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Nutrient utilization by rabbits fed brewers' dried grains from different proportions of barley, maize and sorghum

J.A. Olupona[a] and O.O. Balogun

Department of Animal Production, University of Ilorin, Nigeria
[a] Present Address: Federal College of Animal Health and Production Technology, I. A. R. & T., P. M. B. 5029, Moor Plantation, Ibadan. Nigeria.

Abstract

An experiment was conducted to evaluate the energy and protein of Brewers' Dried Grains (BDG) produced from different proportions of barley, maize and sorghum on the performance of rabbits. Sixteen (16) rabbits made up of New Zealand and Chinchilla, eight (8) weeks old averaging 1.20kg were used in the trial in a completely randomized design. The four (4) diets were BDG (maize:barley:sorghum) (BDG MBS); BDG (maize:barley) (BDGMB); BDG (maize: sorghum) (BDG MS) and BDG (sorghum) (BDG S). The diets were the only source of protein and energy. The treatment effect was significant ($p < 0.05$) with the highest crude protein digestibility and nitrogen retention values recorded for BDG MBS. The digestible and metabolizable energy values were not significantly different ($p > 0.05$) for the BDG investigated. The digestible energy values determined for BDG MS, BDG S, BDG MBS and BDG MB in MJ/kg of dry matter were 16.97, 15.57, 14.84 and 13.35 respectively while the values for ME in MJ/kg of dry matter were 16.32, 14.91, 14.31 and 12.34 respectively. BDG from local sources have potential to make complete feed for rabbits judging from their impressive energy and protein values.

Keywords: Brewer's Dried Grain (BDG), protein and energy values, rabbits

Introduction

The ever-increasing cases of world population coupled with the cases of malnutrition calls for increasing interest in the potential role of some small livestock such as rabbit that has not received adequate attention despite their numerous advantages. Rabbits can utilize diets that are low in grain and high in roughage, hence, this will reduce the competition that exists between man and livestock grain.

In view of the downward trend in the conventional feed resources available for livestock production, there is need to exploit other available but cheaper non-conventional feedstuffs. Brewer's spent grains are the extracted residues of barley malt alone or in mixture with other cereal grains such as maize, sorghum (up to 5-10%). In Nigeria, the current ban on the importation of malted barley has led to partial or total substitution of barley with maize or sorghum. This substitution invariably will have a net effect on the composition and nutritive value of spent grain since most of the studies of Brewers' Dried Grain (BDG) were based on spent grains from barley.

Brewers' grain contains about two times the nutrient contents of the original grains except for the starch that was converted to alcohol. The composition of the BDG varies depending on the brewery and the grain proportions used in the production of beer. However, according to NRC (1984), BDG contain an average of 25.3%

crude protein, 27% acid detergent fibre and 9% ether extract. The protein of BDG has been shown to be highly insoluble, Udedibie (1984) and with the high crude fibre, there is limit to the use of BDG in the diet of monogastric animals (Omole and Adegbola, (1979).

The purpose of this study reported herein was to evaluate the protein and energy of brewers' dried grain currently available in our brewing industries on the performance of rabbits

Materials and Methods

Brewers' dried grain (BDG) of various compositions were obtained from breweries located in Offa, Kwara State, Ilesa and Ibadan in Osun and Oyo States of Nigeria respectively. They were properly sun-dried for 48hrs. and stored in an air-tight polythene bag prior to use. The four (4) diets were made up mainly of various BDG with the following composition and ratio:

BDG (Maize (36):Barley (32):Sorghum (32)) [BDG MBS]
BDG (Maize (66.6):Barley (33.4)) [BDG MB]
BDG (Maize (50):Sorghum (50) [BDG MS]
BDG (Sorghum (100)) [BDG S]

It has been noticed that feeding only the major ingredients plus min-vitamin supplement would be a better estimation of the energy and protein contribution.

Animals and their Management

Sixteen (16) rabbits: eight (8) males and eight (8) females, eight weeks old cross breed of Chinchilla and New Zealand White were used for the study. Four (4) rabbits were assigned to each treatment and the treatment groups were randomly assigned to pens in four replicates. During the pre-experimental period, the rabbits were fed with commercial pellets and wilted *Tridax procumbens*, the health and welfare of the animals were strictly monitored; they were given antibiotics orally (tetracycline capsule) and also de-wormed with piperazine. The animals were weighed at the beginning of the trial. They were offered feeds and water *ad libitum* twice daily at 8:00 and 16:00hrs. The orts were packed every morning, dried and weighed.

In the trial, there were five (5) days adjustment periods during which only the experimental diets were given to the animal for adaptation followed by a four-day collection period during which faeces and urine were collected separately. The experimental diets were mixed with marker (chromic oxide), which is green in colour, at the beginning and the end of each collection period. It has been observed that the appearance and disappearance of the marker in the faeces marked the beginning and end of the collection period (Ivan, *et al* 1974). Faeces and urine were collected each morning before feeding. Total daily samples of faeces dried at 80^{0}C in an oven, were bulked, milled and stored in polythene bags in the deep freezer until required for analysis. The urine was collected in plastic bottles containing hydrochloric acid (0.01ml) as preservative and 10% of the total daily output were retained and stored in a deep freezer (-5^{0}C) until required for analysis.

