Nig. J. Anim. Prod. 2022, 49(1):313-321. https://doi.org/10.51791/njap.v49i1.3430. *Nigerian Journal of Animal Production*

Replacement value of cassava peel meal for maize on the reproductive potential of rabbit does in Nigerian tropical region

[*]Evans, E. I., Sam, I. M. and Ukpanah, U. A.
[1]*Department of Animal Science, Faculty of Agriculture,*
Akwa Ibom State University,
Obio Akpa Campus, Akwa Ibom State, Nigeria
[*]**Corresponding author:** ememevans2015@gmail.com

Abstract

The high cost of conventional grains /energy sources as impacted negatively on livestock production. This scenario has compelled feed millers and livestock farmers to utilize non-conventional feed resources in animal production. In this study the replacement value of cassava peel meal for maize on the reproductive potential of rabbits in a tropical environment was determined. Sixty cross bred pre - pubertal rabbits of both sexes (20 bucks and 30 does) with an average initial weight of 698.34±0.02g were used in a feeding trial that lasted weeks for the growth phase and another 16 weeks for pubertal/reproductive phase. Five experimental diets were formulated at both phases, comprising 0, 25 50, 75 and 100% replacement levels of cassava peel meal for maize designated as T_1 (control), T_2, T_3, T_4 and T_5 respectively. The rabbits were randomly assigned to the diets after weight equalization using a completely randomized design (CRD). The reproductive characteristics of the rabbits were determined at the pubertal phase and data subjected to one-way ANOVA. Results of the reproductive characteristics for the female rabbits (does) showed significant ($P < 0.05$) differences between dietary treatments for conception rates (100, 75, 90,100 and 100 %), average weight of kitten at 21 days (316, 200, 205, 200 and 250 g/kitten) and average weaning weight (590, 500, 523, 550 and 530 g) for T_1, T_2, T_3, T_4 and T_5 respectively. The female reproductive tract morphometry showed that weight of the whole reproductive tract, paired uterine horns, uterus, cervix and vagina were not significantly ($P>0.05$) affected by dietary treatments The study can be concluded that the replacement value of cassava peel meal for maize up to 100% was not detrimental to the reproductive performance of rabbits.

Keywords: Rabbits, reproductive potential, litter size, weaning and gestation

Valeur de remplacement de la farine d'écorces de manioc pour le maïs sur le potentiel reproducteur des lapines en région tropicale nigériane

Résumé

Le coût élevé des céréales/sources d'énergies conventionnelles a eu un impact négatif sur la production animale. Ce scénario a contraint les fabricants d'aliments pour animaux et les éleveurs à utiliser des ressources alimentaires non conventionnelles dans la production animale. Dans cette étude, la valeur de remplacement de la farine d'écorce de manioc pour le maïs sur le potentiel reproducteur des lapins en milieu tropical a été déterminée. Soixante lapins pré-pubères croisés des deux sexes (20 mâles et 30 femelles) avec un poids initial moyen de 698,34 ± 0,02 g ont été utilisés dans un essai d'alimentation qui a duré des semaines pour la phase de croissance et 16 semaines supplémentaires pour la phase pubertaire/reproductive. Cinq régimes expérimentaux ont été formulés aux deux phases, comprenant des niveaux de remplacement de 0, 25, 50, 75 et 100 % de farine d'écorces de manioc pour le maïs désigné par T_1 (témoin), T_2, T_3, T_4 et T_5 respectivement. Les lapins ont été assignés au hasard aux régimes après égalisation du poids en utilisant une conception

complètement randomisée (CCR). Les caractéristiques de reproduction des lapins ont été déterminées à la phase pubertaire et les données soumises à une ANOVA à une voie. Les résultats des caractéristiques de reproduction des lapines (femelles) ont montré des différences significatives (P <0,05) entre les traitements alimentaires pour les taux de conception (100, 75, 90, 100 et 100 %), le poids moyen du chaton à 21 jours (316, 200, 205 , 200 et 250 g/chaton) et poids moyen au sevrage (590, 500, 523, 550 et 530 g) pour T_1, T_2, T_3, T_4 et T_5 respectivement. La morphométrie de l'appareil reproducteur féminin a montré que le poids de l'ensemble de l'appareil reproducteur, des cornes utérines appariées, de l'utérus, du col de l'utérus et du vagin n'était pas significativement (P>0,05) affecté par les traitements diététiques L'étude peut conclure que la valeur de remplacement de la farine d'épluchures de manioc pour le maïs jusqu'à 100 % n'a pas nui aux performances de reproduction des lapins.

