

Body Weight and Morphometric Dynamics of West African Dwarf Goats fed graded levels of *Enterolobiumcyclocarpum*

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Abstract

A research was carried out with eight (8) West African Dwarf (WAD) goats aged 0-8 weeks old in Animal Science Department, University of Uyo, Nigeria. The WAD goats were managed intensively to investigate their body weight and morphometric dynamics, when fed graded levels (0.0%, 7.0%, 15.0% and 22.5%) of *Enterolobiumcyclocarpum*. Data were collected on body weight and morphometric parameters (body, ear, tail, neck and face lengths; body, neck and head circumferences; height at withers, fore and hind limbs). Data were analysed with Gen Stat Software Computer Program, 13th edition. Means were separated using Duncan's Multiple Range Test and significance compared with Student Newman Keuls Method. Body weights with age. Body weight dynamics varied with diets, with diet 3 recording the highest mean body weight (45562.50g), followed by diet 2 (4476.49g), diet 1 (3774.69g) and lastly diet 4 (3375.00g). Mean body weight in diets 2 and 3 were significantly ($P < 0.05$) higher than those in diets 1 and 4. Morphometric parameters increased with age but varied with diets. Highest values for most morphometric dimensions (body, face, tail and neck lengths, fore limbs, height at withers, body and neck circumferences) were obtained from diet 3 (15.0%) whereas most of the least values (body, neck and head circumferences; ear, body, face and tail lengths; fore and hind limbs) were obtained from diet 4 (22.5%). There were significant differences ($P < 0.05$) between diets for all morphometric parameters, except for neck and head circumferences. The inclusion of *Enterolobiumcyclocarpum* in the diets of WAD goats should not exceed 15.0%.

Key words: Goats, body weights, morphology, dynamics, *Enterolobiumcyclocarpum*

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I. Introduction

Goats are one of the oldest domesticated species of animals that have been used for meat, milk and skin across much of the world. West African Dwarf (WAD) goat is a member of the animal family, *Bovidae* and sub-family, *Caprinae*. WAD goat is from coastal West and Central Africa. This goat breed plays a very important role in the rural economy of West Africa. Most of the poor and small-scale farmers in this region raise them (Dubeuf *et al.*, 2004). WAD goats are herbivores (plant eaters), who spend most of the day grazing.

Enterolobiumcyclocarpum (Gunacaste, carocar, mokey ear tree or elephant tree) is a fast-growing forage tree legume from tropical America. It is a multipurpose species that can be used to feed browsing livestock (Francis, 1988). *Enterolobiumcyclocarpum* plants help to reduce heat stress of goats in hot and humid areas and they are an important alternative forage source. *Enterolobiumcyclocarpum* is commonly used to feed all kinds of livestock. Its foliage, fruits and seeds are relished by cattle, goats, sheep and horses. The leaves are high in protein (18-26%) (Francis, 1988; Moscoet *et al.*, 1995; Pinero *et al.*, 2013 and Flores *et al.*, 2012).

Live weights play an important role in determining several characteristics of farm animals. Knowledge of an animal's live weight is of importance for breeding, feeding and healthcare, treatment doses of medications and proper wellbeing of animals. To determine the live weight of animals, simple and easily measurable morphological variables of different parts of the body become evident. Estimating live weight using linear body measurements is practical, faster, easier, accurate, consistent and cheaper in the rural areas where other means of measurement are insufficient for breeders (Noso *et al.*, 2003). The feeding of WAD goats with *Enterolobiumcyclocarpum* is novel. The effects of such feeding could alter the already established pattern of growth traits in WAD goats. This study is therefore aimed at investigating the live body weight and morphometric dynamics of WAD goats fed graded levels (0.0%, 7.0%, 15.0% and 22.5%) of *Enterolobiumcyclocarpum* so that appropriate breeding strategies can be established for them. Earlier studies had investigated the pattern of early growth traits in progenies of Mongrel rabbits (Udoh, U. H. and Udofot M. M., 2016); early growth traits in WAD sheep (Udoh, U. H. and Inyang U. A., 2017) and pattern of early growth traits in progenies of Muturu cattle (Udoh, U. H. and Udoh, J. E., 2019).

