Nigerian J. Anim. Sci. 2018, 20 (4): 522-560

Blood Biochemical Profile and Carcass Characteristics of Weaner Rabbits Fed Varying Inclusion Levels of Gamba Grass (*Andropogon gayanus* Kunth.) Forage

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***Target audience**:* Smallholder rabbit farmers, Forage agronomists and Extension agents

Abstract

A study was conducted to investigate the effect of varying inclusion levels of Gamba grass (Andropogon gayanus Kunth) forage on haematological, blood biochemical and carcass characteristics of weaner rabbits. A total of 20 male rabbits of mixed breeds with an average initial weight of 450g were randomly assigned into four dietary treatments containing varying inclusion levels of gamba grass forage (0, 5, 10 and 15%). There were four rabbits per treatment, each serving as a replicate in a completely randomized design. Blood samples were collected at the end of eight (8) week feeding period before the carcass analysis.. Results indicated that there were significant (P<0.05) increasing trend in the haematological and blood biochemical parameters measured. There were 51% and 55% increases (P<0.05) in total protein (8.53 vs. 5.65g/dl) and calcium ions (2.65 vs. 1.18mmol/dl) in rabbits fed diet containing 15% inclusion level of gamba grass forage compared to the control. However, there were 10% and 17% decreases (P<0.05) in white blood cells (4.92 vs. 4.43%) and alkaline phosphate (89.33 vs. 76.33IU/dl) in rabbits fed the control diet than those fed diet containing 15% inclusion level of gamba grass. Also, there were 13% and 49% increase (P<0.05) in dressing percentage (54.80 vs. 48.60%) and weight of thigh (16.95 vs. 11.35%) in rabbits fed diet containing 15% inclusion level of gamba grass forage compared to the control. However, length of small intestine and weights of heart, head, stomach and small intestines were similar (P>0.05) across the treatments, respectively. It was concluded that gamba grass forage can be included up to 15% in the diet of weaner rabbits, without adverse effect on haematological, biochemical profile and carcass characteristics of the rabbits in Northern Guinea savanna of Nigeria. Gamba grass (Andropogon gayanus Kunth) forage can be included in the diets of weaner rabbits to reduce cost of production.

Keywords: Blood, competition, carcass, feed, gamba, Nigeria, rabbit

Description of Problem

The rapid increase in human population has been accompanied by a deficit in animal feedstuff especially conventional or primary protein feedstuffs like soybean, groundnut cake and fishmeal (1). This is because they are

competed for by humans and industrial users. The shortage of conventional livestock feedstuff has also resulted in the search for alternative protein sources for livestock feeding (2). Olorede *et al.* (3) had earlier opined that the feed and nutritional crises besetting the livestock population in Nigeria strongly indicates the need to expand the raw material base for livestock feed formulation to accommodate unconventional feed resources.

The need for quality animal consumption by man cannot be overemphasized, as it has direct impact on the health and well being of the people with regard to human nutrition. It can be demonstrated very easily that nutrition may affect health, welfare, emotion, physical capacities and susceptibility to and recovery from diseases (4). It is well recognized that malnutrition is a common problem for impoverished people in the lesser developing countries (5). It is reported that per capital animal protein consumption is about 13g/d in the less developed countries (6). The number of undernourished people is on the increase all over the world, climbing by five million people a year, with the over-whelming majority in the developing world (7). With the recommendation of a minimum of 56g/day of protein intakes per person given by (8), many Nigerians are unable to meet this requirement due to high cost of animal products (9).

Rabbit is a good source of meat, which is of high quality with low cholesterol and therefore suitable for special diets (10). Rabbits have a potential as meat-producing animals in the tropics, particularly on subsistence-type small farms. Such characteristics as small body size (thus low daily feed requirements), short generation interval, high reproductive potential, rapid growth rate and the ability to utilize forages and fibrous agricultural by-products are attributes in favour of rabbit production (11). In spite of these apparent advantages, rabbit production has not yet achieved its potential in the tropics.