Mots-clés : Lapins, potentiel reproducteur, taille de la portée, sevrage et gestation

Introduction

Feeding non conventional feed stuff can mitigate against the problem of high feed cost and stiff competition between livestock industry and feed processing industries for the available resources (Durunna *et al.,* 2006). Cassava peel is found mostly in areas with cassava processing industries. Cassava peel a bye product of cassava is found in large quantities as waste constituting environmental pollutant, by the release of methane gas into the atmosphere (Robinson, 1990). Cassava peel has been researched on and used by several authors as non conventional feeding stuff (Salami, 2000; Kateria, 2014; Olorutola *et al.,* 2016). Cassava peel meets the benchmark of availability recommended for any lesser known feeding stuff to be qualified as a nonconventional feed stuff (Ojebiyi, 2013). Nutrition plays a crucial part by influencing the functional efficacy, efficiency and production system of livestock production (Robison, 2019). Nutrition is important in regulating the body condition and maintaining reproductive efficiency of farm animals (Robinson, 1990; Hoedemaker, 2009). The link between nutrition and reproduction cannot be overemphasized; since their interaction is known to have a direct correlation with reproductive performance Watches *et al.* (2007) opined that high productivity livestock must be nutritionally balanced in order to attain a high reproductive and productive quotient. Reproductive efficiency is regarded as the costly and limiting constraint to efficient animal production. Since reproduction can become a source of low productivity in livestock production (Ewuola and Egbunike, 2010). Inadequate consumption of energy, protein, vitamins, micro and macro minerals has been linked to reduced reproductive performance. Reduced energy balance has been singled out and identified as the most essential nutritional factor associated with poor reproductive functions (Randa, 1990; Puls, 1994). The influence of nutrition starts early since it can result to delayed sexual maturity. Energy deficiency in young animals affect age at puberty and sexual development due to reduced endocrine activity (Randal, 1990). In female animals the number of eggs shed from the ovaries is the most important predictor of fertility and litter size (Scrarmmuzal and Martin, 2006). Inadequate nutrition affect the amount of ova or spermatozoa produced resulting in conception failure or production of fewer and weaker offspring. This study is aimed at evaluating the reproductive potential of rabbit does in Nigeria tropical region.

Materials and methods

Location of the study

The study was carried out at the Rabbitry unit of the teaching and Research farm,

Department of Animal Science, University of Calabar, Calabar, Cross River State, Nigeria. According to the GeoNames geographical database by Google Earth (2012), Calabar is located at 4.9517^{0}latitude and 8.322^0 longitude with an average elevation/altitude of 42 metres. The annual rainfall ranges from 3000-3500mm and the average daily temperature is 25^{0}C/77^{0}F increases to 30^{0}C (86^{0}F) in August. The relative humidity is between 70-80% while the wind speed/direction is 8.1km/h West and the cloud is broken at 1000ft with little cumulonimbus at 2200ft. The time zone in Calabar is Africa/Lagos.

Processing of the test ingredient (cassava peel meal, cpm)

Fresh composite cassava peels were collected from cassava processing locations in Odukpani and Akamkpa, washed and sun dried for seven to eight days and milled using a hammer mill. The milled cassava samples were stored in sterile polythene bags at room temperature of 23^{0}C and kept to be used as replacement in the test diets. Cassava peel meal served as the test ingredient while the major feed ingredients were maize, full fat soybean, rice husk, palm kernel meal, and crayfish dust. The proximate composition of sun dried cassava peel meal was determined using the A.O.A.C (1990) method.

Experimental diets

Five experimental diets were formulated each comprising of 0, 25, 50, 75 and 100% in the ratios of 100:0, 75:25, 50:50, 25:75 and 0:100 maize: sun dried CPM respectively. Each of the dietary treatments were assigned 1, 2, 3, 4 and 5 respectively. Treatment 1 served as the control diet. The proximate composition of the experimental diets was carried out based on the procedures outlined by A. O. A. C. (1990). The composition of experimental diets is presented in Tables 1 and 2.