II. Materials And Methods

Experimental Site

This research was carried out in the Goat Unit, Teaching and Research Farm, Department of Animal Science, Faculty of Agriculture, University of Uyo, Nigeria. University of Uyo lies between latitude 05°02' North and longitude 07°56' East. Uyo has natural day length of 12 – 13 hours. The monthly mean minimum temperature ranged from 21.3°C to 24.9°C and the monthly mean maximum temperature ranged from 28.4°C to 34.5°C. The annual mean rainfall ranged between 2000mm and 3000mm, relative humidity ranged from 78 - 93%, (Courtesy, The Meteorological Unit, Geography Department, University of Uyo). The study lasted 8 weeks.

Acquisition and Management of Experimental Animals

A total of eight (8) does in their first parity were randomly selected from the Goat Unit of the Teaching and Research Farm, Animal Science Department and used for the study. Estrous was synchronized and a stud buck served all the 8 does. Prior to their mating, the does were quarantined for 2 weeks and treated against endo and ecto parasites using Keprooxylet 20% LA injection (oxytetracycline) and Jay Ivermectin 1% (Ivermectin injection). They were also injected with multivitamin. Animals were treated against PPR. All the veterinary treatments were as directed by the Veterinary Consultant in the Department. The in-does were randomly divided into 4 groups of 2 does per group and fed experimental diets. The in-does were housed individually in cement-floored pens. Wood shavings were used as bedding materials. Does were monitored till parturition.

Feeding of Experimental Animals

During the first four months of pregnancy, does were fed mainly on forages and a supplement concentrate (at 2% body weight) made up of wet brewers' spent grains and other ingredients (wheat offals, palm kernel cake, bone meal, salt and vitamin/trace mineral premix) that were later used to formulate the experimental concentrate diet. The leaves of *Enterolobium cyclocarpum* (EC) were air-dried for 2 days, shredded/cut and mixed with other feed ingredients (brewers' dried grains, wheat offals, palm kernel cake, cassava peels, bone meal, salt and vitamins/trace mineral premix) to formulate 4 diets containing 0.0%, 7.0%, 15.0% and 22.5% EC leaves inclusion. From the last month of pregnancy, the does were given these diets. There were four feeding groups (Diet 1 = 0.0%, Diet 2 = 7.0%, Diet 3 = 15.0%, Diet 4 = 22.5%), with two does per group. Weighed but *ad libitum* quantities of the experimental concentrate diets were fed at 3% of their body weight while forages comprising mostly *Panicum maximum* was fed at 2% body weight. The weight of the dams was taken weekly. This feeding regime started from the last month of pregnancy and continued throughout parturition into the 56th day of lactation of each doe.

Kid Management

A total of 8 kids were obtained from the 8 does (that is, one kid per doe). The individual pen of each doe served as the maternity pen. At birth, each kid's umbilical cord was severed from the naval flap, cleansed with disinfectant and a tincture of iodine applied to aid healing. Birth weight was recorded immediately after parturition. Kids were allowed to freely suckle their dams and nibble on the diet of the dams.

Data Collection

The eight WAD kids were systematically ear numbered and identified with their dams for purpose of data collection. Data were taken on body weight, body circumference, head circumference, neck circumference, body length, face length, ear length, forelimbs and hind limbs of the kids, for a period of 8 weeks. Body weight of the kids were taken from 7 days old whereas other linear body parameters were taken from 14 days old. Measurements were taken once a week by 6:30 am before feeding. Each animal for measurement was carefully restrained and calmed before measurements were taken.

Procedure for Data Collection

Body dimensions were taken by using a tailor's measuring tape (Salako and Ngere, 2002). The tailor's tape measured from 1 centimeter to 100 centimeters (1 – 100 cm). Body weight was taken by using a digital sensitive scale measured from 0.1 grams to 10.0 kilograms. The following parameters as described by Salako and Ngere (2002) were measured on each of the kids:

- (i.) **Body Weight (BWT):** This was measured by restraining the animal manually and placing the animal on the digital electronic weighing scale and taking the weight in kilogram (kg) by reading the scale.
- (ii.) **Body Length (BL):** Body length of each animal was taken from the point of shoulder to the pin bone.
- (iii.) **Height at withers (HAW):** This is the distance from the surface of the platform to the wither of the animal.

