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Full Length Research Article

EFFECTS OF SUN-DRIED CASSAVA PEELS ON GROWTH PERFORMANCE IN RED SOKOTO DOES (*Capra aegagrus hircus)* DURING GESTATION

*Balogun B.I., Omodara A.A., Owoyele O.O.

Department of Agricultural Education, Federal University of Education, Zaria, Nigeria

*Corresponding Author Email Address: kayodescholar@gmail.com

ABSTRACT
This study was conducted to evaluate the potentials of graded levels of sun-dried cassava peels as alternatural energy source to replace maize offal in supplement diets for pregnant Red Sokoto (Maradi) does. Five (5) supplementary diets were formulated to contain Sun-Dried Cassava Peels (SDCP) at levels of 0, 18.5, 37.0, 55.5 and 74.0%. A sixth diet contained Cotton Seed Cake (CSC) without maize offal, and SDCP. Treatment 1 and 6 containing 0% supplementation of SDCP served as the control diets. The diets were iso-calorific and iso-nitrogenous. Thirty (30) pregnant Red Sokoto does aged between 1.5-2.0 years were weighed and equally allotted to six (6) treatments at a means of 26.1-26.6kg in a Randomize Complete Block Design. The goats were fed at 1.5% weekly live weight. After supplementation for two hours (8:00-10:00am) each morning, they were released to graze on natural pasture within a specified paddock. Results obtained showed that the daily dry matter intake (DMI/head) in treatment 6 was significantly higher than Treatments 1 and 5. Although, the supplementation of SDCP recorded low CPI compared to the two controls, their increasing levels of supplementations also showed a decreasing tendency on CPI. There were no significant differences between Treatments 3 and 4 for crude protein intake (CPI), although Treatment 1, 2, 5 and 6 differ significantly ($P<0.05$) for CPI. Treatment 6 recorded higher CPI (103.1 g) while Treatment 5 was lower (43.1 g). The efficiency of dry matter utilization (EDMU) and efficiency of crude protein utilization (ECPU) were not significantly ($P>0.05$) different for all treatments. The higher average daily gain (ADG) 67.4 g was obtained in Treatment 3 and the least (14.3 g) in Treatment 4. The results obtained for ADG in Treatment 3 was significantly higher than Treatment 4 only ($P<0.05$). the higher final mean live weight of 32.2kg was obtained for Treatments 3 and 6. Treatments 1, 2, 4 and 5 were not significantly ($P>0.05$) different. Based on the results of this study, Maize offal can be replaced with up to 74% Sun dried Cassava peels in the diet of Red Sokoto Does grazed on natural pasture during gestation without adverse effect on growth performance.

Keywords: Sun-dried cassava peels, Alternatural energy source; Red Sokoto does, Pregnancy.

INTRODUCTION

Among all the species that makes up the farm animals in Nigeria, ruminants, comprising sheep, goats and cattle, constitute the farm animals largely reared by farm families in the country's agricultural system. Nigeria has a population of 34.5 million goats, 22.1 million sheep and 13.9 million cattle (Lawal-Adebowale, 2012). Goats play significant roles in the finance and budget of resource poor rural farmers in the tropics (Miller & Lu, 2019). Similarly, Wadajo *et al.*(2020) reported that goats contribute tremendously to food security in small holder farmers' economy and livelihood. The Red Sokoto goats are the dominant goat species in Northern Nigeria while the West African Dwarf goats are the most common in the Southern and Eastern parts of the country. Nutrition is one of the major factors affecting livestock productivity in Africa, Nigeria inclusive. The main features of productivity of ruminant in the tropics is their inherent low level of performance, which is invariably associated with poor nutritional management and inadequate exploitation of the attributes of individual species such that their potential productivity is often never realized (Bocquier and Gonzalez-Garcia, 2010).

According to Ukanwoko and Ibeawuchi (2014), goat rearing in Nigeria is mainly traditional and consequently it is characterized by inadequate feeding, this is because the animals are allowed to scavenge. Therefore, the necessary adjustments required in the nutrition of the animals during pregnancy or lactation are lacking. The supplementation given to the goats in the form of kitchen wastes in most cases, does not meet their maintenance requirements for energy and protein (Balogun, 2001). The overdependence on conventional feedstuffs like maize as the main dietary energy source has adverse effects on the livestock industry with particular reference to the scarcity and high cost (Adegun and Aye, 2022) that emanated from the competition that now exists between man, livestock and industry (Balogun, 2013). The foregoing trend has therefore necessitated the search for non-conventional alternatural crop residues and by-product feedstuffs which would meet the nutritional requirements of livestock in terms of energy and that are relatively cheap and not in competition with man (Balogun, 1997, Balogun, 2001 and Amin *et al.,* 2020). Processed cassava peels have tremendous potentials for this purpose. Many feeding trial experiment have shown that cassava provides a good quality carbohydrate, which may be substituted for maize (Gunun, *et al,* 2023; Fasae *et al.,* 2021; Etchu *et al.,* 2015).