Table 1: Gross composition of the experimental diets (growth phase)

Ingredient	T_1	T_2	T_3	T_4	T_5
Maize	30.00	22.00	15.00	7.50	0.00
SBM	12.70	15.60	17.60	18.60	19.79
Cray fish dust	4.00	4.00	4.00	4.00	4.00
PKC	7.00	11.10	12.10	12.80	12.91
Wheat offal	15.00	10.00	9.00	9.20	7.00
Rice husk	25.00	23.00	21.00	19.10	20.00
Cassava peel meal	0.00	7.50	15.00	22.50	30.00
Bone meal	2.50	2.50	2.50	2.50	2.50
Methionine	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
Premix	0.20	0.20	0.20	0.20	0.20
Salt	0.10	0.10	0.10	0.10	010
Palm oil	3.00	3.00	3.00	3.00	3.00
Total	100.00	100.00	100.00	100.00	100.00
Calculated analysis					
%CP	16.21	16.95	17.17	17.43	17.33
%CF	9.76	10.05	10.31	10.61	10.47
Me	2,482.05	2,391.53	2,279.28	2,155.90	2,022.02

Gross Composition of Bio —Super Premix per Kg; Vitamin A -1,500,000IU; Vitamin D3 -300,000IU; Vitamin E -400mg; Vitamin B2 -400mg; Vitamin B12 -2,000mg; Nicotinamide -2,000mg; Calcium D Panto thenate -800mg; Choline Chloride -40,000mg; Ferrous Sulphate -2,000mg; Manganate Sulphate -5,000mg; Copper Sulphate -80mg; Zinc Oxide -3,000mg; Cobalt sulphate -10mg; Potassium Iodide -120mg; DL-Methionine-10,000mg and Antioxidant-18,000mg. The premix was manufactured by Bio-Phamachemic Company HCM city, CF-Crude fibre, CP- Crude Protein, SCPM- Sun dried cassava peel meal, SBM- Soybean meal, PKC-palm kernel cake, ME-methabolizable energy. Note well that 0%CPM is the control diet.

Table 2: Gross composition of the experimental diets (reproductive phase)

Ingredient	T_1	T_2	T_3	T_4	T_5
Maize	30.00	22.50	15.00	7.50	0.00
SBM	12.70	15.60	17.60	18.60	19.79
Cray fish dust	4.00	4.00	4.00	4.00	4.00
PKC	7.00	11.10	12.10	12.80	12.91
Wheat offal	15.00	10.00	9.00	9.20	7.00
Rice husk	25.00	23.00	21.00	19.10	20.00
Cassava peel meal	0.00	7.50	15.00	22.50	30.00
Bone meal	2.50	2.50	2.50	2.50	2.50
Methionine	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
Premix	0.20	0.20	0.20	0.20	0.20
Salt	0.10	0.10	0.10	0.10	0.10
Palm oil	3.00	3.00	3.00	3.00	3.00
Total	100.00	100.00	100.00	100.00	100.00
Calculated analysis					
%CP	16.21	16.95	17.17	17.43	17.33
%CF	9.76	10.05	10.31	10.61	10.47
ME (Kcal/kg)	2,482.05	2,391.53	2,279.28	2,155.90	2,022.02

Gross Composition of Bio —Super Premix per Kg; Vitamin A -1,500,000IU; Vitamin D3 -300,000IU; Vitamin E -400mg; Vitamin B2 -400mg; Vitamin B12 -2,000mg; Nicotinamide -2,000mg; Calcium D Panto thenate-800mg; Choline Chloride -40,000mg; Ferrous Sulphate -2,000mg; Manganate Sulphate -5,000mg; Copper Sulphate -80mg; Zinc Oxide -3,000mg; Cobalt sulphate -10mg; Potassium Iodide -120mg; DL-Methionine-10,000mg and Antioxidant-18,000mg. The premix was manufactured by Bio-Phamachemic Company HCM city, CF-Crude fibre, CP- Crude Protein, SCPM- Sun dried cassava peel meal, SBM- Soybean meal, PKC-palm kernel cake, ME-methabolizable energy. Note well that 0%CPM is the control diet.

Experimental animals and management

A total of sixty crossed-bred weaner rabbits(40 does and 20 bucks) aged 5-6 weeks old with an average initial weight of 559.58 $\pm$ 0.42g were used for the study. The rabbits were obtained from standard rabbitries in Uyo and Calabar. Immediately on arrival the rabbits were given vitalyte an anti-stress medication via drinking water. The rabbits were then randomly distributed into five different treatment groups after standardizing for weight, with a stocking ratio of 4 bucks to 8 does. Each rabbit occupied a compartment to make up a replicate. The rabbits were conditioned by providing prophylactic medication using anti-biotics and vitamins against bacterial and viral diseases and also health screening against ecto and endo parasites. The rabbits were fed with commercial diet, a small quantity of forage and water was given *ad libitum*. All these procedures took two weeks within which the rabbits acclimatized to the environment.

