Nigerian Journal of Animal Science and Technology
Nig. J. Anim. Sci. Tech. Vol. 4 (1):33 - 42
Available @ www.njast.com.ng

Effect of Brewers' Dried Grain on Growth, Milk Yield and Composition of Yankasa Sheep in Guinea Savannah

Dikko, A. H*., T. Z. Adama*, P. P. Barje, D.N. Tsado*and M. J. Ibrahim***
*Department of Animal Production, Federal University of Technology, Minna, P.M.B. 65, Niger State, Nigeria
** National Animal Production Research Institute (NAPRI), Shika Zaria.

Abstract
The aim of this experiment was to determine the effect of feeding varying levels of brewers dried grain on feed intake, body weight gain, milk yield and composition of Yankasa ewes. Five treatment diets designated T1, T2, T3, T4 and T5 were formulated with maize substituted with BDG at 0 %, 10 %, 20 %, 30 % and 40 % respectively. The experimental animals were randomly allotted to five treatments groups with four replicates each comprising of one ewe per replicate in a complete randomized design and fed the formulated diet. The animals were sourced from Biotechnology department of National Animal Production Research Institute (NAPRI), Shika Zaria. The dates of birth and weight at birth were taken. The ewes were used for the experiment at twelve week. The animals were intensively managed given the experimental diets in the morning and supplemented with forage (Digitaria smutti) afterward. The oestrus of ewes was synchronized using a synthetic prostaglandin named Estrumate® administer through intramuscular injection to have a uniform gestation and parturition. The parameters measured were feed intake, body weight gain, milk yield, milk composition. One way ANOVA using SAS (2000) statistical package was used for analysis. A non-significant ($P>0.05$) difference was observed among the treatment groups in respect of feed intake, weight gain. However D5 had a better result (4.75 Kg, 22.08) in respect to weight gain and feed conversion ratio respectively. Milk composition showed a significant ($P<0.05$) difference IN T5, T4 and T3 (7.39%, 7.25 % and 6.63 % respectively. Milk yield showed a significant ($P<0.05$) difference at week two among the dietary treatment with treatment two (D2) having the best result ((0.11 Kg). It was concluded and recommended that maize can replace BDG up to 40 %.

Keywords: Effect, Brewers Dried Grain, Yankasa Sheep, Milk composition,

Introduction
The primary purpose of sheep production is to supply wool, meat and milk. The need to increase the supply of milk and mutton is worrisome as seen in the most cities in Nigeria. The high demand for milk and mutton could be as a result of its potential over other milk and meat.

Nutritional needs of sheep and cost of feeding are major challenges facing farmers in Nigeria throughout the year. This is as a result of seasonality of forage. To develop and increase Sheep production in Nigeria would require increased use of locally available feedstuff, thus reducing the cost of production. Limited supply of forages coupled with their poor nutrient status notwithstanding, by products emanating from agro- allied industries such as corn cobs, cassava peel, BDG and plantain peel form the major sources of ruminant feedstuff (Baah, 1994).

Due to chemical composition of BDG, it is regarded as an important source of alternative feed ingredient for livestock (Uchegbu *et al*., 2011). Brewers dried grain is a good protein and energy source (Isikwenu, 2011; Mufwa *et al*., 2011; Uchegbu *et al*., 2011: Banjo *et al*, 2012) and a lot of work has been reported on its incorporation in the diet of monogastric animals but little work has been done on its

uses in ruminant diets, and the ones available are not recent (Umunna *et al.,* 1980; Ogundola, 1984).

Animal protein consumption is among the most important components of human diet and varies from country to country (Okai *et al*., 2005). Reports of studies indicated that there is a general scarcity of protein supply especially in countries within the tropics (Okai *et al*., 2005). Increasing population and dismal productivity of livestock has led to low intake of protein of animal origin in developing countries like Nigeria. This has led to demand of this animal protein to exceed its supply. To solve this problem of lack of adequate intake of animal products and to increase the output by majority of Nigerians, the need to increase animals and animal products production by putting a lot of effort in the production of highly reproductive animals becomes very paramount (Ani and Adiegwu, 2005). The feeding cost constitutes about 65-75 % total production expenses under intensive animal production system. This scenario is attributed to the struggle for foodstuff between livestock and man for conventional feed and foodstuff. This situation is so serious in third world countries such as Nigeria thereby necessitating the sourcing for cheaply available unconventional feedstuff that can meet the growth and reproductive requirements of the animals. This article therefore is aimed at determining the effect of graded levels of brewers' dried grain on the Growth, Milk yield and composition of Yankasa Sheep