- (iv.) **Tail Length (TL):** Measured from the base to the tip of the tail and width as the widest part in the centre of the tail.
- (v.) **Ear Length (EL):** This is the distance between the tip of the ear and the point of attachment to the body.
- (vi.) **Neck Length (NL):** This was taken from neck attachment with head to the neck attachment with body from lateral side.
- (vii.) **Neck Circumference (NC):** This was measured round the animal's neck beneath the head region.
- (viii.) **Body Circumference (BC):** This was measured by placing round the body of the animal across the navel.
- (ix.) **Forelimb (FL):** This was measured from the point of the attachment of the forelimb to its feet.
- (x.) **Hind Limb (HL):** This was measured from the point of attachment of the hind limb to its feet.
- (xi.) **Face Length (FL):** This was measured from in between the ear to base of the mouth.
- (xii.) **Head Circumference (HC):** This was measured round the head of the animal close to the neck and the ear.

Statistical Analysis

Means were separated using Duncan's Multiple Range Test and significance compared with Newman Keuls method. All data we analysed with Gen Stat Software Computer Programme, 13th edition.

III. Results And Discussion

Body Weight Dynamics of WAD Goats Fed Graded Levels of *Enterolobiumcyclocarpum*

Average Body weights of WAD goats (0-8weeks old) fed graded levels of *Enterolobiumcyclocarpum* are presented in Table1:

Table1: Average Body Weights of WAD goats(0-8 weeks old) fed graded levels of *Enterolobiumcyclocarpum*

Diet (treatment)	Age(weeks)								Treatment Mean
	1	2	3	4	5	6	7	8	
1.	2216.05	2714.95	3161.00	3643.70	4474.45	4820.70	5434.95	6700.00	3774.69 ^b
2.	1893.75	2939.20	3514.35	414.65	4500.00	5550.00	6000.00	7300.00	4476.49 ^a
3.	2350.00	3150.00	3650.00	4200.00	4900.00	5500.00	6000.00	6550.00	4562.50 ^a
4.	1400.00	2000.00	2100.00	2900.00	3200.00	4100.00	5300.00	6000.00	3375.00 ^b

Diet 1 = 0.0% Diet 2 = 7.0% Diet 3 = 15.0% Diet 4 = 22.5%

^{a-b} Means along same column with different superscripts are significantly different (P <0.05).

Body weights of WAD goats in all treatments increased with age from birth to 56days(8 weeks). Youndset *al* (2013)observed that animal ranging from 0-8 weeks of age have more potentials to grow physically when their diets are supplemented with *Enterolobiumcyclocarpum*. Tiwari *et al* (2006) suggested that better growth rates could be achieved in kids fed with *Enterolobiumcyclocarpum* under good feeding and management conditions. In this study, body weight dynamics varied across the disets with diet 3 recording the highest body weight (4562.50g), followed by diet 2 (4476.49g), diet 1 (3774. 69g) and lastly diet 4 (3375.00g). Body weight of West African Dwarf kids in diet 2 and 3 were significantly (P<0.05) higher than those in diet 1 and 4. Mailafia *et al* (2010) reported that the main effect of *Enterolobiumcyclocarpum* on West African Dwarf goats showed that as age increased, their body weight also increased. They however noted that when West Africa Dwarf goats were offered graded levels of *Enterolobiumcyclocarpum* leaves as supplement with *Panicum maximum*, their body weight values decreased with increasing levels of *Enterolobiumcyclocarpum*leaf inclusion. These adverse effects could be attributed to the higher contents of saponins at higher levels of inclusion. Saponins found in *Enterolobiumcyclocarpum* have been associated with short-term minimal antiprotozoal activity. Saponins reduce rumen protozoa and cellulolytic bacteria (Wang *et al.*, 2000), which may be related to digestibility reduction. Koenig *et al* (2007) reported a 22% reduction in organic – matter digestibility with diets containing higher inclusions of *Enterolobiumcyclocarpum*. Overall results indicate that body weight estimation in West African Dwarf goats is possible with diets supplemented with *Enterolobiumcyclocarpum*.