Cassava peels are a major by-product of cassava tuberous root processing industry. Approximately 10 million tons of cassava are processed into flakes (garri) annually in Nigeria alone (Ganiyu, 2006). In many regions of Nigeria where cassava is grown and the tubers processed, the peels are largely underutilized as livestock feed. The potentials of cassava as a substitute to grains in livestock feed are yet to be fully explored probably due to the presence of cyanogenic glycoside (Ogundu *et al.,*2018). However, processing cassava peels reduces the inherent level of the toxic material while preserving its nutritive value (Oboh, 2006). Cassava peels however, constitute an important potential resource for animal feed if properly utilized in a bio system (Etchu *et al.,* 2015). According to Hahn and Chukwuma (1986) the average annual 4.2t of cassava

peels/ha is available for feeding ruminants, goats inclusive since the peel constitutes 20.1% of the tuber. The proximate composition of cassava peels reportedly contains protein content of 4%, digestible fat 0.9%; crude fibre 4.7%; ash 1.9% and nitrogen free extract 88.5% (Abubakar & Ohiaege, 2011).

With due consideration to the large quantities of cassava peels produced annually in Nigeria as well as their proximate composition, this study therefore aimed at evaluating the potentials of cassava peels as energy source for replacing maize offal in the diets of Red Sokoto does during pregnancy.

MATERIALS AND METHODS

Experimental Site

The study was carried out at the National Animal Production Research Institute, (NAPRI), Shikka, Zaria, Nigeria, on Latitude 11^0 12' N, Longitude 7^0 33' E and on the altitude of 610 m above sea level. Shikka is within the Northern Guinea Savanna Zone and has a sub-humid tropical climate with average annual rainfall of 1092 mm, which fall mainly between April and October. The mean maximum temperature ranges from 27 to 35°C (Ovimaps, 2011).

System of Management of Animal

The Red Sokoto does used in this study were managed semi intensively and were individually identified by means of numbered plastics ear-tags. The animals were housed in pens with individual feeding troughs and the feeds were offered between 8:00-10:00am each day for supplementation. Thereafter, the goats were released for grazing in specified paddocks with pastures under the close supervision of a herdsman till 18:00 hours before they were returned to their enclosures (holding pens) at night to drink water and to pass the night.

At the commencement of the experiment, the experimental animals were dipped using acaricide (Stelladone) solution against ecto-parasites and dewormed with an anthelmintic (Banminth F) suspension against endoparasites.

Experimental Procedures

A proven breeding buck was introduced and allowed to run with the does. A breeding harness with crayon was fitted ventral to the sternum of the buck. The does were examined at 18:00 and 07:30 hrs of the following day for marks of the crayon on their rump. The day the crayon mark was observed on the does were recorded as the breeding day. The buck was withdrawn after all the does had been bred.

Thirty (30) pregnant Red Sokoto does aged between 1.5 and 2 years were weighed and equally allocated to the six treatments (1-6) in a Randomize Complete Block Design. Each goat was placed in an individual feeding pen at 08:00 hrs daily and offered a weighed quantity of the appropriate Treatment equivalent to 1.5% of its weekly body weight. They were allowed 2hrs to eat ration provided and clean tap water was provided to them ad libitum prior to being released to graze on natural pasture in a specified paddock. The leftovers of the treatment in the individual feeding pens were weighed to determine the daily feed intake of the goats prior to grazing. Samples of the treatment offered to the animals and the leftovers were separately collected on weekly basis and bulked for proximate analysis while the goats were weighed weekly to determine any live weight change during the 168 days feeding trial. Parameters such as daily dry matter intake/head (DM/Head), crude protein intake (CPI), efficiency of dry matter utilization (EDMU) and efficiency of crude protein utilization (ECPU), mean live weight (LVWT) and average daily gain (ADG) were recorded and later transcribed for computer analysis.

Graded levels of Sun-dried cassava peels (SDCP) were used as an energy source to replace maize offal at levels of 0% (Treatment 1); 18.5% (Treatment 2); 37.0% (Treatment 3); 55.0% (Treatment 4); and 74.0% (Treatment 5) in the compound treatment. An additional Treatment (Treatment 6) comprised only Cotton Seed Cake (CSC) and Common Salt (Table 1).