In developing countries, where commercial feeds for rabbits are either not available or cost-prohibitive, (12) advocated raising rabbits on a basic forage diet with an energy supplement. Forages are readily available and cheap in the tropics, and rabbits, being pseudoruminants, have the ability to utilize forages for growth. Though optimum rabbit production has not been sustained on forages alone using most tropical forages, it is possible to reduce the cost of concentrates in the rations by utilizing forages that are nutritious and palatable, to achieve a compromise between level of production and cost that is acceptable to producers. The major nutritional requirements of rabbits of concern in small-scale tropical rabbit production are protein and energy. The rabbit is a small herbivore that has evolved a digestive tract uniquely suited to the utilization of herbage. The ability of rabbits to efficiently digest the protein in forages is associated with caecal fermentation and caecotrophy (13).

Feed is one of the major problems of intensive rabbit production in Nigeria due to the competition between man, animals and industries for conventional feed materials. This has led to the escalating cost of conventional feed ingredients and has made feed cost to account for about 70% of total cost of production (14). This problem has been the prime stimulants for the continuous search for alternative feedstuffs that can meet the nutritional requirements of micro-livestock, reduce the cost of feed and animal production (4).

The use of forages in rabbit feeding is becoming a normal practice, and rabbit producers are advised to feed forages as a supplement to a basic concentrate diet in order to meet the fibre and some of the vitamin requirement. Although, rabbits can be produced on forage alone, but production can

be improved by the addition of other feed supplements (15). Livestock require a daily supply of feed throughout the year to provide for growth, maintenance and production, however throughout the year and from year to year, the supply is subject to continuous change. The total annual rainfall and its seasonal distribution are important factors influencing pasture growth in this part of the country. Some workers (16) opined that some of the limiting factors associated with using browse plants as animal feeds include procurement, storage, high fibre content, toxic substances, poor feed intake, poor digestibility and consequent low performance of the animals. One natural feed resource on which feeding system can be based in Nigeria is gamba grass. Gamba grass *Andropogon gayanus* is available in abundance in almost all ecological zones in Nigeria.

The problem with gamba like other tropical grasses is the rapid decline in crude protein and soluble carbohydrate with age. This is coupled with a progressive increase in crude fibre and lignin (17). Gamba grass tussock recovers well after fire with development of new tillers. The main aim of this study was to investigate the blood biochemical profile and carcass characteristics of weaner rabbits fed varying inclusion levels of gamba grass (*Andropogon gayanus* kunth) forage in the diet.

Materials and Methods

Experimental site

The experiment was conducted at the rabbitry unit of the Department of Animal Science, Teaching and Research Farm, Ahmadu Bello University, Samaru Zaria, lying between latitude 11° 12' N, 07° 33'E and at an altitude of 686m above sea level. The area falls within the Northern-Guinea Savannah Zone with an average annual rainfall of 1100mm, which last from late April and early May to Mid-October. The peak of the rainy season is between June and September and usually followed by the harmattan; a period of cool, dry weather which last from Mid-October to January. This is by a dry-hot weather from February to May (pre-rains) (18).

Source of Gamba grass and Rabbits

The Gamba grass used in this experiment was harvested at pre-flowering stage from the irrigation site of the Institute for Agricultural Research, Samaru, Zaria. The forage material was allowed to dry in the shade for one week before it was chopped into smaller pieces and milled into powder using a Hammer mill in the Biochemical Laboratory, Department of Animal Science, Ahmadu Bello University, Zaria for inclusion in the diets. Twenty five (25) seven weeks old male weaner rabbits of average initial weight range of 400 - 450g were obtained from Samaru market, in Zaria, Kaduna State. The rabbits were given Ivermictin® injection at the dose of 0.2mg/kg body weight before the commencement of the experiment. This drug was repeated two weeks after the first dose was administered to the animals.

Pre-experimental operations

Twenty (20) weaning rabbits were individually housed in wire-meshed in-door cages for 2-weeks physiological adjustment period before the commencement of the feeding trial. All the rabbits were fed daily at 0800 and 1600h *ad libitum* with the same feed for the 2-week physiological adjustment period.

