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Effect of Brewers' Dried Grain on Growth Performance, Hematology and Serum Biochemistry indices of Yankasa Sheep

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Abstract

The study was conducted to reveal the effect of brewers dried grain (BDG) on growth, haematology reproduction and lactation performance of Yankasa sheep. One experiment was design to study the proximate, mineral, amino acids and the anti- nutritional composition of brewers dried grain obtained from Kaduna brewery. A second experiment was also designed to determine the effect of feeding varying levels of brewers dried grain on feed intake, body weight gain, haematology, biochemical parameters and reproductive performance. The third experiment was design to determine the milk yield and composition from Yankasa ewes. Five treatment diets was designated D_1, D_2, D_3, D_4 and D_5 formulated with maize component 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 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 animal were intensively managed given the experimental diet in the morning and supplemented with forage (*Digitaria smutti*) afterward. The parameters measured in these experiments were feed intake, body weight gain, haematology values and biochemical values. A non-significant ($P>0.05$) difference was observed among the treatment groups in respect of feed intake, weight gain and haematology. Biochemical values, showed a significant ($P<0.05$) difference. It was concluded that maize can be replaced with BDG up to 40 %. This is nutritionally an effective means of improving animal growth. it is therefore, recommended that maize can be replaced with BDG without any negative effect.

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Introduction

Animal protein consumption is among the most important components of man 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 among the countries in the tropics (Okai *et al*., 2005). Increasing population and dismal productivity of livestock has led to low protein intake of animal origin in developing countries like Nigeria. To solve this problem of lack of adequate intake of animal products and to increase the output by majority of Nigerians, the need of improving the increase of 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 by livestock and man for some common and normal feed and foodstuff (Fanimo *et al*., 2004). 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. Means of evaluating wastes from agro-industries and crop by products is very important so as to come up with unconventional feed stuff that can be used for feeding animals. (Fanimo *et al*., 2004).

In Nigeria, there abound untapped potentials for unconventional feed ingredients which can be utilized to feed sheep and other small ruminants. Among these, is an agro – industrial by- product brewers' dried grains (BDG) which is a major by-product of brewing industries. Brewers' Dried grain (BDG) is accessible year round at cheap rate and is being produced in large quantities by breweries (Duru, and Uma, 2003). At present, there is need to recycle BDG in order to reduce the pollution resulting from brewing industries. This has become a world problem that both developing and developed countries are adopting ways by which they can checkmate their processes so that brewing by products or residues can be recycled. In response to this, Breweries especially in Nigeria look at BDG as a raw material for production of other activities; animal feeding inclusive (Duru, and Uma, 2003). 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 most cities in Nigeria. The high demand for milk and mutton could be as a result of its potential over other milk and meat. Low productivity levels due to nutritional constraints characterize Sheep production in Nigeria (Tolera *et al*., 2000). This has resulted in slow growth rate, increased susceptibility to diseases

and parasites, loss of body condition, low reproductive performance and general production (Tolera *et al*., 2000).

Due to chemical composition of BDG, it is regarded as an important source of alternative feed ingredient for livestock (Uchegbu *et al*., 2011). Until now, BDG was used for feeding mainly cattle because of its high level of protein and fibre (Isikwenu, 2011). In Nigeria, research efforts have completely replaced maize with maize offal as energy source and cotton seed cake has been the major protein source. The prices of these ingredients are on the increase hence the need to evaluate other cheaper ingredients, for this reason, Brewers' dried grain comes to mind. 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 (Khalili *et al*. 2011).

The nutritional value of BDG and its availability makes it a very good ingredient that can be substituted for the costly maize bran and cotton seed meal. Brewers' dried grain cost N34/kg compared to maize bran and cotton seed meal that cost as high as N40-50/kg and N60-65/kg respectively (Isikwenu, 2011).

This work therefore is aimed at determining the effect of graded levels of brewers' dried grain on the Growth Performance, Hematology and Serum Biochemical Indices of Yankasa Sheep.