Materials and Methods

Experimental Location

The experiment was conducted at the Biotechnology department farm of the National Animal Production Research Institute (NAPRI), Ahmadu Bello University, Shika - Zaria. Shika lies between Latitudes 11^{o} and 12^{o} N, and between Longitude 7^{o} and 8^{o}E and is located in the sub-humid zone of the Northern Guinea Savannah at the elevation of 640 meters above sea level. Shika experience an average annual rainfall of 1100mm from May to October. The peak of rainfall is witnessed between July and September record the peak of the rainfall Shika also has an average daily temperature of about 25^{o}C with mean relative humidity of about 75 %. The wet period (rainy season) is preceded by dry season (dry period) that starts November to April, having an average daily temperatures ranging from 14 to 36^{o}C and an average relative humidity of between 20 and 37 % (IAR, Meteorological report, 2009).

Design and Management of the Experimental animals

The experimental design used for the study was complete randomized design (CRD). Twenty Yankasa ewes aged between 5 and 6 months raised at the Biotechnology department farm of the National Animal Production Research Institute (NAPRI), Ahmadu Bello University, Zaria, Shika station were used. The experimental animals were treated with ivomec to control the internal parasites and vaccinated against Pestes des Petite Ruminate (PPR), before allotting them to dietary treatments. The weights of experimental animals were taken on the farm and allowed a 14-day adjustment period and subsequently on a weekly basis. The experimental animals were fed at 1.5 % body weight. The experimental animals were allotted to five dietary treatments, T1 (control 0 % Brewers' Dried grains BDG), T2 (10 % BDG), T3 (20 % BDG), T4 (30 % BDG) and T5 (40 %) with each treatment having four animals and each animal constituting a replicate. The animals were managed intensively. Water and forage were given *ad libitum*. This experiment lasted for 90 days.

Feed Composition

Five different experimental feeds were compounded for the five treatments which

were designated as T1, T2, T3, T4 and T5. Diet1 served as control containing 0 % BDG replacing maize, while T2, T3, T4 and T5 had 10 %, 20 %, 30 % and 40 % respectively of BDG replacing maize. The composition of the experimental diets is presented in Table 1.

Breeding procedure and oestrus synchronization

Oestrus synchronization was done on all the twenty experimental animals during the feeding trial. This was aimed at having a uniform gestation and parturition period using Estrumate®; a synthetic Prostaglandin $F_{2\alpha}$ analogue (Coopers Animal Health Ltd, Berkhamsted, England) containing 263µg of Cloprostenol Sodium (Vet), equivalent to 250 µg Cloprostenol, and 0.1 % w/v Chlorocresol (BP). Intramuscular injection of 2 ml of the $PGF_{2\alpha}$ was administered to each animal. Following intramuscular injection of experimental animals with $PGF_{2\alpha}$, they were observed for oestrus continuously for 7 days (Voh Jr. 2004). All the animals that came into oestrus during the first $PGF_{2\alpha}$ treatment were mated using rams of proven performance at the rate of one ram to 10 ewes (1:10) The experimental animals were twice daily (at 0700 and 1800 hours), observed for oestrus visually by trained inseminators. Pregnancy was determined through the use of Ultra sound Technology.

Collection of Data

Feed intake

Data on intake of feed was taken on daily basis. Feed that was offered to the experimental animals were weighed and unconsumed feed was collected and weighed in the morning of the preceding day. Feed intake was obtained by subtracting the leftover from the amount of feed offered in each treatment.

Body weight gain

Body weight was taken at the beginning of the experiment using CAMRY Scale of 150 Kg capacity made in China Model NS-(100kg-150kg). Body weight gain for each week was determined by differences between the body weight of the present week and the preceding week.

Milk Samples Collection

After lambing, the lambs were allowed to stay with their dams for 4 days to obtain colostrum, after which the lambs were separated/weaned and taken to shed for indoor rearing. Milking was done once daily using partial milking method. This was done by separating the lambs from their dams in the night and their weight taken in the morning before they are taken to their dams between the hours of 7-8 am. At noon their weight is again taken. The difference between the weight taken before they are taken to their dams and weight after they stay with their dams represent yield of milk. .

Milk composition Determination

100 ml milk samples were taken weekly from each animal by hand milking and preserved with potassium chromate tablets and were used for the determination of milk protein - using the AOAC (2006) procedures.

