoted total solids in milk of crossbred goats (WAD x RS). Ibeawuchi *et al.* (2003) obtained lower values of total solids of 12.8% in red Sokoto goat's milk, indicating that milk constituents could vary with breed. Milk protein, butter fat and solids - corrected milk did not indicate significant differences ($p>0.05$) among the treatment means.

The ash content of the milk was lower ($p<0.05$) in the group fed diet B probably stemming from it lower dietary ash content (Table 2). The ash content recorded in goats fed diets A (0.98 %), C (0.92 %) and D (0.91 %) are close to the range of 0.90 to 0.95

% reported by Okah and Ibeawuchi (2011) for milk of WAD sheep, but higher than the range of 0.80 to 0.84 % reported for WAD goats (Igwe, 2016).

Table 3: Milk yield and composition of WAD × RS goats fed different replacement levels of cassava peel meal (CPM) for maize offal

	Diets				
Parameter	**T_1 (0%CPM)**	**T_2 (60%CPM)**	**T_3 (80%CPM)**	**T_4 (100%CPM)**	**SEM**
Daily milk yield (g/d)	129.62^b	143.03^b	140.18^b	196.84^a	15.09
Total solids (%)	14.36^b	14.87^{ab}	14.04^b	15.59^a	0.34
Milk protein (%)	4.40	5.29	5.12	5.66	0.53
Ash (%)	0.98^a	0.68^b	0.92^a	0.91^a	0.09
Lactose (%)	4.06^a	4.03^a	3.72^b	4.09^a	0.09
Butter fat (%)	4.92	4.87	4.28	4.93	0.39
Solids-not- fat (%)	9.44^b	10.00^{ab}	9.76^{ab}	10.66^a	0.34
Milk energy (MJ/kg)	2.14^a	2.92^a	2.77^a	1.20^b	0.30
Fat-corrected milk (kg)	0.20^a	0.16^a	0.14^a	0.07^b	0.02
Solids-corrected milk (kg)	0.15	0.21	0.15	0.24	0.04

a,b Means within the same row with different superscript differ significantly ($p<0.05$)
SEM= Standard Error of Means

Lactose, which is the milk sugar was significantly ($p<0.05$) lower in the goats fed diet C than in the groups fed diets A, B, and D which were similar ($p>0.5$). The lactose content of goats' milk in this study was lower than the range of 5.12 to 5.95 % reported by Igwe (2016) for WAD goats. The breed and type of diet fed could be major contributing factors to the chemical composition of milk. The lower lactose content in goats' milk fed diet C might be due to lower soluble sugar content of the diet. Solids-not-fat was significantly ($p<0.05$) higher in the milk of goats fed diet D than those fed diet A. Milk energy and fat corrected milk followed the same pattern and indicated significantly ($p<0.05$) lower values for the goats fed diet D than for those fed diets A, B and C. This implies that higher milk yield results in lower milk energy. Fat-corrected milk value (0.07 kg) of the group fed diet D (100 % CPM) was lower ($p<0.05$)) than the groups fed diets A (0 % CPM), B (60 % CPM and C (80 % CPM), indicating a depressant effect of CPM on fat–corrected milk value. Solids-corrected milk did not indicate significant ($p>0.05$) differences among the treatment means.

Table 4: Relationship between various milk constituent parameters of WAD × RS Goats fed Different Replacement Levels of cassava peel meal (CPM) for maize offal

Parameters X Y	**Regression equation**	**SE**	**R^2**	**r**	**Sign.**
Yield and TS	Y=21.380-0.023X	4.15	0.308	-0.555	*
Yield and BF	Y= 9.442-0.014X	5.46	0.095	-0.308	NS
Yield and MP	Y= 15.241+0.009X	1.66	0.011	0.103	NS
Yield and SNF	Y= 11.937-0.008X	5.48	0.032	-0.180	NS
Yield and Lactose	Y= 4.040-0.000X	0.35	0.023	-0.151	NS
Yield and Energy	Y= 3.600-0.006X	2.02	0.102	-0.319	NS
TS and BF	Y= -2.433+0.540X	5.07	0.220	0.469	*
TS and MP	Y= 19.169-0.142X	1.70	0.004	0.066	NS
TS and Energy	Y= -1.131+0.217X	1.83	0.258	0.508	*
TS and Lactose	Y= 3.556+0.023X	0.33	0.108	0.329	NS
SNF and MP	Y= 18.177-0.146X	1.69	0.006	0.076	NS
SNF and Lactose	Y= 3.805+0.016X	0.34	0.062	0.249	NS
BF and MP	Y= 16.395+0.030X	1.72	0.000	0.016	NS
SCM and FCM	Y= 0.114+0.150X	0.08	0.072	0.268	NS