MATERIALS AND METHODS

Experimental Location

This experiment was conducted at the Small Ruminant Research Programme farm of the National Animal Production Research Institute (NAPRI), Ahmadu Bello University, Shika - Zaria. its geographical *coordinates* are 11° 12' 0″ North, 7° 34' 0″ East and is located in the sub-humid zone of the Northern Guinea Savannah of Nigeria and at elevation of 640 meters above sea level. Shika experience an average annual rainfall of 1100mm from May to October. July and September record the peak of the rainfall. Shika also has an average daily temperature of about 25°C with mean relative humidity of about 75 %. The wet period (rainy season) is preceded by dry season (dry period)that start November to April, having an average daily temperatures ranging from 14 to 36°C and an average relative humidity of between 20 and 37 % (IAR, Meteorological report, 2018).

Management of the Experimental animals

The experimental design used for the study was complete randomized design (CRD). Twenty Yankasa Sheep aged between 5 and 6 months raised at the

Small Ruminant Research Programme farm of the National Animal Production Research Institute (NAPRI), Ahmadu Bello University, Zaria. The experimental animals were treated with ivomec to control the internal parasites and vaccinated against Pestes des Petite Ruminate (PPR), haemorrhagic septicaemia before allotting them to dietary treatments. The weight of experimental animals was taken on the farm and allowed a 14 day adjustment period. The experimental animals were fed at 1.5% body weight. The experimental animals were allotted to five dietary treatments, D1 (control 0% Brewers' Dried grains BDG), D2 (10% BDG), D3 (20% BDG), D4 (30% BDG) and D5 (40 %) with each treatment having four animals with each animal as a replicate. The animals were managed intensively. Water and forage were given *ad -libitum*. This experiment lasted for 90 days. The composition of experimental diets is presented in table 1

Samples of blood were collected for analysis to determine packed cell volume (PCV), Hemoglobin(HGB), Total White Blood Cell (TWBC), Total Red Blood Cell (TRBC), Neutrophils, lymphocytes, monocytes, band, blood glucose, cholesterol, blood urea, triglycerides, total protein, albumen, Alkaline phosphatase (ALP), alanine aminotransferase (ALT), Aspartate aminotransferase (AST) and creatinine.

Collection of Data

Feed intake

Data on feed intake 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. Feed Intake = Feed offered - feed leftover

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.

Haematological and Biochemical Parameters Determination

Blood Sample collection

All the twenty experimental animals, that is, four ewes per treatment were bled through the jugular vein to collect about 5ml of blood using 10ml syringe and 16 gauge needles, into each of two sets of twenty (20) labeled sterile plastic bottles. One set of plastic bottles contained 1.0mg/ml of ethylene diamine tetra acetic acid (EDTA) (anticoagulant) was used for collecting blood for hematological analysis, while samples of blood for serum biochemical analysis were

collected into second set of plastic bottles without the EDTA (anticoagulant).

3.2.7.2 Haematological Examination
Hematological analysis was done using the Sysmex Hematological Auto-Analyser for the following hematological parameters: *PCV, HGB, TWBC, TRBC, Neutrophils, lymphocytes, monocytes and band cells*

3.2.7.3 Serum biochemistry indices
The serum biochemistry analysis was done to determine the levels of *glucose, total protein, cholesterol, blood urea, triglycerides, albumen, ALP,* ALT, AST *and* creatinine. The blood samples for serum biochemistry were stored at room temperature to clot. Separation of blood cells from the serum was done by spinning the clotted blood samples with the aid of centrifuge. The blood serum was used for the following analysis: total protein (TP); Biuret method as described by Kohn and Allen (1995) was used to determined total protein. Bromocresol Green (BCG) method was used to determine Albumin. CHOP PAP method as described by De Peter *et al.* (1990) was used to estimate Total cholesterol (TC). The globulin content was determined by subtracting albumin from the total protein.

Oxidase method was used to measure the concentration of glucose; total protein by burette method, urea and creatinine was determined spectro-photometrically using commercial kits, triglycerides by Wako method, and cholesterol by enzymatic method. The commercial kit (Alpha Diagnostics) was used to measure the activity of alanine aminotransferase (ALT), alkaline phosphatase (ALP) and aspartate aminotransferase (AST). All spectrophotometric measurements were done using EPOLL 200 spectrophotometer.