The actual feeding trial proceeded thereafter, initially for nine weeks during which their pre-pubertal growth performance were determined. During this period a weighed amount of feed were given daily, morning and evening and leftover weighed to determine the daily feed intake, daily, fresh and clean water was supplied *ad libitum*. Then the rabbits were now kept for another sixteen (16) weeks for evaluation of haematological and reproductive parameters.

Housing and equipment

The animals were housed in wooden double tier cages, covered with wire mesh and measuring 65cm X 65cm X65cm and raised 25cm from ground level. The cages and the rabbitry unit were thoroughly washed with

a strong disinfectant and allowed for seven days to dry before animals were brought in. A concrete watering trough and a fabricated feeding trough were placed in each hutch.

Reproductive performance of rabbits (does)

The does were mated fourteen weeks (14) after the commencement of the study. "Each doe was taken to the buck pen for mating and were all mated within an interval of 3 days". After which they were separated. Pregnancy was confirmed after abdominal palpation and obvious changes in body size and weight of does (Oguike *et al*., 2011). During the third week of gestation kindling boxes were placed in each of the hutches of the pregnant does. The reproductive parameters that were assessed for the does were pregnancy rate, gestation length, litter size, average birth weight, average weaning weight (at 6 weeks) and mortality, milk yield (g/day) was estimated from the equation reported by Nguyen *et al*. (2000) as 1.18 x [live weight of litter at 21days-live weight at weight].

Reproductive tract morphometry

Six rabbits per treatment were dissected and the reproductive tract obtained immediately after slaughter, trimmed of fat and adhering tissues and subjected to morphometric analysis as described by Bitto and Egbunike, (2006). All weights were determined using an electronic precision scale (Kerro model) while linear measurement were obtained with measuring tape and a glass rule, respectively.

Statistical analysis

All data collected on the reproductive performance and reproductive tract morphometry of rabbit does were subjected to one-way analysis of variance (ANOVA) using SAS version 9.2 (SAS, 2013). Where means were significantly different at 5% ($p<0.05$), they were separated using Duncan's Multiple Range Test.

Results and discussion

The conception rate in this study ranged between 75 to 100 %.There was a significant ($P<0.05$) difference between the dietary treatments. Partidge *et al.*(1981) recorded a lower conception rate of 60 to 90 % for normal rabbit does. The result of this present study is contrary to the non-significant ($P>0.05$) effect reported by Hasanat *et al.*(2006) for rabbits fed concentrate supplemented diets. Gestation length was not significantly ($P>0.05$) affected by dietary treatments, all does kindled within the period of the experiment. The values reported in this present study ranged between 29.90 -31.50 days. The result of this study corroborates that of these authors). (Aduku and Olukosi, 1990; (Rizzi *et al.,* 1997; Ehiobu *et al.,* 1997; Hosanat, 2006). The result is slightly lower than 28.32 day reported by Aduku and Olukosi (1990). The high varied conception rate and gestation length for all treatments groups may be attributed to nutrition and environment as opined by Yamani *et al.* (1991). The average litter size at birth and at *weanin*g showed no significant ($P>0.05$) effect for dietary treatments. The results is related to the reports of Aduku and Olukosi (1990) and Hasanat (2006) who reported the values for average "litter size at birth and at weaning" to be 3 and 18, respectively. The average birth weight showed a non significant ($P>0.05$) effect for the dietary treatments, while the average weaning weight was significantly ($P<0.05$) influenced by dietary treatments. This observation affirms the report of Ayyat *et al.*(1996) and Rizzi *et al.*(2008) who fed rabbits with different levels of concentrate supplement and basal diets respectively, but differ from the findings of Rizzi *et al.*(2008) who fed rabbits under different nutritive levels. The litter size and weight at birth and at weaning indicate the effect of maternal ability (Rommers *et al.* 2001). Foetal and birth weight has a remarkable influence on

litter size and number of fetuses found in the uterine horn (Eshiet *et al.,* 1980) Larger litter sizes are linked to smaller birth weight and higher mortality. Milk yield was significantly (P<0.05) affected by dietary treatments astreatment 1 (conrol) had the highest level of milk yield. The values were 343.38, 207.00, 211.00, 207.00 and 266.20g for treatment 1, 2, 3, 4 and 5, respectively. The residual cyanide may have inhibited the amount of milk released. Several authors (Ayyatt *et al*., 1996; Rommers, 2001; Mousa and Malable, 2004) have affirmed that milk yield can be affected by maternal, non-genetical and genetical factors. The values for this study were lower than the value of 408g, reported by Youno *et al.* (1986).