Milk Fat content was determined using the Gerber Milk test procedure, while Total solid was calculated using the formular

TS = Lc/4 + (1.22 x % Fat) + 0.72,

Where Lc = lactometer reading. Solid non-Fat was determined by subtracting % fat from Total solids.

Ash content was determined by oven drying the samples at $550^{o}C$ for 2 days.

Data analysis

Data collected were subjected to analysis of variance (ANOVA) using SAS. The separation of means and others are contained in the package.

Table 1: Composition of Experimental Diets

	Dietary Supplements				
Ingredients (%)	T1	T2	T3	T4	T5
Maize	37.87	34.08	30.30	26.51	22.72
BDG	0	3.79	7.57	11.36	15.15
Maize Offal	18.94	18.94	18.94	18.94	18.94
CSC	39.19	39.19	39.19	39.19	39.19
Bone Meal	2.50	2.50	2.50	2.50	2.50
Salt	1.50	1.50	1.50	1.50	1.50
TOTAL	**100**	**100**	**100**	**100**	**100**
Calculated Nutrients (%)					
CP	13.71	23.20	33.29	14.96	15.64
CF	10.07	14.40	18.72	10.99	11.43
ASH	3.11	4.32	6.04	2.90	3.04
EE	3.80	6.54	9.04	2.90	3.04
NFE	69.31	51.62	62.91	67.02	65.64
Calcium	18.28	17.59	16.91	16.03	15.28
Phosphorus	4.16	4.21	4.26	4.14	4.14
Methionine	0.21	0.35	0.50	0.24	0.25
Lysine	0.51	0.85	1.71	0.59	0.62
Energy (kcal/kg/ME)	3516	3624	3619	3757	3355

BDG –Brewers Dried Grains, CSC – Cotton Seed Cake T1 = 0 % BDG, T2 = 10 %, BDG T3 = 20 % BDG T4 = 30 % BDG, T5 = 40 % BDG CP = Crude Protein, CF = Crude Fibre, EE = Ether Extract, NFE = Nitrogen Free Extract

Results

Growth Performance of Yankasa ewes fed varying levels of Brewers Dried Grains diet

Growth performance of Yankasa ewes fed varying levels of BDG diet is presented in Table 2. No significance (P>0.05) difference among the treatments with regard to feed intake, total feed intake and final body weight gain was observed. However a trend was observed, animals fed diet having 10 % BDG (T2) had the highest (28.70) value for final body weight, and animals fed diet having 30 % BDG (T4) had the lowest value (25.00 %). Body weight gain was highest (4.75 Kg) in treatment five where the animals were fed 40 % BDG. Animals fed diet containing 40 % BDG (T5) had the highest value (0.86 Kg) and T4 which contains 30 % BDG had the lowest value (0.75 Kg) for daily feed intake. As for total feed intake, T5 containing 40 % BDG has the highest value (78.49 %) while T4 which contain 30 % BDG had the lowest Value (68.25 %).

Weekly milk Yield samples from Yankasa ewes fed varying levels of Brewers Dried Grain diet.

Table 3 shows the weekly milk yield from Yankasa ewes fed varying levels of BDG from Nigerian brewery Kaduna. There was no significant differences (P>0.05) within the diet groups except in week two where there was significant differences among the diet groups. D2 which contain 10 % BDG had the highest value (0.11 Kg) diet T5 which contain 40 % BDG had the lowest value (0.03 Kg). Total milk yield was highest (0.40 Kg) in animals fed 10 % BDG (T2) and lowest (0.29 Kg) in T5 which contains 40 % BDG.

Composition of milk of Yankasa ewes fed varying level of Brewers Dried Grain

Table 4 shows the composition of milk from Yankasa ewes fed varying levels of brewers dried grains. Milk Protein values of T3, T4 and T5 showed significant difference between T1 and T2. Milk protein is observed to have increased as the level of BDG increases. Total solids decreases from 20 % inclusion level as inclusion level increases. However, T1 and T3 differ significantly from T4 and T5 in total solids Milk fat, moisture and energy values showed no significant difference among the diet groups. Non- fat- solids values of T3 and T1 (control) are significantly different from those of T4 and T5 but are statistically similar to T2. Moisture is significantly higher in T3, T5 and T2 but is statistically similar with other diet groups. Ash values in T2 are significantly lower than other diet groups. Calcium and phosphorus values of animals fed T5 are significantly higher than those fed T1. It is also observed that Calcium and Phosphorus increases in the milk as the inclusion levels of BDG increases in the diet. Sodium values are significantly higher in T2, T3, T4 and T5 over T1 (control). Sodium is seen to have increased in the milk up to 30 % BDG inclusion in the diet. Potassium values of milk from animal fed T4, T3, T1 (control) and T2 were significantly higher than those of T5.