Chemical analysis
Chemical composition of Brewers' dried grain and proximate composition of experimental diets were determined according to the method of A.O.A.C. (2000).

Data analysis
Data collected were subjected to analysis of variance (ANOVA) using SAS version 9.3. The separation of means and others are contained in the package

Table 1: composition of experimental diets

	Dietary Supplements				
Ingredients	D1	D2	D3	D4	D5
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	3516	3624	3619	3757	3355

BDG –Brewers Dried Grains, CSC – Cotton Seed Cake
D1 = 0% BDG, D2 = 10%, BDGD3 = 20% BDG D4 = 30% BDG, D5 = 40% BDG
CP = Crude Protein, CF = Crude Fibre, EE = Ether Extract, NFE = Nitrogen Free Extract

Results

Proximate composition and energy values of experimental diets fed Yankasa ewes

The proximate composition of the experimental diets is presented in Table 2. The Dry matter content was highest in D1 (0% BDG) and lowest in D5 (40%). The Crude Protein content was highest in diets having 10% BDG (21.75%) and lowest in diet with 20% (20.05%) BDG. Ash was highest in diet having 20% BDG (10.11%) and lowest in diet having 0 % BDG and in diet with 30% BDG (8.50%). Crude Fibre content was highest in D1 which had zero level of inclusion of BDG (15.50%) followed by Diet 5 (15.00%) then D3 (12.50%) and Diet 1 (11.50%).

Crude fibre content was lowest in Diet 4 (9.50%). Ether Extract increases with increase in the inclusion level of BDG in D1 to 4 (14.00%, 14.00%, 15.11%, and 15.00%, respectively). However there was a decrease of Ether Extract in D5 (12.50%). Nitrogen Free Extract (NFE) was lowest in D1 with 0% BDG inclusion (35.12%) while D4 with 30% BDG inclusion has the highest percentage of NFE (39.52%). D2, 3 and 5 had 37.35%, 36.43% and 35.15% respectively. Moisture content was highest in D5 (40% BDG) and lowest in D1 (0% BDG). The energy values of the experimental diet was highest (3, 756, 80 Kcal/Kg ME) in D4 with 30% BDG and lowest (3, 355, 10 Kcal/Kg ME) in D5 having 40% BDG.

Proximate and Energy values of the experimental forage (*Digiteria smutii*) fed to Yankasa ewes

The proximate composition of the forage fed to Yankasa ewes is presented in table 3. The dry matter content was 93.04% with CP (7.00%), CF (38.37%), Ether Extract (1.00 %) and Nitrogen Free Extract (42.67%). Ash and moisture content were 4.00% and 6.96%, respectively.

Table 2: Proximate composition and energy values of experimental diets fed Yankasa ewes

	Treatments				
Nutrient	D1	D2	D3	D4	D5
Moisture (%)	5.60	6.40	5.80	6.80	7.40
Dry Matter (%)	94.40	93.60	94.20	93.20	92.60
Crude Fibre (%)	15.50	11.50	12.50	9.50	15.00
Crude Protein (%)	21.28	21.75	20.05	20.65	20.50
Ether Extract (%)	14.00	14.00	15.11	15.00	12.50
N F E (%)	35.12	37.35	36.43	39.52	35.15
Ash	8.50	9.00	10.11	8.50	9.45
Energy (Kcl/Kg ME)	3516.00	3624.00	3619.10	3756.80	3355.10

NFE = Nitrogen Free Extract
D1 = 0%, BDG D2 = 10%, BDG D3 = 20%, BDG D4 = 30%, BDG D5 = 40% BDG

Table 3: Proximate and Energy values of the experimental forage (*Digiteria smutii*) fed to Yankasa ewes

Nutrient	Composition (%)
Dry Matter	93.04
Moisture	6.96
Crude Protein	7.00
Crude Fibre	38.37
Ether Extract	1.00
Nitrogen Extract	42.67
Energy (Kcl/Kg ME)	2077.60

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

Overall performance of Yankasa ewes fed varying levels of BDG diet is presented in Table 4. No significance (P>0.05) difference among the treatments with regard to feed intake, total feed intake and final body weight gain observed.