Experimental design and treatment diets

The experimental design used was a completely randomized design (CRD). Experimental diets consisted of four (4) diets with different inclusion levels of milled gamba grass (*Andropogon gayanus*) forage at 0%, 5%, 10% and 15%, respectively (Table 1). There were five rabbits per treatment, which served as replicates. The experiment lasted for eight weeks.

Table 1: Percentage composition of diets containing inclusion levels of Gamba grass forage fed to weaner rabbits

	Inclusion levels of Gamba grass Forage (%)			
Feed Ingredients	0	5	10	15
Maize	27.00	25.00	25.00	22.00
Maize offal	10.00	12.00	11.00	9.00
Wheat offal	10.00	12.00	11.00	9.00
Brewers Dried Grains	8.00	8.00	8.00	8.00
Palm Kernel Meal	8.00	8.00	8.00	8.00
Groundnut cake	9.00	8.50	8.50	9.00
Oil sludge	1.50	1.50	1.50	1.50
Soya cake	6.00	6.00	6.00	6.00
Gamba grass	0.00	5.00	10.00	15.00
Rice offal	18.00	11.50	8.50	10.00
Limestone	0.25	0.25	0.25	0.25
Bone ash	1.80	1.80	1.80	1.80
Common salt	0.25	0.25	0.25	0.25
Vitamin premix*	0.25	0.25	0.25	0.25
Total	**100.00**	**100.00**	**100.00**	**100.00**
Calculated Analysis				
M.E: Kcal/kg	2631.40	2617.60	2612.60	2548.80
% CP	16.20	16.40	16.40	16.30
EE%	10.25	9.69	9.55	9.81
CF%	11.53	11.32	11.61	13.01
Ca%	0.68	0.86	1.05	1.24
Avail. P%	0.63	0.72	0.78	0.81
Ca: P ratio	1.08	1.20	1.35	1.53
Cost ₦/25kg	55.90	56.90	56.80	55.60

*A Vitamin mineral premix provides per kg diet: Vitamin A, 13.340 iu, vitamin D_3 2680 iu, vitamin E_{10}iu, vitamin K, 2.68 iu, Calcium pentothenate, 10.68mg, Vitamin B_{12} 0.022mg; Folic acid, 0.668mg; Choline chloride 400mg; Chlorotetracycline, 26-28mg; Manganese, 133.34mg; Iron, 66.68mg; Zinc, 53.34mg; Copper, 3.2mg; Iodine, 1.86mg; Colbalt, 0.268mg; Selenium, 0.108mg.

Blood Collection and Analysis

At the end of the 8 weeks feeding trial, blood samples (5ml each) were collected via the jugular veins of three rabbits per treatment into sample bottles containing ethylene diamine tetra-acetate (EDTA) as anticoagulant. The bottles were carefully labeled. The blood samples were analyzed for haemoglobin content (Hb), total protein (Tp), packed cell volume (PCV) and white blood cells (WBC). Packed cell volume and haemoglobin concentration were determined using Wintrobes. Microhaematocrit and Calorimetry Cyan-omethaemoglobin methods, respectively. Biochemical parameters such as total protein, albumin, globulin, glucose, urea and creatinine were also determined using commercial diagnostic kits at the Clinical Pathology Laboratory of the Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria.

Carcass characteristics

At the end of eight weeks feeding trial, 4 rabbits were selected from each treatment based on their average weight; they were starved for 18hrs, weighed, slaughtered and dressed at the Meat Product Laboratory, Department of Animal Science, Ahmadu Bello University, Zaria. The Fore legs, Hind legs, Heart, Liver intestines and others were removed and weighed individually and expressed as a percentage of dressed live weight.

Statistical Analysis

The design used for the experiment was Completely Randomized Design (CRD). All the data obtained were subjected to statistical analysis using analysis of variance (ANOVA) procedure of SAS (19). Significant treatment means were compared using the Dunnet's Test option of the same software.