Table 1: Ingredients Composition of Experimental Treatments (kg DM)

Treatment	Maize Offal (MO %)	Sun-Dried Cassava Peels (SDCP %)	Cotton Seed Cake(CSC %)	Common Salt (CS %)	Total %
1	74.0	0	25.0	1.0	100
2	55.5	18.5	25.0	1.0	100
3	37.0	37.0	25.0	1.0	100
4	18.5	55.5	25.0	1.0	100
5	0	74.0	25.0	1.0	100
6	0	0	99.0	1.0	100

MO-Maize Offal, SDCP- Sun-Dried Cassava Peels, CSC-Cotton Seed Cake, CS-Common Salt

Inventory and Abundance of Plant Species

An inventory (botanical survey) of the plant species in the grazed paddock (5ha) was undertaken at the beginning of the study. In addition, visual estimates to determine the relative abundance of each species was carried out. One hundred quadrats (1m x 1m) were observed per hectare in the paddock. Plant species in each quadrat were rated either as present (rare), common, abundant or most abundant.

The different pasture species identified to be grazed by the animals and rated to be of medium to high acceptability/palatability were sampled weekly for Proximate analysis.

Proximate Analysis

The milled feed and pasture samples were subjected to proximate analysis as described by the Association of Official Analytical Chemists (AOAC, 2004). The Neutral Detergent Fibre (NDF) and Acid Detergent Fibre (ADF) were determined by the methods of Van Soest (1965) and Van Soest and Wine (1967) as described in Mongeau and Brooks (2016) and Wirchern et al. (2018).

Statistical Design

The data collected were analysed using the General Linear Models Procedure and the Duncan's Multiple Range Test of the Systems Analytical Statistics Package (SAS, 2020).

RESULTS

Proximate Analysis of the Treatments and Grazed Forages

The results of the Proximate analysis of the treatments and grazed forages are shown in Tables 2 and 3 respectively. The Crude Protein (CP) content of the energy-based treatment decreased systematically from 18.6% in Treatment 1 to 11.3% in Treatment 5. Treatment 6 being primarily a protein supplement contained 23.5% CP, the NDF, and Ash of the supplements never showed any definite trends, However, ADF showed an increasing trend (Table 2).

Table 2: Proximate Components of the Treatments (%)

Treatment	DM	ASH	EE	NDF	ADF	CP
1	90.2	4.2	4.5	55.6	21.8	18.6
2	93.1	10.9	4.1	44.5	23.4	16.5
3	90.6	6.2	2.9	49.1	29.9	13.6
4	91.2	7.0	1.4	46.8	31.0	12.8
5	88.0	7.2	3.3	54.1	35.6	11.3
6	93.4	5.2	4.6	65.9	41.7	23.5

DM – Dry Matter; ASH - Ash; EE Ether Extract; NDF - Neutral Detergent Fibre, ADF - Acid Detergent Fibre, CP - Crude Protein

Table 3 shows that generally, the herbaceous and shrub legumes contained more CP than the grasses, while the grasses contained between 4.9 and 7.5% CP, the CP in the other plant species, except for *Aspilia africana,* ranged 7.1% to 15.8%.

Table 3: Proximate Composition of Grazed Forage (%)

Forage	DM	ASH	EE	NDF	ADF	CP
Gramineae:						
Andropogon gayanus	93.2	12.1	73.7	52.8	0.7	4.9
Chloris pilosa	94.2	15.6	71.3	46.4	1.1	6.9
Panicum phragmitoides	94.1	15.7	70.6	39.1	1.1	7.0
Setara anceps	93.8	4.2	75.1	40.1	0.9	6.0
Urelytrum nutricatum	93.8	15.6	68.7	38.0	1.2	7.5
***Caesalpiniceae*:**						
Piliostigma thonningil	92.8	7.1	57.7	45.5	1.1	7.1
***Compositae*:**						
Aspilia africana	93.3	20.6	62.7	46.9	0.7	4.3
***Malvaceae*:**						
Sida rhombifolia	91.7	4.9	60.3	40.1	1.9	12.3
Urena lobate	92.2	9.6	53.1	37.8	1.7	10.6
***Papilionaceae*:**						
Desmodium velutinum	93.0	7.2	66.3	45.0	1.6	10.3
Indigofera arrecta	92.6	7.1	52.1	43.6	2.5	15.8
Indigofera pulchra	92.6	11.8	54.5	38.6	1.4	9.0
Stylosanthes hamata	93.6	6.6	68.6	52.7	1.2	7.5
Tephrosia linearis	93.2	5.1	80.8	80.7	1.6	10.0
Zornia diphylla	92.1	5.5	59.3	45.1	1.9	11.9

DM – Dry Matter; ASH - Ash; EE Ether Extract; NDF - Neutral Detergent Fibre, ADF - Acid Detergent Fibre, CP - Crude Protein

Table 4 shows an inventory of the plant species in the grazed paddock. Most of the moderately to highly palatable species were of the family, *Papilionaceae*. The species in the Composite, *Rubiaceae, Caesalpiniaceae, Tiliaceae, Scrophulariaceae* and *Sterculiaceae* were mostly of low acceptability in the forage value rating.