Table 2: Growth performance of Yankasa ewe fed graded levels of Brewers Dried Grain from Nigerian Brewery

Parameters (Kg)	T1	T2	T3	T4	T5	SEM	LS
Initial body weight	24.63	26.75	23.88	23.75	21.25	0.788	NS
Final body Weight	27.50	28.70	26.25	25.00	26.00	0.862	NS
Weight Gain,	2.87	1.95	2.37	1.25	4.75	0.862	NS
Daily Feed Intake	0.83	0.78	0.79	0.75	0.86	0.261	NS
Total Feed Intake	75.08	70.98	71.66	68.25	78.49	2.353	NS

[abc] Means in the same row with the same superscript are significantly not different (P>0.05)SEM = Standard error of mean, NS = Not Significant LS = Level of Significance FCR = Feed Conversion Ratio, T1 = Diet 1 – 0 % BDG T2 = Diet 2 - 10 % BDG T3 = Diet 3 - 20 % BDG T4 = Diet 4 - 30 % BDG T5 = Diet 5 - 40 % BDG

Table 3: Weekly Milk yield of Yankasa ewe fed graded levels of Brewers Dried Grain from Nigerian Brewery

Parameters (Kg)	T1	T2	T3	T4	T5	SEM	LS
Wk 1	0.07	0.08	0.08	0.05	0.04	0.014	NS
Wk 2	0.04[b]	0.11[a]	0.03[b]	0.08[ab]	0.03[b]	0.010	*
Wk 3	0.03	0.04	0.03	0.03	0.03	0.003	NS
Wk 4	0.02	0.01	0.02	0.03	0.03	0.003	NS
Wk 5	0.02	0.02	0.02	0.02	0.03	0.001	NS
Wk 6	0.02	0.02	0.02	0.03	0.02	0.002	NS
Wk 7	0.02	0.02	0.02	0.02	0.02	0.001	NS
Wk 8	0.01	0.02	0.02	0.01	0.02	0.001	NS
Wk 9	0.02	0.01	0.01	0.02	0.01	0.001	NS
Wk 10	0.01	0.01	0.01	0.02	0.01	0.001	NS
Wk 11	0.02	0.02	0.02	0.01	0.02	0.001	NS
Wk 12	0.02	0.02	0.01	0.02	0.12	0.001	NS
Wk 13	0.01	0.01	0.02	0.01	0.02	0.001	NS
WK 14	0.02	0.03	0.02	0.01	0.01	0.001	NS
TMYield	0.31	0.40	0.30	0.30	0.29	0.020	NS

[abc] Means in the same row with different superscript are significantly different (P>0.05)
SEM = Standard error of mean NS = Not Significant LS = Level of Significance

TMYield = Total Milk Yield

T1 = Diet 1 – 0 % BDG T2 = Diet 2 - 10 % BDG T3 = Diet 3 - 20 % BDG

T4 = Diet 4 - 30 % BDG T5 = Diet 5 - 40 % BDG

Table 4: Composition of milk of Yankasa ewes fed varying level of Brewers Dried Grain obtained from Nigerian Brewery

Parameter (%)	TI	T2	T3	T4	T5	SEM	LS
Protein	5.31^{b}	5.84^{b}	6.63^{a}	7.25^{a}	7.39^{a}	0.254	*
Total Solids	17.56^{ab}	18.20^{ab}	19.73^{a}	16.49^{b}	16.24^{b}	0.453	*
Fats	5.87	6.19	6.28	6.63	7.06	0.267	NS
Solid-not-fat	12.41^{a}	11.14^{ab}	13.52^{a}	10.97^{b}	11.14^{b}	0.323	*
Moisture	67.53	83.23	83.38	81.54	83.28	3.110	NS
Ash	2.93^{a}	2.92^{a}	2.92^{a}	2.83^{a}	2.37^{b}	0.056	*
Energy (Kcal/Kg)	4199.15	4263.09	4164.06	4182.50	4166.57	15.232	NS
Calcium (ppm)	6095.50^{b}	6248.80^{ab}	6264.10^{ab}	6517.10^{ab}	6669.10a	77.652	*
Phosphorus (ppm)	2570.00^{c}	2583.80^{c}	3250.40^{b}	3603.40^{ab}	4002.70^{a}	5.273	*
Sodium (ppm)	75.74^{c}	130.92^{ab}	145.31^{a}	153.31^{a}	119.08^{b}	7.177	*
Potassium (ppm)	246.23^{a}	244.41^{a}	249.63^{a}	254.72^{a}	198.44^{b}	4.956	*