Results and Discussion

Proximate composition of experimental diets

Results of the proximate analysis of gamba grass forage are presented in Table 2. The results obtained for the proximate analysis showed that the diet with 15% inclusion level of gamba grass forage had the highest dry matter, organic matter and nitrogen free extract, respectively. However, highest values of crude fibre and ash were observed in the control treatment. The crude protein content of the diet ranged from 13.85 to 16.15%.

Table 2: Proximate composition of the experimental diets (%)

	Inclusion levels of Gamba grass forage (%)			
Parameter	0	5	10	15
Dry matter	92.44	94.15	91.85	95.45
Organic matter	81.18	85.59	82.68	87.05
Crude protein	15.35	13.85	16.15	15.09
Crude fibre	12.72	13.95	13.73	18.84
Ether extract	2.45	3.02	2.85	2.91
Ash	11.26	8.56	9.17	8.40
Nitrogen free extract	58.22	65.22	62.50	64.76

Haematological and blood biochemical profile of weaner rabbits fed varying inclusion levels of gamba grass forage in the diets

The results obtained for haematological and blood biochemical profile of rabbits fed gamba grass forage is presented in Table 3. The results indicated that there were significant ($P<0.05$) differences across the dietary treatments for all the parameters measured. The values of PCV obtained in this study (42.50 – 44.30%) fall within the normal ranges of 38-55% reported previously (20). This therefore implies that the rabbits had normal haematopoiesis while on the test diets. The values of 13.45 – 18.60g/d for haemoglobin were higher than the range of 12.5 – 15.0g/d (21) and 12.9 – 13.0g/100ml (22). However, it was observed that the highest values of PCV, Haemoglobin and MCH were observed in rabbits fed 15% gamba grass forage in the diet.

Table 3: Blood biochemical profile of weaner rabbits fed varying inclusion levels of Gamba grass forage

	Inclusion levels of Gamba grass forage (%)				
Parameters	0	5	10	15	SEM
Packed cell volume (%)	42.50^{c}	43.10^{b}	43.90^{a}	44.30^{a}	0.04
Haemoglobin (%)	14.50^{c}	13.45^{d}	16.00^{b}	18.60^{a}	0.10
MCH (pg)	23.30^{a}	19.60^{b}	18.62^{c}	19.41^{b}	0.20
MCHC (g/dl)	34.31^{a}	34.23^{b}	33.25^{b}	33.19^{c}	0.01
MCV (fl)	38.90^{c}	43.31^{b}	49.57^{a}	49.60^{a}	0.50
White blood cell (%)	4.92^{a}	4.50^{b}	4.32^{c}	4.43^{d}	0.03
Total Protein (g/dl)	5.65^{d}	6.74^{c}	6.80^{b}	8.53^{a}	0.04
Albumin (g/dl)	3.15^{c}	3.12^{c}	3.22^{b}	3.78^{a}	0.03
Globulin (g/dl)	2.50^{d}	3.62^{c}	3.58^{b}	4.75^{a}	0.02
Glucose (g/dl)	81.25^{d}	86.77^{c}	89.84^{b}	92.27^{a}	1.14
Urea (mg/dl)	15.55^{b}	16.12^{b}	17.80^{a}	17.79^{a}	0.30
Creatinine (mg/dl)	1.13^{c}	1.08^{d}	1.19^{b}	1.66^{a}	0.01
Total cholesterol (g/dl)	80.23^{a}	73.47^{b}	68.21^{c}	63.10^{d}	1.11
Ca^{2+} (mmol/dL)	1.18^{c}	2.01^{b}	2.57^{a}	2.65^{a}	0.02
PO_4^{2-} (mmol/dL)	1.20^{b}	0.96^{d}	1.03^{c}	1.54^{a}	0.01
ALP (IU/dL)	89.33^{a}	68.00^{d}	73.00^{c}	76.33^{b}	2.33

^{abc}Means with different superscript on the same row differed significantly (P<0.05); SEM = Standard Error of Mean; MCH = Mean Corpuscular Haemoglobin; MCHC = Mean Corpuscular Haemoglobin Concentration; Ca^{2+} = Calcium ions concentration in blood; PO_4^{2-} = Phosphorus ion concentration in blood; ALP = Alkaline Phosphate.