Morphometric Dynamics of WAD Goats Fed Graded Levels of *Enterolobiumcyclocarpum*

The morphometric dynamics of WAD goats (0-8weeks old) fed graded levels of *Enterolobiumcyclocarpum* are presented in Tables 2 to 11:

Table 2: Body Length (cm) of West African Dwarf Goats (0-8 weeks old) fed graded levels of *Enterolobiumcyclocarpum*

Diet (treatment)	Age(weeks)								Treatment Mean
	1	2	3	4	5	6	7	8	
1.	21.25	23.75	26.00	27.25	29.25	30.85	31.80	32.45	27.83 ^c
2.	22.00	25.25	27.75	30.35	31.75	34.50	35.25	35.50	30.29 ^b
3.	23.35	25.25	27.50	30.25	32.00	33.00	35.00	37.05	42.64 ^a
4.	29.50	31.50	34.50	36.00	39.00	39.00	41.00	43.60	36.50 ^b

Diet 1 = 0.0% Diet 2 = 7.0% Diet 3 = 15.0% Diet 4 = 22.5%

^{a-c} Means along same column with different superscripts are significantly different (P <0.05).

Table 3: Body Circumference (cm) of West African Dwarf Goats (0-8 weeks old) fed graded levels of *Enterolobiumcyclocarpum*

Diet (treatment)	Age (Weeks)								Treatment Mean
	1	2	3	4	5	6	7	8	
1.	34.00	36.25	37.25	41.00	42.00	44.30	46.35	48.50	41.21 ^a
2.	31.75	34.50	37.25	39.65	41.35	43.25	45.00	53.00	40.72 ^a
3.	34.25	36.75	39.75	41.75	42.95	45.50	46.50	51.35	42.31 ^a
4.	29.50	31.50	34.50	36.00	39.00	29.50	41.00	43.60	36.50 ^b

Diet 1 = 0.0% Diet 2 = 7.0% Diet 3 = 15.0% Diet 4 = 22.5%

^{a-c} Means along same column with different superscripts are significantly different (P <0.05).

Table 4: Ear Length (cm) of West African Dwarf Goats (0-8 weeks old) fed graded levels of *Enterolobiumcyclocarpum*

Diet (treatment)	Age(weeks)								Treatment Mean
	1	2	3	4	5	6	7	8	
1.	7.75	8.00	8.20	8.35	9.45	9.90	10.35	10.75	9.09 ^b
2.	7.10	8.10	8.10	8.60	8.95	8.95	9.18	10.30	8.66 ^a
3.	7.25	7.35	7.80	8.00	8.60	8.60	9.10	9.70	8.30 ^a
4.	6.70	7.50	7.50	8.00	9.00	9.00	9.50	9.50	2.84 ^c

Diet 1 = 0.0% Diet 2 = 7.0% Diet 3 = 15.0% Diet 4 = 22.5%

^{a-c} Means along same column with different superscripts are significantly different (P <0.05).

Table 5: Height at Withers (cm) of West African Dwarf Goats (0-8 weeks old) fed graded levels of *Enterolobiumcyclocarpum*

Diet (treatment)	Age (weeks)								Treatment Mean
	1	2	3	4	5	6	7	8	
1.	24.00	27.00	29.25	30.25	31.75	33.25	34.75	36.15	30.80 ^a
2.	23.00	26.50	27.65	30.85	32.50	34.70	36.50	37.50	26.90 ^b
3.	24.75	25.50	28.00	30.50	31.75	33.50	35.00	37.50	30.85 ^a
4.	21.50	22.70	25.00	29.00	29.50	31.00	33.50	35.10	28.39 ^b

Diet 1 = 0.0% Diet 2 = 7.0% Diet 3 = 15.0% Diet 4 = 22.5%

^{a-c} Means along same column with different superscripts are significantly different (P <0.05).