Table 4: Inventory of Plant Species in the Grazed Paddock

Family/Sub-Family	Plant Species	RAR	FVR
Gramineae	*Andropogon gayanus*	XX	3
	Andropogen schrirensis	XX	2
	Chloris Pilosa	XX	2
	Digitaria tanata	X	3
	Elionurus pobeguinii	XX	1
	Hyparrehenia rufa	X	3
	Loudetia simplex	X	1
	Monocymbium ceresiiforme	X	3
	Panicum phragmitoides	X	3
	Pennisetum pedicellatum	XX	3
	Setara anceps	XX	3
	Sporobolus pyramidalis	XXX	1
	Urelytrum muriatum	X	2
Caesalpiniceae	*Cassia nigricans*	XX	1
	Cassia rotundifolia	X	1
	Cassia tora	X	1
	Isoberlinia doka	XX	1
	Piliostigma thonningii	X	2
Compositae	*Ageratum conyzoides*	XX	1
	Aspilla africana	XXX	2
	Blumea aurita	X	1
Malvaceae	*Sida rhombifolia*	XX	2
	Urena lobate	XX	3
Papilionaceae	*Desmodium velutinum*	X	2
	Indigofera arrecta	XX	3
	Indigofera dendroides	X	2
	Indigofera secundiflora	X	1
	Stylosanthes hamate	XX	3
	Tephrosia bracteolate	X	3
	Tephrosia linearis	X	3
	Tephrosia pedicellate	X	2
	Zornia diphylla	X	2
Rubiaceae	*Borreria radiate*	XX	1
	Borreria verticillate	X	1
Scrophulariaceae	*Striga species*	X	1
Sterculiaceae	*Waltheria indica*	XX	1
Tiliaceae	*Corchorus tridens*	X	1

RAR = Relative Abundance Rating
X = Present / Rare
XX = Common

XXX	=	Abundant
XXXX	=	Most Abundant
FVR	=	Forage Value Rating
1	=	Low Acceptability/palatability
2	=	Medium acceptability/palatability
3	=	High acceptability/palatability

Table 5 gives the daily dry matter intake (DMI), daily crude protein intake (CPI) and Efficiencies of Dry Matter Utilization and Crude Protein Utilization (EDMU and ECPU) respectively. The DMI in treatment 6 did not differ significantly from others except treatments 1 and 5. Although Treatments 1 and 5 did not differ significantly, the lower DMI of 379.2 g/head was recorded in Treatment 5, which had the higher SDCP content. The EDMU and ECPU were not significantly (P>0.05) different for all treatments.

Table 5: Means of Daily Dry Matter Intake and Crude Protein Intake and Efficiencies of Dry Matter Utilization and Crude Protein Utilization

Treatment	DMI/Head (g)	CPI (g)	EDMU	ECPU
1.	393.95^{bc}	72.83^{b}	0.360	0.067
2.	415.39^{ab}	68.54^{c}	0.761	0.1226
3.	426.32^{a}	58.09^{d}	0.599	0.002
4.	418.66^{ab}	53.90^{d}	0.293	0.038
5.	379.17^{c}	43.13^{e}	1.138	0.129
6.	438.71^{a}	103.10^{a}	1.075	0.248
Overall mean	412.0	66.59	0.70	0.10
SED	±4.00	±0.948	±0.198	±0.033

DMI- Dry Matter Intake, CPI-Crude Protein Intake, EDMU-Efficiencies of Dry Matter Utilization, CPI- Crude Protein Utilization
Means with the same superscripts in the same column are not significantly different (P>0.05)

Table 6 shows the effects of supplementation in live weight and the average daily gain. The higher average daily gain of 67.4 g obtained in treatment 3 and the least live weight gain of 14.3 g was in treatment 4. Treatment 3 was significantly higher than only Treatment 4 (P<0.05).
The higher final mean live weight of 32.17 kg was obtained for treatment 3 and 6. Treatments 1, 2, 4 and 5 were not significantly (P>0.05) different.