Table 4: Growth performance of Yankasa ewe fed graded levels of Brewers Dried Grain from Nigerian Brewery

Parameters	D1	D2	D3	D4	D5	SEM	LS
Initial body weight (Kg).	24.63	26.75	23.88	23.75	21.25	0.78	NS
Final body Weight (kg)	27.50	28.70	26.25	25.00	26.00	0.86	NS
Weight Gain, (Kg)	2.87	1.95	2.37	1.25	4.75	0.86	NS
Daily Feed Intake (Kg)	0.83	0.78	0.79	0.75	0.86	0.26	NS
Total Feed Intake (kg)	75.08	70.98	71.66	68.25	78.49	2.35	NS
FCR	22.08[a]	24.32[a]	42.27[ab]	54.31[b]	64.24[b]	1.22	*

[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
D1 = Diet 1 – 0% BDG D2 = Diet 2 - 10% BDG D3 = Diet 3 - 20% BDG
D4 = Diet 4 - 30% BDG D5 = Diet 5 - 40% BDG

Hematological values of blood samples from Yankasa ewes fed varying levels of Brewers Dried Grains from Nigerian Brewery

Hematological values of blood samples of Yankasa ewes fed varying levels of BDG from Nigerian brewery Kaduna showed no significant difference in all the parameters within the diet groups (Table 5). Although statistically, no significance difference among diets was observed, but those animals fed diet containing 40% BDG (D5) had the highest value (31.75) of Packed Cell Volume (PCV). Diet 2 (D2) recorded highest values in HGB, TRBC, Neutrophil and band cells. Similarly animals fed D3 had the highest values in TWBC and Lymphocytes.

Serum Biochemical values of blood samples from Yankasa ewes fed varying levels of Brewers Dried Grains from Nigerian Brewery

The biochemical values of blood samples for Yankasa ewes fed varying levels of Brewers Dried Grains from Nigerian Brewery Kaduna is presented in table 6. Diet three (D3) differs significantly ($p<0.05$) from D2 but statistically the same with D1, D4 and D5 in sugar. Urea values showed that D1 and D5 are significantly lower compared to D2, D3

and D4. Cholesterol of animals fed diet 2 (D2) was observed to be significantly lower than animals in D1 and D5. ALT and AST of animals in D4 are significantly higher than other diet groups. Creatinine, Total Protein and Albumen showed no significance differences in the animals in the diet groups. There was significant differences (P>0.05) between the treatment for all the serum biochemistry parameters except for Total protein and Albumin.

Table 5: Hematological values of Yankasa ewe fed varying levels of Brewers Dried Grain obtained from Nigerian Brewery

Parameters	D1	D2	D3	D4	D5	SEM	LS	NR
PCV (%)	27.75	29.75	26.75	29.50	31.75	0.900	NS	24-50
HGB (g/dl)	9.30	10.73	8.88	9.88	10.55	0.293	NS	8-15
TWBC($x10^9$)	7.45	7.58	9.15	8.23	7.68	0.636	NS	7-16
TRBC($x10^{12}$)	4.70	5.40	4.45	4.93	5.25	0.145	NS	6-15
NEUTRO (%)	43.00	43.75	35.00	39.25	34.25	1.836	NS	10-50
LYMPHO (%)	54.75	53.50	63.75	57.75	63.75	1.758	NS	40-75
MONO (g/L)	2.00	2.00	1.25	3.00	0.25	0.533	NS	0-6
BAND (%)	0.25	0.75	0.00	0.00	0.50	0.179	NS	0-1

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, NR = Normal Range
D1 = Diet 1 – 0% BDG D2 = Diet 2 - 10% BDG D3 = Diet 3 - 20% BDG
D4 = Diet 4 - 30% BDG D5 = Diet 5 - 40% BDG
PCV = Packed Cell Volume,HGB = Hemoglobin, TWBC = Total White Blood Cell,
TRBC = Total Red Blood Cell, NEUTRO = Neutrophils, MONO = Monocytes,
LYMPHO = Lymphocytes

Table 6: Biochemical values of Yankasa ewe fed varying levels of Brewers Dried Grain obtained from Nigerian Brewery