Table 6: Hind Limbs (cm) of West African Dwarf Goats (0-8 weeks old) fed graded levels of *Enterolobiumcyclocarpum*

Diet (treatment)	Age (weeks)								Treatment Mean
	1	2	3	4	5	6	7	8	
1.	18.00	19.50	22.25	23.50	24.50	27.50	28.40	30.50	27.00 ^a
2.	17.50	22.00	23.65	24.85	25.00	27.70	31.25	31.50	25.43 ^b
3.	18.75	20.15	21.75	24.40	25.90	26.75	28.75	30.55	24.63 ^b
4.	18.50	19.50	20.20	22.50	23.50	24.80	26.00	27.50	22.82 ^c

Diet 1 = 0.0% Diet 2 = 7.0% Diet 3 = 15.0% Diet 4 = 22.5%

^{a-c} Means along same column with different superscripts are significantly different (P <0.05).

Table 7: Face Length (cm) of West African Dwarf Goats (0-8 weeks old) fed graded levels of *Enterolobiumcyclocarpum*

Diet (treatment)	Age (weeks)								Mean Treatment
	1	2	3	4	5	6	7	8	
1.	9.65	11.15	11.90	12.65	13.30	13.50	14.65	15.60	102.35 ^a
2.	10.55	11.45	12.65	13.25	14.15	15.10	15.25	16.30	108.70 ^a
3.	11.30	12.50	13.00	13.25	13.65	14.75	15.50	16.60	110.50 ^a
4.	10.00	11.20	11.50	12.70	13.00	4.60	17.00	19.50	100.50 ^b

Diet 1 = 0.0% Diet 2 = 7.0% Diet 3 = 15.0% Diet 4 = 22.5%

^{a-c} Means along same column with different superscripts are significantly different (P <0.05).

Table 8: Tail Length (cm) of West African Dwarf Goats (0-8 weeks old) fed graded levels of *Enterolobiumcyclocarpum*

Diet (treatment)	Age (weeks)								Mean Treatment
	1	2	3	4	5	6	7	8	
1.	6.00	7.00	7.40	7.50	7.70	8.15	9.00	9.00	61.35 ^a
2.	5.60	7.35	7.40	7.75	7.95	8.05	8.25	9.00	61.35 ^a
3.	6.65	7.15	7.30	7.75	7.75	8.05	8.30	8.75	61.70 ^a
4.	6.00	6.00	6.30	6.50	6.50	6.90	7.10	8.00	53.30 ^b

Diet 1 = 0.0% Diet 2 = 7.0% Diet 3 = 15.0% Diet 4 = 22.5%

^{a-b} Means along same column with different superscripts are significantly different (P <0.05)

Table 9:Fore Limbs (cm) West African Dwarf Goats (0-8 weeks old) fed graded levels of *Enterolobiumcyclocarpum*

Diet (treatment)	Age (weeks)								Mean Treatment
	1	2	3	4	5	6	7	8	
1.	17.60	19.50	21.50	22.50	22.90	23.50	26.00	29.25	182.75 ^a
2.	17.00	19.00	21.40	23.00	24.80	27.85	29.00	28.50	190.55 ^a
3.	18.25	20.00	22.35	23.75	25.25	26.50	28.00	29.75	193.85 ^a
4.	17.00	17.50	20.00	22.00	22.50	24.00	26.00	28.50	177.50 ^b

Diet 1 = 0.0% Diet 2 = 7.0% Diet 3 = 15.0% Diet 4 = 22.5%

^{a-b} Means along same column with different superscripts are significantly different (P <0.05).

Table 10: Neck Length (cm) of West African Dwarf Goats (0-8 weeks old) fed graded levels of *Enterolobiumcyclocarpum*

Diet (treatment)	Age (Weeks)								Mean Treatment
	1	2	3	4	5	6	7	8	
1.	8.95	8.95	10.00	10.75	12.25	13.50	14.15	15.80	94.35 ^b
2.	7.65	11.50	13.50	13.85	14.90	15.50	16.15	17.00	110.05 ^a
3.	8.75	10.25	12.75	15.00	16.00	16.90	18.25	20.00	117.9 ^a
4.	8.00	10.00	12.00	12.00	12.50	13.50	15.00	15.80	98.80 ^b

Diet 1 = 0.0% Diet 2 = 7.0% Diet 3 = 15.0% Diet 4 = 22.5%

^{a-b} Means along same column with different superscripts are significantly different (P < 0.05).