Table 6: Live Weight Response to Supplementation

Treatment	Mean LVWT (kg)	ADG (g)
1.	31.35^{ab}	37.68^{ab}
2.	30.80^{ab}	60.63^{ab}
3.	32.17^{a}	67.37^{a}
4.	30.16^{b}	14.29^{b}
5.	30.15^{b}	60.30^{ab}
6.	32.17^{a}	60.37^{ab}
Overall mean	31.13	50.10
SED	±0.216	±6.30

LVWT- Live Weight, ADG- Average Daily Gain
Means with the same superscripts in the same column are not significantly different (P>0.05).

DISCUSSION

Proximate Analysis of the Supplement Treatment and Grazed Forage

The grazed natural pastures were relatively high in CP content because most of the species were in the vegetable stage. Higher CP contents and digestibility have been associated with pasture species during this stage compared with the flowering/seeding stage. Furthermore, the growth of the species was enhanced by the amount of rainfall (742.7 mm) during the experimental period (Stojanivic *et al,* 2019).
Preference for the leaf by grazing animals is higher than the stem part. Leaves are more palatable than stems, and new growth or regrowth is nutritious than older tissue (Trlica, 2013). This was attributed partly to the higher CP content of the leaf over other parts of the whole plant (Tomic *et al,* 2002). In this study, the mean CP content of the whole plant of most species were above 7.0%, thus it could be inferred that the performance of the goats was not limited by the portion contents of the herbage.
The ADF of the grass species except, *A. gayanus* and *C. pilosa,* were close to 24.7-57.4% as reported for most tropical grasses, and this is in concordance with the findings of Jayasinghe *et al.* (2022) and Coward-Lord *et al.* (1974) In: Bayble *et al.* (2007). The NDF values of the grass species in this study were generally higher than other species.

Feed Utilization and Live weight Gains

Akinsoyinu *et al.* (1975) showed that a 20 kg goat gaining 200 to 270 kg live weight daily would need a digestible crude protein (DCP) intake of 1.8 kg/day $W_{kg}^{0.75}$ giving a requirement of 0.06 g DCP/day/$W_{kg}^{0.75}$/g live weight gain. This study showed much higher crude protein intake/$W_{kg}^{0.75}$/day (43.1 to 103.1 g/head/day) for a daily weight gain of not more than 67.37 g after conversion. However, Akinsoyinu (1974) made a recommendation of 12.1 g/$W_{kg}^{0.75}$/day/DCP for pregnant and lactating goats. This showed that the pregnant goats used in this study were more efficient than the recommendations made by Akinsoyinu (1974) for pregnant and lactating goats. This may be due to breed and ecologic differences.
The EDMU was not significantly (P>0.05) different for all treatments. Diet 4 was apparently the most efficient utilized.
The ECPU also did not differ significantly (P>0.05) but was apparently more efficient in the energy based diets probably because their higher energy to protein ratio enhanced utilization than Treatment 6. This result confirms the report of Boorman (1980) who stated that insufficient dietary energy prevents full utilization of dietary nitrogen and imposes a threshold on nitrogen retention, which is lower than the maximum determined.
The overall ADG (50 g) for the treatments was slightly lower than the 55-80 g but within 35-65 g reported by Nuru (1985) for Red Sokoto does and West Africa Dwarf goats, respectively.
Abatan *et al* (2015) conducted a study on growth performance, intake, digestibility and nitrogen utilization of West African Dwarf Goats fed diets containing cassava peels as supplements to cassava leaves and cowpea haulms and reported a positive daily weight gain of 21.5 g/day to 43.0 g/day. Jiwuba and Jiwuba (2020) who studied the productive performance of small ruminants fed with cassava by products also reported positive added daily weight gain (ADWG) which is attributable to significant DM intake of the animals and other factors like high energy content of cassava which could have contributed to growth and feed utilization.
Fomunyan and Meffeja (1987) worked with sheep fed on three (3) graded levels of Sun-Dried Cassava Peels (0, 35 and 70%) in

combination with *Pennisetum purpureum* at 70, 35 and 0% of diet respectively while Cotton Seed Cake was given as a protein supplement. The result of the study indicated that daily DMI, digestibility and growth rate increased linearly with increasing dietary levels of cassava peels. The sheep on diet containing 70% cassava peel and 30% cotton seed cake in the diet gained 227.1g/day; sheep 35% grass (*Pennisetum purpureum)* and 35% sun-dried cassava peel gain 106.7g/day. Ifut (1988) fed West African Dwarf goats with diets containing either 30 or 100% cassava peels in combination with *Gliricidia sepium* or *Panicum maximum* or both in varying proportions (W/W) and those entirely on cassava peels significantly ($P<0.05$) lost weight (-54.8g/day) each of *Gliricidia sepium* and *Panicum maximum* gained 66.3g daily. The added daily weight gain obtained in this study compared well with those reported by Nuru (1985) and Ifut (1988). The higher weight gain in sheep obtained by Fomunyan and Meffeja (1987) than observed in this experiment must have been due to level of feeding and species differences.