* ($p<0.05$); NS= Not significant; TS= Total solid; BF= Butterfat; MP= Milk protein; SNF= Solids-not-fat; SCM= Solid-corrected milk; FCM= Fat-corrected milk; SE= Standard error

Table 4 explains the relationship between the various milk constituents of WAD x RS goats fed different replacement levels of cassava peel meal (CPM) as replacement for maize offal. There was a negative significant correlation between yield and TS (r = -0.555; $p<0.05$). This result agrees with the reports elsewhere (McDowell, 1972; Adeneye, 1989; Ahamefule, 2005; Okah and Ibeawuchi, 2011) who reported negative correlation between yield and TS. Milk yield was negatively but not significantly correlated with BF (r = - 0.308; p>0.05). Ehoche *et al.* (1990) also reported negative correlation between milk yield and BF for Yankasa and crossbred sheep. Non significant negative relationship was also observed between milk yield and SNF (r = - 0.180; p>0.05), lactose (r = - 0.151; p>0.05) and milk energy (r = - 0.319; p>0.05). These results agree with earlier reports by Okah and Ibeawuchi (2011) and Igwe (2016). Milk protein showed no significant positive correlation with yield. There was significant positive relationship between TS and BF (r = 0.469; p<0.05), and TS and energy (r = 0.508; p<0.05). Total solids (TS) and MP, TS and lactose, SNF and MP, SNF and lactose, BF and MP, and SCM and FCM all indicated no significant positive correlation at 5 percent significant level. Ahamefule (2005) had earlier reported the same for WAD goats, while Okah and Ibeawuchi (2011) reported the same for WAD sheep. However, the report of Okah and Ibeawuchi (2011) indicated highly positive correlation between SCM and FCM (r = 0.713; p<0.001).

Several factors, namely; breeds, diets offered, stage of lactation, parity and/or even environmental conditions could lead to differences in milk yield and composition. Okah and Ibeawuchi (2011) reported that milk yield and constituents are influenced by the type of diets offered to an animal, as earlier reported also by Mathewman (1993). It therefore follows that such factors may also influence the relationship between milk yield and its constituents.

CONCLUSION AND RECOMMENDATION

Feeding of cassava peel meal (CPM) diets to lactating crossbred does influenced positively milk yield and composition. The does fed diet D (100 % CPM) promoted milk yield, total solids, relatively high protein, ash, lactose and solids-not fat which are very crucial nutrient blend to the kids, but low butterfat, energy and fat-corrected milk. The results of this study showed that a 100% replacement of maize offal with CPM in concentrate diets for lactating crossbred does promoted milk yield and adequate content of milk constituents. Therefore, 100 % level of CPM is recommended for lactating crossbred does for high milk yield and adequate content of milk constituents. However, further studies might be conducted to compare different goat breeds to know if breed could result in differences in milk yield and composition.

REFERENCES

Adegbola, A.A. (1980). New feed resources for Nigerian livestock. Discourses of Nigerian Academy of Science 2(2):50-63.

Adeneye, J.A. (1989). Variation in yield and composition of milk from different quarters of lactating White Fulani cattle in a tropical environment. *Nig. J. Anim. Prod.*, 16(1): 8-15

Ahamefule, F.O. (2005). Evaluation of pigeon pea-cassava peel-based diets for goat production in South Eastern Nigeria. *Ph.D Thesis.* Michael Okpara University of Agriculture, Umudike.

AOAC(Association of Official Analytical Chemists) (2000). Association of Official Analytical Chemists. *Official Methods* of *Analysis,* 17th ed. Published by Association of Official Analytical Chemists, Washington, D.C.

Babatunde, B.B., Oluyemi, J.A., Adeyemi, O.O. and Olupona, J.A. (2002). Preference of commercial feed millers and poultry farmers for fibrous ingredients. *Open Journal of Animal Sciences.* 1: 106-111.

Banerjee, G.C. (2013). A Textbook of Animal Husbandry (8th edn.).Oxford and IBH Publishing Company Pvt. Ltd. India.

Butswat, I.S.R., Zahradeen, D. Mancha, Y.P. and Dachollom, C.C. (2002). Effect of brred and parity on milk yield of red Sokoto and Sahel goats. Proceeding of the 7th Annual Conference of Animal Science Association of Nigeria, September 16-19, 2002, University of Agriculture, Abeokuta, Nigeria. Pp 17-21.

Desjeux, J.F. (1993). Nutritional value of goat milk. Lait. 73: 573-580.

Duncan, D. B. (1955). Multiple range and multiple F-Tests, Biometrics. 11:1-42.