Table 3: Reproductive Performance of rabbit fed cassava diets

Parameters	T_1	T_2	T_3	T_4	T_5	SEM
Number of does bred	7.00	8.00	7.00	6.00	7.00	0.23
Pregnant does (day 14)	7.00	6.00	6.00	6.00	7.00	0.25
Pregnancy rate (%)	100.00	75.00	90.00	100.00	100.00	0.53
Avg. Gestation length (days)	31.00	30.00	31.50	30.00	29.90	0.02
Avg. litter size at birth	3.00	3.00	3.33	3.00	3.00	0.03
Avg. birth wt(g)	29.50	29.00	29.00	29.00	28.85	0.06
Avg. Weight of kitten (g) at 21 days	316.00^a	200.00^c	205.00^c	200.00^c	250.00^b	1.03
Litter size at weaning (6 weeks)	18.00	17.00	18.00	16.00	17.00	0.07
Avg. weaning wt(g)	590.00	500.00	523.25	550.00	530.54	3.05
Milk yield(g)	343.38^a	207.00^c	211.00^c	207.00^c	266.20^b	0.53
Mortality (%)	14.90%	5.55%	10.00%	11.11%	14.28%	0.03

Avg: Average

No: Number

Reproductive tract morphometry of rabbit (does)

The morphometric characteristics of the female rabbit genitalia were evaluated. Weight of the whole reproductive tract, vagina, cervix, uterus, uterine horn (paired), were not "significantly (P>0.05) affected by dietary treatments except" for the paired oviduct and paired uterus, which showed significant (P< 0.05) differences between dietary treatments. The difference showed by both parameters, may not have been due to the dietary treatments, since there was a fluctuating trend across the dietary treatments with treatment 1 (control) weighing the least in the two parameters. The results showed that at 100% replacement of maize with cassava peel meal normal reproductive process can be supported. The result of this study corroborates earlier reports by Bitto *et al.* (2006), and Ozung *et al*. (2011) who used paw-paw peel meal and cassava peel meal to assess the reproductive potentials of the female rabbits respectively. For the linear measurements, the length of the vagina, uterine horn and oviduct showed significant (P < 0.05) differences among dietary treatments. The results of this study is in line with the reports of Fqamunya *et al*. (1981) and Ozung *et al*. (2011) who fed female rabbits with 75% cassava peel meal based diets and corn based meal respectively. Rabbits fed Cassava or corn based diets had comparative reproductive, growth and carcass traits (Famunyan *et al*., 1981). The length of the whole reproductive tract and the cervix were not significantly (P > 0.05) affected by the dietary treatments. The values obtained in this study were higher than the reproductive tract length range of 16.65 and 19.73 cm reported by Ojebiyi *et al*. (2013). According to Lebas *et al.* (1997) longer reproductive tract length shows an

accurate sexual formation and this will assist every reproductive procedure. Small vagina width obstruct penile process and also contribute to painful and hard parturition. Wider vagina width assist mating prevents injury of the reproductive pathway especially when dystocia and foetal suffocation occur during parturition (Bearden and Fuguay, 1980).

Long vagina length assists intromission and successful parturition (Frandson, 1981). Wider cervix is useful in artificial insemination as its facilitate the success of the procedure. Smaller uterine length and width can lead to reproductive failure (Senger, 1999). While a wider and longer uterus allow room for the formation and development of the foetus in the uterus which eventually lead to a smooth conception and delivery (Osinowo, 2006).