Table 11: Neck Circumference (cm) of West African Dwarf Goats (0-8 weeks old) fed graded levels of *Enterolobiumcyclocarpum*

Diet (treatment)	Age (weeks)								Mean Treatment
	1	2	3	4	5	6	7	8	
1.	17.50	18.50	19.00	19.50	20.25	21.25	21.75	22.25	160.00
2.	15.75	18.50	18.50	19.40	20.50	21.15	22.00	23.50	159.30
3.	17.35	18.00	18.25	19.25	20.00	21.00	21.80	23.25	159.30
4.	16.00	16.00	16.50	18.50	18.50	19.50	21.00	23.00	149.00

Diet 1 = 0.0% Diet 2 = 7.0% Diet 3 = 15.0% Diet 4 = 22.5%

Means along same column are not significantly different (P > 0.05).

Table 12: Head Circumference (cm) of West African Dwarf Goats (0-8 weeks old) fed graded levels of *Enterolobiumcyclocarpum*.

Diet (treatment)	Age (weeks)								Mean Treatment
	1	2	3	4	5	6	7	8	
1.	24.15	25.40	26.50	27.50	27.50	27.60	28.50	30.50	217.65 ^a
2.	22.25	25.25	26.75	27.70	28.50	28.50	29.15	32.50	220.6 ^a
3.	24.00	25.00	25.50	26.50	27.25	28.00	28.75	30.50	215.5 ^a
4.	22.00	23.50	24.50	26.00	26.50	27.30	28.70	29.50	208.00 ^a

Diet 1 = 0.0% Diet 2 = 7.0% Diet 3 = 15.0% Diet 4 = 22.5%

Means along same column are not significantly different (P > 0.05).

Morphometric parameters of all goats across the four diets (Tables 2-12) increased with age. Mailafia *et al* (2010) reported that the main effects of *Enterolobiumcyclocarpum* on West African Dwarf goats showed that

as age increased, body dimensions also increased. Youndset *al* (2013) observed that animals ranging from 0 to 8 weeks of age have more potentials to grow physically when their diets are supplemented with *Enterolobiumcyclocarpum*, making it possible for a few major body dimensions like body length, height at withers and head circumference to have profound roles in the early stages of an animal's lifecycle and also comfortably predict their live weights.

The results of this study revealed that highest values in most linear body dimensions (body length, body circumference, height at withers, face length, tail length, fore limbs, neck length and neck circumference) were recorded for diet 3. Whereas diet 1 resulted in highest values in ear length, hind limbs and head circumference. Most of the least values in linear body dimensions (body circumference, ear length, body length, hind limbs, face length, tail length, fore limbs, neck circumference and head circumference) were obtained from diet 4. There were significant differences ($P < 0.05$) between diets for all linear body parameters, except for neck circumference and head circumference.

IV. Conclusion And Recommendation

Body weight of WAD goats increased with age from 0-8 weeks when fed graded levels of *Enterolobiumcyclocarpum* leaves. Body weight dynamics varied across the diets, with diet 3 (15.0%) recording the highest mean body weight. Morphometric parameters increased with age but varied with diets. Highest values for most morphometric dimensions were obtained from diet 4 (22.5%). There were significant differences ($P < 0.05$) between diets for all morphometric parameters, except for neck and head circumferences. Inclusion of *Enterolobiumcyclocarpum* in the diets of WAD goats should not exceed 15.0%.