Rabbits fed 15% inclusion level of gamba grass forage in the diet had significantly higher (P<0.05) values of total protein, albumin, globulin, glucose, urea, calcium, phosphorus and creatinine, respectively. However, there was a significant (P<0.05) decreasing trend in the white blood cells (WBC), total cholesterol and alkaline phosphate (ALP) contents in rabbits fed 15% inclusion level of gamba grass forage in the diet. The values recorded in this study are in agreement with the findings of (21, 22). However, values of blood minerals reported by these authors were higher than in this study. This variation could be attributed to differences in sources of plant materials used in the diets. The ranges of 5.65 – 8.53g/d1 for total protein observed in the present study were within the normal range reported for healthy rabbits (23). The range of 18.62 – 23.30pg and 33.19 – 34.31g/dl for MCH and MCHC, respectively reported in this study were within the normal range of 20.1 – 21.3pg for MCH and 30.8 – 34.5g/dl for MCHC reported by (21). The results obtained for haematological and blood biochemical profile of rabbits in this study implies that the rabbits were in better health to combat foreign bodies in their circulatory system, when fed diets containing varying inclusion levels of gamba grass forage.

Carcass characteristics of weaner rabbits fed varying inclusion levels of Gamba grass forage

Results of carcass evaluation of weaner rabbits fed varying inclusion levels of gamba grass forage are presented in Table 4.

Table 4: Carcass characteristics of weaner rabbits fed varying inclusion levels of Gamba grass forage.

	Inclusion levels of Gamba grass forage (%)				
Parameters	0	5	10	15	SEM
Live weight (g)	1000.00^{d}	1170.00^{c}	1350.00^{b}	1370.00^{a}	5.00
Slaughter weight (g)	850.00^{d}	1105.00^{c}	1275.00^{b}	1295.00^{a}	2.22
Carcass weight (g)	486.00^{d}	599.70^{c}	684.20^{b}	750.50^{a}	2.01
Dressing (%)	48.60^{d}	51.26^{b}	50.68^{c}	54.80^{a}	0.02
Length of Small intestine (cm)	286.00	283.00	287.00	284.00	7.01
Length of Large intestine (cm)	128.00^{d}	143.50^{c}	188.50^{b}	198.50^{a}	1.33
Prime cuts and organ weight expressed as a percentage of live weight					
Heart (%)	0.21	0.20	0.21	0.21	0.01
Liver (%)	3.30^{a}	2.91^{c}	3.00^{b}	2.99^{b}	0.01
Lung (%)	0.14^{c}	0.72^{b}	0.86^{a}	0.88^{a}	0.02
Kidneys (%)	0.79^{b}	0.73^{b}	0.81^{a}	0.87^{a}	0.03
Spleen (%)	0.02^{b}	0.02^{b}	0.04^{b}	0.07^{a}	0.01
Shoulder (%)	15.80^{d}	16.70^{c}	17.55^{a}	16.98^{b}	0.02
Loin (%)	10.50^{c}	10.59^{c}	11.96^{b}	12.93^{a}	0.21
Thigh (%)	11.35^{d}	14.11^{c}	16.57^{b}	16.95^{a}	0.02
Head (%)	8.80	9.00	9.05	8.68	1.11
Legs (%)	2.77^{d}	2.68^{c}	3.40^{b}	3.96^{a}	0.03
Skin (%)	6.50^{d}	7.90^{c}	8.25^{b}	8.89^{a}	0.05
Tail (%)	0.33^{d}	0.42^{c}	0.45^{b}	0.48^{a}	0.01
Weight of stomach (g)	1.55	1.39	1.37	1.38	1.13
Weight of Small intestine (g)	1.96	2.11	2.48	2.59	0.70
Weight of Large intestine (g)	3.00^{c}	3.49^{b}	3.51^{b}	3.85^{a}	0.01

^{abc}Means with different superscript on the same row differed significantly (P<0.05); SEM = Standard Error of Mean.