Chemical Analysis

The milled samples of feed and faeces and aliquots of urine sample were analysed for nitrogen using micro Kjedahl technique. The feeds were also analysed for ether extract, crude fibre and ash according to AOAC, (1980) method. The gross energy values of feed, faeces and urine were determined using the Gallenkamp Oxygen Bomb Calorimeter. The energy values were determined using the following equations employed by NRC (1984):

DE = GE (feed) – GE (faeces)

ME = DE – GE (urine)

Where GE = Gross Energy (MJ/kg); DE = Digestible Energy;

ME = Metabolizable Energy

Statistical Analysis

The data for each response were subjected to analysis of variance while the difference between means were examined by Duncan Multiple Range Test as outlined by Steel and Torrie (1980).

Results and Discussion

The nutrient composition of the test and the diet are presented in Table 1. It could be noticed that BDG has comparable crude protein and fibre values regardless of constituent, place and period they were collected. The CP values obtained were similar to 25.3% reported for BDG in the NRC (1984) except BDG S, which has a lower value. This could be as a result of inclusion of maize and sorghum in the production of beer as compared to the conventional barley based brewer grains.

Effect of various BDG mixtures on Performance, Digestion and Metabolism

There was a significant difference ($P < 0.05$) in the daily dry matter intake. The rabbits fed BDG MS had slightly higher feed intake, which could be attributed to their smooth texture compared to coarse texture of other barley, based brewers' grain.

Table 1 *Proximate composition of various BDG mixtures (%)*

Diets	Crude protein	Crude fibre	Ether extract	Dry matter	Ash	Gross energy (KJ/kg)
BDG MBS	27.12	11.20	9.05	95.40	4.89	21653.15
BDG MB	25.81	13.90	8.10	94.50	4.97	20032.69
BDG MS	25.59	9.70	10.70	95.20	5.10	22925.33
BDG S	21.22	10.40	9.85	94.90	4.79	21390.04

The apparent dry matter, nitrogen and energy digestibilities were not significantly different ($P > 0.05$) for treatment diet (Table 1). However, dry matter digestibility was slightly higher for BDG MS. The apparent nitrogen digestibility for BDG MS was high with the mean value of 77.10% but this was not significantly higher than the value recorded for other treatments. There was a statistical difference ($p < 0.05$) in the digestible crude protein, the result showed that BDG MBS had the highest value of 20.98g/100g. The net protein utilization for all the ingredients were similar and ranged between 45.54% and 58.79% for BDG MB and BDG MS respectively. There was no significant difference in the apparent biological value ($P > 0.05$).

The outstanding performance of rabbits fed BDG MS could be attributed to their feed intake and relatively higher protein quality of BDG MS. This is similar to the observation of Ajakaiye (1990).

There was similarity in energy digestibility and comparable to the value reported by Gomez, *et al* (1965). For each of the ingredient tested, there was a relationship between the feed intake and the energy voided as excreta, consequently, the digestibility energy (DE) and metabolizable energy (ME) was dependent on the variations in feed intake. The DE and ME values for the treatment are similar to the values obtained by Balogun, *et al* (1988).

Appraisal of the result on energy values showed that BDG MS had distinctly higher ME values and superior gross energy utilization compared to other BDG mixtures. The high DE and ME values of BDG MS may be associated with the presence of maize and sorghum. Maize has higher digestibility than barley because of the nutrient present (Proto, 1965). Also, the possible effect of gelatinization and synergism of maize on sorghum might have contributed in part to high ME values of BDG MS.

In conclusion, the energy and protein values of BDG from local sources are impressive and therefore they are good for rabbits. Further studies should focus on the performance of rabbits fed BDG mixtures.

Table 2 *Effect of various BDG mixtures on Digestion and Metabolism*

Item	BDG S	BDG MBS	BDG MB	BDG MS	SEM
Initial body weight (g)	1.15	1.19	1.22	1.21	
Dry matter intake (g/day)	42.7^{a}	27.7^{c}	32.2^{b}	46.5^{a}	3.90^{**}
Apparent digestion coefficient					
Dry matter (%)	62.45	55.0	55.10	67.04	3.90^{NS}
Nitrogen (%)	76.20	77.0	76.80	76.19	1.92^{NS}
Energy (%)	71.05	68.57	67.66	74.51	2.58^{NS}
Nitrogen metabolism					
Daily absorbed nitrogen (g)	0.957	1.210^{c}	0.739^{b}	1.442^{c}	0.129^{**}
Daily retained nitrogen (g)	0.672	0.870^{a}	0.473^{a}	1.037^{b}	0.126^{*}
Net protein utilization (%)	58.42	56.92	45.54	58.79	4.538^{NS}
Biological value (%)	69.02	70.67	61.58	73.07	6.70^{NS}
Digestible CP (g/100g)	17.23^{c}	20.98^{a}	17.34^{c}	19.16^{b}	0.640^{**}
Energy metabolism					
Daily absorbed energy (KJ)	594.87^{a}	507.56^{b}	329.48^{b}	792.95^{a}	68.79^{**}
Daily retained energy (KJ)	570.92^{a}	484.55^{b}	304.54^{b}	761.99^{a}	66.16^{**}
Digestible energy (KJ)	15178.37^{a}	14847.91^{a}	13397.05^{b}	16967.54^{c}	573.74^{**}
Metabolizable energy (KJ)	14574.92^{a}	14319.86^{a}	12280.62^{b}	16322.98^{a}	439.71^{**}
Metabolizable energy corrected for nitrogen retention (KJ)	14558.14^{a}	14305.81^{a}	12270.07^{b}	16271.51^{c}	371.21

BDG MBS - Brewers' Dried Grains (maize:barley:sorghum)
BDG MB - Brewers' Dried Grains (maize: barley)
BDG MS - Brewers' Dried Grains (maize: sorghum)
BDG S - Brewers' Dried Grains (sorghum) NS - Not Significant
** - Significantly different at 5% level of probability

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