References

- [1]. Dubeuf, C. D., Mckell, C.C. and Mishra, H. R. (2004). Origin of West African Dwarf Goat, Indian Journal of Animal Production. 39:6-10.
- [2]. Flores, E. F., Oduguwa, O. O and Oni, A. O. (2012). Utilization of citrus based diets and *Enterolobiumcyclocarpum* foliage (Jacq.griesly) by West African Dwarf Goats. Proceedings of 32nd Annual Conference, Nigerian Society for Animal Production, Calabar. Pp:167-169.
- [3]. Francis, A. D. (1988). Foundation of *Enterolobiumcyclocarpum*. Proceedings of the 13th Annual Conference, Nigerian Society for Animal Production, Zaria, Nigeria. Pp 200.
- [4]. Genstat (2016). Genstat Release 10.3 DE (PC/Windows 7). VSN International Ltd (Rothamsted Experimental Station).
- [5]. Koenig, F. Q., Parkash, S. and Jenness, R. (2007). Genetic analysis of goat litter traits at birth and weaning. Nigerian Journal of Animal Science. 19:60-69.
- [6]. Mailafia, F. G, Asalu, V. O., Akinlade, A. J. and Sodeinde, F. G (2010). Body weight, body measurements and performance of West African Dwarf Goats fed graded levels of *Panicum maximum* and *Enterolobiumcyclocarpum*. Proceedings of 32nd Annual Conference, Nigerian Society for Animal Production. Calabar, Nigeria. Pp:134-138.
- [7]. Moscoco, E. F., Babayemi, O. J and Jonathan, S. G. (1995). Composition, nutritive value and upgrading of CNP (*Enterolobiumcyclocarpum*) leaf. FAO corporate document repository; publishing North Adam's. Zaria, Nigeria. Pp15-17.
- [8]. Noso. F. E., Okoro, C. K. and Singh, H. B. (2003). A text book on the importance of Ruminant animal and their body weight. 1st edition oxford and IBH Publishign co. Pvt-Ltd, Hillman and Calina: Pp: 60-62.
- [9]. Pinerio, V. F, Jinadu, O. A. and Eniolorunda, O. O., (2013). Effect of combined levels of *Panicum maximum* and *Enterolobiumcyclocarpum* on nutrient digestibility and utilization by West African Dwarf Goats fed cassava diet. Proceeding of 33rd Annual Conference, Nigeria Society for Animal Production, Zaria. Pp: 122-125.
- [10]. Salako, A. E. and Ngere, O. O. (2002). Application of multifactorial discrimination analysis in the morphometric structural differentiation of West African Dwarf and Yanteasa goat in South West Nigeria. Nigerian Journal of Animal Production 29:163-167.
- [11]. Tiwari, I. B., Bamikole, M. A., Akinsoyinu, A. O. and Ezenwa, I. (2006). Effect of *Panicum maximum* with *Enterolobiumcyclocarpum* on ruminants, chemical composition and stylosantinehamata in Nigeria. Grass and Forage Science, 5a (4) 357-363.
- [12]. Udoh, U. H. and Udofot, M. M. (2016). Pattern of early growth traits and predictions in progenies of mongrel rabbits. British Journal of Applied Science and Technology. 17(16):1-8
- [13]. Udoh, U. H. and Inyang, U. A. (2017). Early growth traits, correlations and predictions in West African Dwarf Sheep. Proceedings of 6th ASAN-NIAS Joint Annual Meeting, Abuja, Nigeria Pp 339-343.
- [14]. Udoh, U. H. and Udoh, J. E. (2019). Pattern of early growth traits and predictions in progenies of Muturu cattle. Asian Journal of Research in Animal and Veterinary Sciences 4(4):1-7.
- [15]. Wang, I. B., Obva, B. and Somade, B. (2000). Observation of body weight and linear measurements on West African Dwarf Goat. Journal of Applied Goat Research 17:105-140.
- [16]. Younds, J. D., Mcleory, G. L and Butts, W. T (2013). Studies on dimensions of West African Dwarf Goats. Journal of Animal Science. 15 (3): 911-921.

Udoh, U. H, et. al. "Influence of K application on the yield and quality of Bottle Gourds (*Lagenariasiceraria*) in relation of K-forms and release characteristics in Alfisol soils of Eastern India." *IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)*, 13(6), 2020, pp. 07-14.