^{abc} Means in the same row with different superscript are significantly different (P<0.05)
SEM = Standard error of mean * = Significant level (P<0.05), NS = Not Significant
LS = Level of Significance
T1 = Diet 1 – 0 % BDG T2 = Diet 2 - 10 % BDG T3 = Diet 3 - 20 % BDG
T4 = Diet 4 - 30 % BDG T5 = Diet 5 - 40 % BDG

Discussion

The non-significant difference observed in body weight gain and final body weight gain is in line with the findings of Adebowale and Ademosun (1981) who reported that 30 % BDG inclusion in sheep and goats diets did not improve growth rate and feed efficiency. This may be as a result of imbalanced amino acid profile in BDG and its bulky nature which affects digestibility and availability of amino acids and other nutrients. Better nutrient (protein-energy) harmony in T5 might be responsible for the better weight gain and feed conversion ratio as this would have enhanced nutrient utilization in the animals. This agrees with the report of Njidda (2008) that for optimum growth performance in ruminants an efficient utilization of nutrients supplying adequate energy and protein is required.

The milk protein result (Table 4), shows that as the inclusion levels increases, the milk protein, fat, calcium and phosphorus also increase. This means that there is a correlation between milk protein increase and milk fat, calcium and phosphorus increase. This is supported by the work of Cunningham *et al*. (1996) who reported that milk protein is positively correlated with milk fat. The authors believe that that the behavior of the milk protein is influence by milk fat content.

Also the result agrees with the work of Duncan (1998) who reported that calcium and phosphorus in milk are known to be bounded to casein which is a major component of milk protein. The protein content of the milk increased with an increase in milk fat and decreases as milk fat content declined.

This might probably explain the pattern of behavior of calcium and phosphorus content in milk. The general composition of mineral composition in milk is connected to mineral content of the test ingredient (BDG) used. Pyne (1990) reported that nutrition has a major effect on milk composition. Haenlein (1995) reported that energy shortage or delay can lead to low milk yield with high fat content.

Anti-nutritional factors content of the test ingredient could also be responsible for milk constituents' pattern. The beneficial effect of these anti nutritional factors such as anti-bloat and anti-helminthic effect of Tannins (Khan and Diaz-Hermandez, 2000), lowering of cholesterols (Duranti, 2006) and lowered solubility of calcium and phosphorus (Erbas *et al*., 2005) might be responsible for high nutrient utilization resulting in high milk components such as milk. Binding of nutrients to indigestible complexes that are unavailable for further absorption and utilization is associated to phytates/phytic acid as reported by Singh and Krikorian (1982) and Jamroz and Kubizna (2007) might have played roles leading to a decline milk yield in Treatments D2 to D5. Also in the findings of Caja and Bocquier (2005) that a negative shortage exists between milk fat and milk yield.

Conclusion

Based on the results obtained from this study, it can be concluded that:

1. there is no significant difference in weight gain, total feed intake, body weight at birth and body weight at puberty between D1 (control) and other treatment diets.
2. Milk protein, calcium, phosphorus were higher in milk obtained from animals fed D5 than animals in D1 (control).
3. as the inclusion levels of BDG increased, the values of milk protein, calcium and phosphorus increased.

References

Adebowale, E.A. & A.A. Ademosun, (1981). The carcass characteristics and chemical composition of the organs and muscles of sheep and goats fed brewers' dried grains-based rations. Tropical Animal Production, 6, 133-137.

AOAC (Association of Official Analytical Chemicals) (2006). Official Method of Analysis of the AOAC (W. Horwitz Editor Eighteen Edition, Washington; D. C., USA.

Ani, A.O. and Adiegwu, L.I. (2005). The feeding value of velvet beans (Mucuna pruriens) to weaner rabbits. Proceedings of 30th Annual Conference of Nigeria Society for Animal Production (NSAP).20th- 24th March, 2005. University of Nigeria, Nsuka, Nigeria. Pp. 186-189.