Table 4: Reproductive tract morphometry of female rabbits fed cassava peel meal based diet

PARAMETER	T1	T2	T3	T4	T5	S.E.M
Av. Live weight of doe(g)	2026.66^{a}	1880.00^{b}	2020.00^{a}	1950.00^{ab}	1941.66^{ab}	17.48
Weight of reproductive tract (g)	9.82	9.85	8.75	9.57	10.24	0.22
Weight of vagina (g)	0.81	1.08	0.68	0.87	1.06	0.05
Weight of cervix (g)	0.78	0.76	0.83	0.92	0.74	0.04
Weight of uterus (g)	1.24	1.15	1.22	1.22	1.21	0.04
Weight of uterine horns(g)	2.18	2.42	2.05	2.37	2.04	0.05
Weight of paired oviduct(g)	1.94^{b}	3.02^{ab}	3.72^{a}	4.08^{a}	2.13^{b}	0.24
Weight of paired ovaries(g)	0.29^{b}	0.47^{a}	0.58^{a}	0.62^{a}	0.52^{a}	0.03

Conclusion and application

The study showed that the replacement of maize with 100% cassava peel, did not adversely affect the reproductive performance and the reproductive tract morphometry of rabbits doe.

References

A.O.A.C. 1990. Official methods of analysis (15th edition), Washington, DC, Volume 1: 69-90.

Aduku, A. O. and Olukosi, J. O. 1990. Rabbit Management in the Tropics: Production, Processing Utilization, Marketing, Economics, Practices Training, Research and Future Prospects. Living Book Senes Abuja, 24.

Ayyat, M. S., Marai l. F. M and El-Aasar, T. A.1996 New Zealand white rabbit does and their growing offsprings as affected by diets containing different protein level with or without lacto-sacco supplementation. *World Rabbit Science* 4: 225-230.

Bitto, I. I. and Egbunike, G. N. 2006. Seasonal variations in the morphometric characteristics of the pubertal West African dwarf buck in its native tropical environment. Int. J. Morphol., 24: 637-642.

Bitto, I. I. and Egbunike, G. N. 2006. Seasonal variations in the morphometric characteristics of the pubertal West African dwarf buck in its native tropical environment. Int. J. Morphol., 24: 637-642.

Durunna, C. S., Udedibe, A. B. I. and Etuk, E. B. 2006. Performance and organ characteristics of broiler chickens fed graded levels of Anthonata Macrophylla seed meal as replacement of Arachis hypogeal

meal. Nigeria Journal of Agriculture food and Environment, 3(1 and 2): 1-4.

Ehiobu, N. G., Utim, A.and Gwaza, S. D. 1997. Some observations on reproductive performance of rabbits obtained in semi humid tropical conditions in Nigeria. World Rabbit Science 5: 47-49.

Eshiet, N. O., Ademosun, A. A., Omole, T. A. 1980. The effect of feeding Cassava root meal on the reproductive performance of rabbit. J. Nutr. 110:697-702.

Ewuola, E. O. and Egbunike 2010. Effect of dietary fumonisin B1 on the onset of puberty, semen quality, fertility rates and testicular morphology in male rabbits. Society for reproduction and fertility.

Fomunyan, R.T., Adegbola, A.A. and O.L. Oke. 1981. The role of palm oil in cassava-based rations. Pages 152-153 in Tropical Root Crops: Research Strategies for the 1980s. Edited by E.R Terry, K.A. Oduro, and F. Caveness. IDRC-163e: Ottawa, Canada.

Fomunyan, R.T., Adegbola, A.A.and O.L. Oke. 1981. The role of palm oil in cassava-based rations. Pages 152-153 in Tropical Root Crops: Research Strategies for the 1980s. Edited by E.R Terry, K.A. Oduro, and F. Caveness. IDRC-163e: Ottawa, Canada.

Frandson R.D 1981. Anatomy and Physiology of Farm Animal 1st edition LEA and Febiger, Philadelphia

Hasanat, M. S., Hossain, M. E., Mostari, M. P. & Hossain, M. A. 2006. *Bangladesh JournalVet*. 4(2): 129 - 132

Hoedemaker, M., Prang D., Gundelach, Y. 2009.Body condition change ante and postpartum, health and reproductive performance in German Holstein Cows Reprod. *Demest. Anim* 44, 167-173.

Kateria, R. 2014. Proximate nutritional evaluation of maize and rice gliton-free cereals. Jounal of Nursing and Health Sciences 3(2), 1-6.