The result of this study showed an increase in average daily DMI when the pregnant does (412 g/head/day) used in the study were compared to the non-pregnant does (353.5 g/head/day used by Balogun (1997; 2001). The result is at variance with reports on sheep and goats (Adu et al., 1974; Akinsoyinu *et al.,* 1975; Adu, 1981) showing increase in DMI (97.8 g daily/$W_{kg}^{0.75}$) at mid pregnancy, which declined to 71.8 g daily $W_{kg}^{0.75}$ during the last one-third of pregnancy. The difference in the pattern of feed intake was probably due to the influence of pregnancy compared since there is distention of the digestive tract, thereby reducing feed intake. The average daily DMI which was 412 g/head/day in this experiment was much lower than in the reports of Adu *et al.,*1974; Akinsoyinu *et al.*,1975, Adu, 1981) after conversion and this may have been due to breed differences and type of feed offered.

The results obtained have indicated that maize offal can be replaced with Sun-Dried Cassava Peels (SDCP) up to 74% level in the ration as supplement for pregnant Red Sokoto does without having adverse effect on the growth performance. The results of this study are in agreement with the findings of Balogun (1997) and Lakpini *et al.* (1997), which revealed that cassava peels based diets have tremendous potentials as energy source for pregnant Red Sokoto does.

Conclusion

The result of this study indicated that cassava can successfully replace maize offal without adverse effect on feed intake, efficiency of feed utilization and live weight gain of Red Sokoto does during pregnancy.

The result further indicated that without adjusting for energy, Sun-Dried Cassava Peels could be used to replace maize offal in the ration of goats up to 74% level without adverse effects on the animals.

REFERENCES

Abatan, O., Oni, A. O.and Adebayo, K. (2015). Effects of supplementing cassava peels with cassava leaves and cowpea haulms on the performance, intake, digestibility and nitrogen utilization of West African Dwarf goats. *Trop Anim Health Prod,* 47(1), 123129. https://doi.org/10.1007/s11250-014-0695-1

Abubakar, A. and Ohiaege, P.E. (2011). The use of Cassava Peels for Maize in the Diets of Broiler Finisher Chicken. 9 (No. 2)

Adegun, M.K. and Aye, P.A. (2022). Effect of Supplementing Cassava Peels with lablab and gliricidia hay on performance of goats. *Asian J. Anim. Vet Adv*. 7: 118-125

Adu, I.F., Olaloku, E.A. and Oyenuga, V.A., (1974). Effects of Energy Intake during Late Pregnancy of Lamb Birth Weight and Lactation of Nigeria Dwarf Sheep Niger. *J. Anim.Prod.* 1:151-161

Adu,I.F. (1981). Water Intake of Yankasa Ewes During Late Pregnancy. *J. Anim. Prod. Res.* 3: 49-56

Akinsoyinu, A.O. (1974). Studies on Protein and Energy Utilization by the West African Dwarf Goats. Unpublished Ph.D Thesis, University of Ibadan, Nigeria.

Akinsoyinu, A.O., Mba, A.U. and Olubajo, F.O. (1975). Studies on Energy and Protein Utilization for Pregnancy and Lactation by the West African Dwarf Goats in Nigeria. *E. Afr. Agric. For. J*. 4: 167-176.

Amin, A.B., Audu, R., Haruna, A., Salisu, I.B. and Isa, A.A. (2020) Effects of Feeding Diets Containing Differently Processed Cassava Peel Meal on the Haematology and Serun BioProximate Parameters of Red Sokoto Bucks. *Nig. J. Anim. Sci. Tech,* 3(3):45-52

AOAC (Association of Official Analytical Chemists), (2004). Official Method of Analysis Washington, DC, USA.

Balogun, B.I. (1997). Effect of Sun-Dried Cassava Peels on Live weight Gain and Reproductive Performance of Red Sokoto Does. Unpublished M.Sc. Thesis, Department of Animal Science, Faculty of Agriculture, Ahmadu Bello University, Zaria.