Erdman, R. A. and Verner, M. (1995). Fixed yield responses to increasing milking frequency. *J. Dairy Sci,.* 78: 1199-1203

Ehoche, O. W., Adu, I. F. and Olorunju, S. A. S. (1990). Yield and composition of milk and their relationship with preweaning lamb growth in Yankasa ewes and their crosses with sires of Suffolk X Wenselydale breed. *Nig. J.Anim.* Prod., 17: 36-41.

Food and Agricultural Organization (1988). Food and Agricultural Organization. Mission *on Integrated Dairy Development in Nigeria.* 9-28 October, 1988, FAO, Rome Italy.

Gaines, W. L. (1928). The energy basis of measuring milk yield in dairy cows, *Univ. Illinois Agric. Expt. Sta. Bull.*, pp. 308.

Hahn, S.K., Chukwuma, E.M. and Alimon, A.R. (1986).Losses of cassava tuberous roots during processing into gari Root and Tuber Improvement Program Annual report 1985. IITA. Ibadan. Nigeria.

Ibeawuchi, J.A., Ahamefule, F.O. and Ringim, I.A. (2003). The influence of lactation stage on milk constituents of Sahelian goats. *Nig. J. Anim. Prod.*, 30(2): 259-264.

Igwe, N.C. (2016). Performance of West African dwarf (WAD) goat fed varying levels of palm kernel cake (PKC)/ brewers' dried grains (BDG) in cassava peel meal based diets. Ph.D Dissertation. Michael Okpara University of Agriculture, Umudike.

Ministry of Agriculture,Forestry and Fisheries (1977). Energy allowances and feeding systems for ruminants. *Tech. Bull.* 33. Ministry of Agric., Fisheries and Food, London.

Makinde, O.A. (2006). Processing of vegetable-carried bovine blood meal and its utilization by poultry and fish. Ph. D. Thesis, Obafemi Awolowo University, Ile Ife, Nigeria.

Marrier, J. and Boulet, M. (1959). Direct analysis of lactose in milk and serum. *J. Dairy Sci*., 42: 1390-1391.

Mathewman, R.W. (1993). *Dairying.* Macmillan. Trop. Agric. Ser. University of Edinburgh, U.K.

Mbanasor, J.A. (2002). Response use pattern among poultry enterprises in Abia State Nigeria Journal of Animal Production. 29(1&2): 63-70.

Mc Donald, P., Edwards, R. A. and Greenhalgh, J. P. D. (1981). *Animal Nutrition* (3rd edition) Longman London, UK.

McDowell, R.E. (1972). Effect of high temperature and dietary fat on performance of lactating cows . *J. Dairy Sci.,* 50: 1909-1915.

National Root Crop Research Institute (2016). *Agro-Meterologic Unit*. National Root Crop research Institute, Umudike, Nigeria.

Okah, U., Adedokun, O.O. and Ebere, C.N. (2017). Effect of processing methods on the chemical composition of cassava peel as livestock feed resource. *Nigerian Journal of Agriculture, Food and Environment*. 13(2): 5-9.

Okah, U. and Ibeawuchi, J.A. (2011). Yield and composition of milk of West African dwarf (WAD) sheep fed graded levels of boiled pigeon pea seed meal. *International Journal of Agriculture and Rural Development* 14(2): 733-740.

Onifade, A.A. and Babatunde, G.M. (1998). Comparison of the utilization of palm kernel meal, brewers' Dried grains and maize offal by chicks. British Poultry Science, 39: 245-250.

Peroni, N., Kageyama, P.Y. and Begossi, A. (2007). Molecular differenciation, diversity and folk classification of sweet and bitter cassava (Manihot esculenta) in Caicara and Caboloclo management systems (Brazil). Genetic Resources and Crop Evolution, 54(6): 1333-1349.

Resource Inventory and Management (1992). Nigerian National Livestock Survey. Kaduna Federal Development of Livestock and Pest Control Services.

Salami, R.I. and Odunsi, A.A (2005). Evaluation of processed cassava peel meals as substitute for maize in the diet of layers. International Journal of Poultry Science.2(2):112-116.

Statistical Analysis System (1999). *Statistical Analysis System User's guide*: Statistics. SAS Institute Inc. Cary, NC 27513 USA.

Smith, O.B. (1988). A review of ruminant response to cassava based diets. In: S.K. Hain, L Raynold and G.N. Egbunke (Eds.). Cassava as Livestock feed in Africa. 14-18 Nov. 1988. Ibadan, Nigeria.

Steel, R.G.D. and Torrie, J.H. (1980). *Principles and Procedures of Statistics.* (2nd edition). McGraw-Hill Inc.,Tokyo, Japan 633pp

Tyrrell, H.F. and Reid, J.T. (1965). Prediction of the energy value of cow's milk. *J. Dairy Sci*., 48: 1215-1223.