The results indicated that there were significant (P<0.05) differences in all of the carcass parameters measured except for length of small intestine, heart weight, head weight and weights of stomach and small intestines, respectively. Rabbits fed 15% inclusion level of gamba grass forage in the diet had significantly (P<0.05) higher live weight (1370g), while those for control diet had the least value (1000g). The increase in live weight in rabbits fed 15% inclusion level of gamba grass forage can be ascribed to palatability of the diet and better nutrient utilization by the rabbits. Previous studies revealed that when rabbits are fed high quality diets, weight gain is affected positively (24). Another possible reason could be related to increased fibre level in the diet with 15% inclusion level of gamba grass forage in the diet, since it has been established that rabbits perform better in diets with adequate fibre level in the diet (25).

There was significant (P<0.05) increasing trend in most of the parameters with increase in the level of gamba grass forage in the diet. The results obtained in this study are similar to

the findings of (25). The dressing percentage (54.80%) recorded in rabbits fed 15% gamba grass forage in the diet was higher than the value of 52.94% reported in Egypt (22). This result indicates that gamba grass forage could be a very good source of earning extra income from sales of rabbits with higher dressing percentage in Nigeria. Similarly, weights of all organs considered were higher ($P<0.05$) in rabbits fed 15% inclusion level of gamba grass forage in the diet, except liver and shoulder weights. This result therefore indicates that gamba grass forage had significant effect on the carcass parameters of the rabbits. The length of small intestine which ranges between 283cm to 287cm was similar ($P>0.05$) among the dietary treatments. This observation is similar to the report of (250), who fed forages in mixed feeding regime to weaner rabbits and recorded between 269cm to 290cm for the length of small intestine. However, weights of stomach and small intestine were not affected ($P>0.05$) by levels of gamba grass inclusion in the diets.

Conclusion and Application

It can be concluded from this study that:

1. Blood biochemical profile and carcass characteristics of weaner rabbits were affected by varying inclusion levels of gamba grass forage in the diets.
2. Gamba grass forage can be included in the diet of weaner rabbits up to 15% without any adverse effect on blood biochemical profile and carcass characteristics of rabbits in Northern Guinea savanna of Nigeria.

References

1. Musalia, L.M., Anandan, S. ,Sastry, V.R, Katiyar, R.C. and Agrawal, D.K. (2005). Effect of replacement of groundnut cake with Urea treated neem *(Azadirachta indica*) seed kernel on nutrient utilization in Lambs. *Asian Australia Journal Animal Science* 155 (9): 1273-1277.
2. Dafwang, I.I. (2006). Milk, eggs, and meat from farm wastes; explorations in Animal Nutrition on Research and Extension. An Inaugural Lecture. University Organized Lecture Committee. Vice Chancellor's Office, Ahmadu Bello University, Zaria. Nigeria. 27 – 29 March.
3. Olorede, B. K., Onifade, A. A. and Babatunde, G.M. (1997).Corporative Utilization of Shear butter cake and Palm Cake by broiler chickens. *Nigeria Journal of Animal Production*. 24 (2) 124-131.
4. Church, D. C and Pond, W. G. (1988). *Basic Nutrition and Feeding*. Publisher: John Wiley and Son. Inc. Canada. PP. 77.
5. Ruiz-Feria, C.A., Lukefahr, S. D. and Felker, P (1998). *Evaluation of Leucocephala and Cactus (opuntia sp.) as Forages for Growing Rabbits*. *Livestock Research for Rural Development.* 10(2): 104-108.
6. Sansoucy, R. (1995). Livestock – a driving force for food security and sustainability development. *World Animal Review.* 3 – 4:5-17.
7. Food and Agriculture Organization (2003). The State of Food Security in the World, FAO, Annual Report. December 25, 2003.
8. Food and Agriculture Organization (1985). *Energy and Protein Requirements*, WHO Technical Report, Series 724, Geneva, Switzerland.
9. Fasuyi, A.O. (2005). Nutritional Evaluation of Cassava *(Manihot escalenta, crants),* leaf protein concentrates (CLPC) as alternative protein sources in rat assay. *Pakistan Journal of Nutrition* 4:50-56.
10. Owen, J.E. (1981). Rabbit Meat Production for the Developing Countries. *Biochemistry Journal.* 32:2-11.
11. Cheeke, P.R. (1994). Nutrition and nutritional diseases. In: Manning, P.J., Ringler, D.H. and Newcomer, C.E. (Ed),