Balogun, B.I. (2001). The Effect of Sun-Dried Cassava Peels as Energy Source for Red Sokoto Does Prior to Breeding. *Journal of Vocational and Technical Education (JOVED)* 2(2): 1-8

Balogun, B.I. (2013). Evaluation of the Nutritional Potentials of Fermented Oil Bean Seed Pentaclethra macrophyllah Benth. *Ahmadu Bello University Journal of Vocational Studies (ABUJOVS)*, 7(1):17-25.

Balogun. B.I. (2013).

Bayble, T., Melaku, S. and Prasad, N.K. (2007). Effects of cutting dates on nutritive value of Napier (Pennisetum purpureum) grass planted sole and in association with Desmodium (*Desmodium intortum*) or Lablab (*Lablab purpureus*). *Livestock Research for Rural Development.* Volume 19, article N0. 11. Retrieved from http://www.lrrd.org/lrrd19/1/bayb19011.htm

Bocquier, F. and Gonzalez-Garcia, E. (2010). Sustainability of Ruminant Agriculture in the new Concept: feeding strategies and features of Animal adaptability into the necessary holistic approach. *Animal,* 4(7): 1258-1273.

Boorman, K.N. (1980). Dietary Constraints on Nitrogen Retention. In: Buttery, P.J. and Lindsay, D.B. (eds) Protein Deposition in Animals. Butterworths London-Boston

Coward-Lord, J., Arroyo-Auilu, J.A. and Garcia-Molinari, O. (1974). Fibrous Carbohydrate Fraction and in Vitro True and apparent Digestibility of 10 Tropical Forage Grasses, *J. Agric. Univ. Puerto-Rico* 58 (3): 293-304

Etchu, K.A., Tapong, V., Ndamukong, K and Enokenwa, O. (2015). Substituting Maize for Processed Cassava Peels: A Cost Benefit Analysis in Poultry Farming. *International Journal of Research Agricultural Sciences.* 2(4): 2348-3997

Fasae, O.A; Adegoke, H.B; Ogunmekan, K.O. and Adu, I.F.(2021). Improving the feed utilization of Cassava Peels in smallholder goat production. *Nigeria Journal of Animal*

Production, 34(2),251-257.

Fomuyan, A.T. and Meffeja, F. (1987). Cassava By-Products in Rabbits and Sheep Diets. In: Proceedings, Workshops on Utilization of Agricultural By-Products as Livestock Feeds in Africa. Little, D.A. and Said, A.N. (eds). African Research Network for Agricultural By-Products (ARNAB). September 1986, Blantyre, Malawi. ILCA Addis Ababa, Ethiopia. 103-107.

Ganiyu, O. (2006). Nutrient Enrichment of Cassava Peels Using a Mixed Culture of Saccharomyees Cerevisae and Lactobaccilus Spp Solid Media Fermentation Techniques. *Electronic Journal of Biotechnology I*SSN, 9 (1): 0717-3458

Gunun, P; Cherdthong, A; Khejornsart, P. and Wanapat, M. (2023). Replacing concentrate with Yeast or EM-Fermented Cassava Peel (YFCP or EMFCP): Effect on the Feed Intake Feed Digestibility, Rumen Fermentation, and Growth Performance of Goats. *Animals,* 13(4),1-9

Hahn, S.K., Chukwuma, E.M and Almazan, A.M (1986). Losses of Cassava Tuberous Roots during Processing into Gari. Root and Tuber Improvement Programme Annual Report, IITA, Ibadan, Nigeria.

Ifut, O.J. (1988). The Potential of Cassava Peel for Feeding Goats in Nigeria. In: Hahn, S.K. Reynolds, L. and Egbunike, G.N. (eds.) Cassava as Livestock Feed in Africa. Proceeding of the IITA/ILCA/University of Ibadan Workshop on Potential Utilization of Cassava as Livestock Feed in Africa. 14-18th November, 1988, Ibadan, Nigeria, pp 27-81

Jayasinghe, P; Ramilan, T; Donaghy, D.J; Pembleton, K.G and Barber, D.G. (2022). Comparison of Nutritive values of Tropical Pasture species grown in different environments and implications for Livestock Methane Production: A Meta-Analysis. *Animals (Basel)* 12(14):1806

Jiwuba, P. C., &and Jiwuba, L. C. (2020). Productive and physiological response of small ruminants fed Cassava (*Manihot esculenta Crantz*) and cassava by review. *Zhivotnovadni Nauki*, 57(2), 1731.