Parameters	D1	D2	D3	D4	D5	SEM	LS	NR
Sugar (g/dL)	5.09^{ab}	4.84^{b}	5.67^{a}	5.57^{ab}	5.05^{ab}	0.119	*	4-25
Urea (mg/dL)	4.33^{b}	6.88^{a}	7.80^{a}	7.05^{a}	4.53^{b}	0.399	*	4-20
Chole (mg/dL)	4.34^{a}	2.95^{b}	3.30^{ab}	3.61^{ab}	4.21^{a}	0.191	*	35-60
Trigly (mg/dL)	1.89^{a}	1.64^{ab}	1.76^{a}	0.99^{b}	1.82^{a}	0.119	*	0.01-2.0
T/Prot (g/dL)	7.42	7.08	7.06	7.37	7.58	0.101	NS	5.4-7.9
Albumen (g/dL)	4.56	4.62	4.68	4.73	4.62	0.048	NS	2.5-4.5
ALP (µ/L)	47.76^{ab}	43.48^{ab}	41.16^{b}	43.31^{ab}	48.10^{a}	1.020	*	30-280
ALT (µ/L)	48.77^{b}	52.82^{b}	65.85^{a}	67.40^{a}	48.82^{b}	2.253	*	40-387
AST (µ/L)	33.96^{b}	34.88^{b}	41.77^{b}	56.54a	37.33^{b}	2.299	*	30-280
Creat (mg/dL)	1.13	0.77	0.91	1.29	0.84	0.083	NS	1-2.7

^{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
ALP = Alkaline Phosphatase ALT = Alanine Aminotransferase, T/Prot = Total Protein
AST = Aspartate Aminotransferase Chole = Cholsterol
Trigly = Triglyceride NR = Normal Range, Cret = Creatine
LS = Level of Significance D1 = Diet1 – 0% BDG D2 = Diet2 - 10% BDG D3 = Diet3 - 20% BDG D4 = Diet 4 - 30% BDG D5 = Diet 5 - 40% BDG

Discussion

The result of Chemical composition of Brewers Dried Grains (BDG) shows that the test ingredient contains adequate nutrients that meet the nutritional requirement of sheep as recommended by National Research Council (NRC) (2006). Differences in the proximate composition of BDG used in this work showed similar values in all the parameters with the report of Etchu *et al*. (2012) but lower values with that of Levic *et al*. (2010). This difference could be attributed to fermentation process, inclusion levels, method of analysis and grain composition.

The proximate composition of the diet in this study also showed similarities with that of Smith (1992) and Asaolu (1988). The Crude Protein values of all the experimental diets are within the requirement of (14,g 100g) of growing small ruminants (NRC, 2006).The crude fibre component agreed with the findings of Yaakugh and Tegbe (1990) which revealed a high CF of up to 20% in BDG. The ash content of experimental diet observed in this study can be compared with the value of 10.11% as reported by Okpara *et al*. 2014.

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 D5 might be responsible for the better weight gain and feed **conversion** ratio as this would have enhanced nutrient utilization in the animals. This agreed 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 similarities recorded in hematological parameters is in line with the work of Otsyina *et al*. (2007) who observed in their work that BDG can be safely included in the diet of sheep and reported that hematological indices of animals fed BDG were similar to the result obtained when animals were fed diet without BDG when compared. Also hematological values obtained in all the animals in all the diet groups were within the normal range of 4-12×10^9/L for clinically healthy sheep. The PCV, TRBC, TWBC and other calculated hematological values were within normal range for sheep.

Biochemical values of the parameters measured in this work is within the safe level. However the significant differences observed among the diets in most parameters could be due to inclusion levels. This agrees with work of Ekenyem and Madubuike (2007) whose work was on monogastric and concluded that BDG have no detrimental effect.

Conclusion

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

1. The chemical and energy (3524) obtained in BDG meet the proximate and energy requirement of Yankasa yearling and the phytochemical properties studied are found to be within the safe level.
2. There is no significant difference in weight gain, total feed intake, and between D1 (control) and other treatment diets.
3. There are no significant differences between D1 (control) and other treatment diets in hematological parameters measured. However, urea, ALT and AST values showed significantly lower values compared to those in D4 in serum biochemical parameters.

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