Lebas, F, Coudert, P, De-Rochambeau, H. and Thebault R .G 1997. The Rabbit. Husbandry, health and production. FAO Animal Production and Health Series Rome, Italy

Mousa-Balabel, T. M. 2004. Effect of heat stress on New Zealand white rabbits behaviour and performance. Minufiya *Vet*. *Journal Volume* 3(1). Pp 125-134

Nguyen, Q. S., Ly, T.L and Dinh, B. 2000. Feeding system for tropical rabbit production emphasing root and banana in workshop making better use of local feed resources SAREE UAF. January, 2000, Vietnam.

Oguike, M.A., Igwe, C. O., Odika, I. E.and Onyekweodiri, E. O. 2011, Effect of *Aspilia africana* leaves on the reproductive potentials of rabbits buck. Proceedings of the British Society for Animal Sciences. Cambridge University Press. 2(1): 176.

Ojebiyi, O. O., Farinu, G. O., Babatunde G. M., Togun, V. A., Oseni, S.O., Shittu, M. D. & Amao, O. A 2013. Reproductive potentials of rabbits does fed dets containing processed cassava peel/ blood meal mixtures. *International Journal of livestock production 4* (4):42- 48.

Ojebiyi, O.O., Farinu, G. O., Babatunde G.M., Togun, V.A., Oseni, S.O., Shittu, M.D & Amao, O. A 2013. Reproductive potentials of rabbits does fed dets containing processed cassava peel/ blood meal mixtures.

International Journal of livestock production 4 (4):42- 48.

Olorutola, O. D., Agbede, J. O., Ohibi, G. E. and Igbasan, F. A. 2016. Replacement value of rumen liquor fermented cassava peels for maize in growing rabbit diets. *Archivos dezooteenia* 65(249), 89-97.

Osinowo O. A 2006. Introduction to Animal Production, 1st Edition Sophie Academic Services. Abeokuta, Nigeria. pp. 21-30.

Ozung, P. O., Nsa, E. E., Ebegbulem, V. N. and Ubua, J.A.2011. The Potentials Of Small Ruminant Production In Cross River Rain Forest Zone Of Nigeria:A review Continental *J. Animal and Veterinary Research* 3 (1): 33—37.

Partidge, G. A., Foley, S. and Corrgall, W. 1981. Reproductive performance in pure breed and cross bred commercial rabbits. *Animal Production*, 32:325-333.

Puls, R. 1994. Mineral levels in animal health diagnostic data. Sherpa International, Canada.

Randa, R. O. 1990. Nutrition and postopatum rebreeding in cattle. *J. Anim. Sci*. 68, 853-862

Rizzi, C., Chiericato, G. M. andDalle Zotte, A. 2008. Reproductive and Physiological responses of rabbit does under different nutritive levels before the first parturition.

Robinson, J. J. 1990. Nutrition in the Reproduction of Farm Animals. Nutitio Reviews, 3:253 — 276.

Rommers J. M., Meijerhof R., Noordhuizen J.P.T.M., andKemp B., 2001. Effect of different feeding levels during rearing and age at first insemination on body development, body compositon, and pubrty characteristic of rabbit does. *World,rabbit sci*. 9, 101- 108.

Rommers, J. M., Meijerhof, R., Noordhuizen J.P.T.M. and Kemp B., 2002. Relationship between body weight at first mating and subsequent body development, fed intake and reproductive performance of rabbit does Journal of Animal Science 80, 2036-2042.

Salami, R. I. 2000. Preliminary studies on the use of parboiled cassava peel meal as a substitute for maize in layer diets trop. Agri., (Trinidad) 77:199-204.

SAS 2013. Statistical Analysis System Institute. Statistical analysis users guide. Version 9.2 Cary; NC.

Senger, P.L. 1999. Pathways to Pregnancy and Parturition.1st Revised ed. Current Conceptions Inc.Pullman Washington,USA, pp. 168-186

Watches D. C., Fenwick, M., Cheng, Z., Bourne, N., Llewellyn S., Morris D. C., Kenny, D., Murphy, J. and Fitzpatrick, R. 2007. Influence of negative energy balance on cyclicity and fertility in the hugh producing dairy cow. *Theriogenology* 68:5232-5241.

Yamani, K. A., Daader, A. T. and Askar, A.,1991. Effect of remating I terval on the performance of rabbits.

Youno, C., Raharj, C., Cheeke, P.R. and Patton N.M.,1986. Growth and reproductive performance of rabbits on a moderately low crude protein diet with or without methionine or urea supplementation. *Journal of Animal Science* 63: 795-80.

Received: 11th November, 2021
Accepted: 17th February, 2022