The biology of the laboratory rabbit, 2nd Ed. *Academic Press, New York*

12. Linga, S. S. and Lukefahr, S. D. (2000) Feeding of alfalfa hay with molasses blocks or crumbles to growing rabbit fryers. *Livestock Research for Rural Development,* 12(4).
13. Robinson, K.L., Cheeke, P.R., Patton, N.M. 1985. Effect of prevention of coprophagy on the digestibility of high-forage and high-concentrate diets by rabbits. *Journal of Applied Rabbit Research,* 8: 57–59.
14. Akinmutimi, A.H. (2004). Evaluation of sword bean (*Canavalia gladiata)* as an alternative feed resource for broiler chickens. PhD Thesis, Micheal Okpara University of Agriculture Umudike, pp: 10-26.
15. Biobaku, W.O., Bamgbose, A. M. and Achike, C. U. (2003). Utilization of different protein Sources for growing rabbits. *Pertanika Journal of Tropical Agricultural Science*, 26: 73-77.
16. Adegbola, T.A. and Oduozo, C. (1992). Nutrient intake, digestibility and performance of rabbits Fed varying levels of fermented and unfermented cassava peel meal. *Nigerian Journal for Animal Production,* 12: 41-47.
17. Agishi, E.C. (1983). Forage legume and pasture development in Nigeria. In: S. Nuru and S.G. Ryan (Eds), Agricultural Research ACIAR proceeding, series 4; pp 79 – 87.
18. Ovimaps, (2017). Ovi Location Map; Ovi Earth Imagery date; January 15th, 2016.
19. S.A.S (2006), *Statistical Analysis System Institute Inc*. User's Guide. Statistics version 6th ed. Carry. North Carolina, U.S.A.
20. Swenson, M.J. and Reece, W. O. (1993). *Dukes Physiology of Domestic Animals*.11th Edition Cornel University Press. New York. Pp 30-32.
21. Saleh, J. L., Njidda, A. A., Adeniji, A. A. and Lawan, G. B. (2014). Haematological and Biochemical Indices of Rabbits Fed Graded Levels Browse Forage (*Balanites aegyptiaca*) in Semi Arid Environment. *Global Journal of Science Frontier Research: Agriculture and Veterinary,* 14(2) Versions 1.0: 1-7.
22. Hanna, M. F. S., Meshreky, S. Z. and El-Zaiat, A. A. A. (2008). Effect of some supplementation of medicinal plants on growth performance, carcass traits and economical efficiency of growing rabbits. *Proceedings of the Animal Production Department, University of Cairo,* 29th -30th October, 2008, 1-15.
23. Taiwo, A.A., Adejuyigbe, A.O., Talabi, E.O., Okumakuma, G.O. and Adebawale, E.A. (2003). Effect of raw and cooked Mucuna seed meal based diets on the performance and haematology of weaned rabbits. *8th Annual Conference of Animal Science Association of Nigeria*. September, 16 – 18. FUT. Minna. Pp. 83 – 86.
24. Iyeghe-Erakpotobor, G.T. (2006). Performance of grower rabbits fed concentrate and Stylosanthes (Verano) combination under tropical conditions. *Animal Science Journal*. 77(1): 71 – 78.
25. Basavaraj, M., Nagabhushana, V, Prakash, N., Appannavar, M.M., Prashanth Wagmare and Mallikarjunappa, S. (2011). Effect of Dietary Supplementation of *Curcuma longa* on the Biochemical Profile and Meat Characteristics of Broiler Rabbits under Summer Stress, *Veterinary World,* 4 (1):15-18.