Baah J. (1994). Selection and evaluation of feedstuffs for urban and peri-urban small Ruminant production systems in Ghana.A system approach. Dissertation. University of British Columbia, Vancouver, BC, Canada.

Banjo, O. S., Mako, A. A., and Ettu, R.O. (2012). The replacement of maize with graded level of Brewer's Dried Grain (BDG) in the diet of weaner grass cutters. *Journal of Natural Sciences Research*. 2(8), 186-190.

Caja, G. and Bocquier, F. (2005). "Effect of Nutrition on the composition of Sheep milk" Journal *of Dairy Science*. 88: 2134-2139.

Cunningham, K.D., Cerava, M.J., Johnson, T.R. & Ludden, P.A., (1996). Influence of Source and amount of dietary protein on milk yield by cows in early lactation. Department of Animal Sciences, Purdue University, West Lafayette, IN47907

Duncan, J.S. (1998). Secretion of milk protein. *Journal of mammary Gland Biology and Neoplasia*, 3, 275-286

Duranti, M. (2006). Grain Legumes for Neutraceutical Properties. Net Display Paper.

Erbas, M. Certel, M. &Uslu, C. (2005). Physio-chemical Properties of white Lupin. Food Chemistry. *www.sciencedirect.com.*

Haenlein, G. W. F. (1995). Milk and Milk products: Nutritional value of dietary products of ewe And Sheep milk. Department of animal Science and Agricultural Biochemistry, University of Delaware. Bulletin III: 124pp

IAR. (2009). Meteorological Statistics-Institute for Agricultural Research, A.B.U, Samaru,
Zaria.

Isikwenu, J.O. (2011). Performance and economic analysis of cockerel chicks fed enzyme supplemented brewer's dried grains groundnut cake-based diets. *Agriculture and Biology Journal of North America*, 2(1), 47-51

Jamroz, D. & Kubizna, J. (2007). Some Beneficial effects of Legume anti – nutritive substances. Net Paper Display. Retrieved on May 10, 2018 from *www.agrotec-spa.net.*

Khan, L. P. & Diaz-Hermandez, A. (2000). "Tannins with anti-helminthic properties". In: Brooker, J. D. (ed) Tannins in livestock and human nutrition. ACIAR proceedings No 130: 139

Mufwa, B.J., Kibon A., Mafindi M. & Yakubu B. (2011). Effect of graded levels of brewers' dried grain on the performance of growing rabbits. Growth performance and economy of production. *Journal of Sciences and Multidisciplinary research* 3:47-54

Njidda, A.A. (2008). The effect of protein and energy supplementation on the growth performance of grazing sheep during the wet season. *Nigeria Journal of Experimental Applied Biology* 9:17-22.

Ogundola, F.I (1984). Studies on the utilization of brewers dry grains and wheat offal by calves. *East African Agricultural Forage Journal* 46(2):23.

Okai, D.B., Abora, P.K.B., Davis, T. and Martin, A. (2005). Nutrient composition, availability, current and potential uses of "Dusa": A cereal by-product obtained from "koko" (porridge) production. *Journal of Science and Technology*, 25:33-38.

Payne, W. J. A. (1990). An introduction to Animal husbandry in the Tropics. 3rd (ed.). London, New York, *Longman*. P 120.

SAS (2002). Statistical Analysis System. SAS Institute Inc., Gray N.C., USA. Pp. 967-978.

Singh, M. & Krikorian, A. D. (1982). Inhibitory activity in Vitro by Phytates. *Journal of Agriculture and Food Science*, 11:799-800

Uchegbu, M. C., Etuk, E. B., Omede, A.A., Okpala, C. P., Okoli, I. C., & Opara, M. N. (2011). Effect of replacing maize with cassava

root meal and maize/sorghum brewers‟ dried grains on the performance of starter broilers. *Tropical and Subtropical Agroecosystems* 14:363 - 367

Umunna, N.N., Yusuf, A.A., & Aganga, A.A. (1980). Evaluation of brewers' dried grains and palm kernel meal as major sources of nitrogen for growing cattle. *Tropical journal of animal production*, (5) 3:239-247

Voh Jr., A.A., Larbi, A.,Olorunju, S.A.S.,Agyemang, K., Abiola, B.D. & Williams, T.O. (2004). Fertility of N'Dama and Bunaji Cattle to artificial insemination following oestus synchronization with PRID and PGF2α in the humid Zone of Nigeria. Tropical Animal Health and Production. 36, 499-511.