Lakpini, C.A.M., Balogun, B.I, Alawa, J.P, Onifade, O.S. and Otaru., S.M. (1997). Effects of Gradded Levels of Sun-Dried Cassava Peels in Supplement Diets fed to Red Sokoto GoatRed Sokoto does in First Trimester of Pregnancy. *Elsevier Journal of Animal Feed Science and Technology* 67:197-204

Lawal-Adebowale, O.A. (2012). Dynamics of Ruminant Livestock Management in the Context of the Nigerian Agricultural System. In: Live Stock Production Ed Khalid Javed. Intech Publishers Chapter 4, Pp 61-80. Retrieved from https://edn.intechopen.com/pdfs-wm/40420.pdf

Miller, B.A and Lu, C.D. (2019). Current status of Global Dairy Goats Production: An overview. *Asian -Australasian Journal of Animal Science*s, 32,1219-1232.

Mongeau, R. and Brooks, S.P.Y. (2010). Dietary Fibre: Determination. Encyclopedia of Food and Health. Reference Module in Food Science, Vol. 3 pp 383-391. Elsevier Science Ltd

Nuru, S., (1985). Trends in Small Ruminant Production in Nigeria. In: Adu, I.F., Osinowo, O.A., Taiwo, B.B.A. ad Alhassan, W.S. (eds) Small Ruminants Production in Nigeria Proceedings of National Conference on Small Ruminant Production, Zaria, Nigeria. October 6th – 10th 1985, Pp 35-48.

Oboh, G. (2006). Nutrient enrichment of cassava peels using a mixed culture of Saccharomyces cerevisae and Lactobacillus spp. Solid media fermentation. *Electronic Journal of Biotechnology,* 9(1):46-49

Ogundu, E.C., Eyoh, G.D., Idiong, N.B. and Udo, M.D. (2018). Haematological and BioProximate Profiles of West African Dwarf Goat fed diets containing cassava peels, brewers' spent grain and panicum maximum. *International Journal of Scientific and Research Publication,* Vol. 8(3) Http://dx.doi.org/10.29322/IJSR.8.3.2018.p7

OVIMAPS. (2011). Ovi Location Maps: Ovi earth imagery date November, 5th 2022.

SAS.(2020). (System of Analytical Statistics). SAS Institute, Inc., Cary, NC 2712-8000 USA.

Stojanivic, B; Grubic, G; Dordevic, N; Bozickovic, A; Simic, A; Davidovic, V.and Ivetic, A. (2019). Efficiency of Protein Utilization by Grazing Ruminants and Possibility for Improvement. *Proceedings of the 12th International Symposium Modern Trends in Livestock Production*, October 9-11

Tomic, Z; Sokolovic, D; Ignjaovic, S; Zujovic, M; Negovanovic, D; Nesic, Z; Krnjaja, V and Vorkapic, M. (2002). Proximate composition of domestic and foreign cultivars of perennial grasses according to cuts for animals. *Biotechnology in Animal Husbandry,* 18(5-6), 265-274.

Trlica, M.J. (2013).Grass Growth and response to Grazing. Colorado State University. Extension, *Fact Sheet* No 6.108.

Ukanwoko, A.I. and Ibeawuchi, J.A. (2014). Evaluation of Cassava Peel – Cassava Leaf Meal Diets for Milk Production by the West African Dwarf Goats in South Eastern Nigeria. *IOSR Journal of Agricultural and Veterinary Science.* 7(5): 27-30

Van Soest, P.J. (1965). Use of Detergents in the Analysis of Fibrous Feeds, II: A Rapid Method for the Determination of Fibre and Lignin. *J. Assoc. Off. Agric. Chem.,* 46: 829-835.

Van Soest, P.J., and Wine, R.H., (1967). Use of Detergents in the Analysis of Fibrous Feeds. IV: Determination of Plant Cell-Wall Constituesnts. *J. Assoc. Off. Chem.* 50: 50-55.

Wadajo, H.D., Gemeda, B.A., Kinati, W., Mulem, A.A. Van Eedrdewijik, A and Wieland, B. (2020). Contribution of small ruminants to ffod security for Ethiopian smallholder farmers. *Small Ruminant Res.* Vol. 184. 10.10106/j-smallrumres2020. 106064

Weir, W.C., and Torell, D.T. (1959). Selective Grazing by Sheep as Shown by a Comparison of the Proximate Composition Range and Pasture Forage Obtained by and Clipping and that collected by Esophageal Fistulated Sheep. *J. Agric. Sci.* 18: 641-648

Wirchern, M., Gehring, T. and Lubken, M. (2018). Modelling of Biological Systems in Wastewater Treatment, Institute of Environmental Engineering Bochum, Germany. Reference Module in Goat System and Environmental Sciences.