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UTILIZATION AND COST BENEFIT OF REPLACEMENT OF MAIZE WITH BREAD WASTE IN THE DIET OF WEANED RABBITS

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ABSTRACT

Forty-eight (48) crosses of Chinchilla and white California weaned rabbits of mixed sexes of mean weight of 543.45 ± 3.6g were used for this research work. Four diets were compounded and bread waste (BW) was added at varying inclusion levels at 0% (control, BW1), 50% (BW2), 75% (BW3) and 100% (BW4) as a substitute for maize grain. Each dietary treatment was repeated three times with 4 rabbits per replicate. Data collected include feed intake (FI), weight gain (WG), feed conversion ratio (FCR), cost/weight gain (CWG), and dressing percentage (DP). The FI increased numerically ($P<0.05$) as the level of bread waste added up from zero percent inclusion to a hundred percent (BW4). Varying inclusion levels of bread waste did not affect the performance of the rabbit in terms of WG across the treatments ($P>0.05$). The FCR of diet BW3 is similar to that of BW1. No mortality was reported across the treatments. The chemical compositions of the meat were not affected by the dietary treatments ($P>0.05$). The highest CWG was reported in the control diets while the lowest CWG was recorded in BW4. Bread waste could be used to substitute maize up to 100% in the diet of weaned rabbits.

Keywords: Bread waste, Cost-per-weight-gain, Feed efficiency, Maize, Weaned-rabbits

1. INTRODUCTION

Micro-livestock species are small-bodied animals reared for meat and other animal by-products. It plays important role in meeting the protein requirement of the mankind. Micro-livestock includes rabbits, poultry species such as duck, geese, turkey, quail, game birds and rodents (Omole *et al*., 2011; Popoola *et al*., 2017; Fayenuwo *et al*., 2018). These animals are also called unconventional farm animals. The crude protein content of the meat from micro-livestock species ranges from 16 – 18% which is similar to that of meat from conventional farm animals. Rabbit meat is low in cholesterol (Omole *et al*., 2011; Popoola *et al*., 2017) and thus is considered favourable for those who have fat-related diseases such as hypertension. Rabbit farming can be started as a small-scale business for a low-cost investment (Fayenuwo *et al*., 2018). It is a good experimental animal for research. Their feed can be locally sourced. It feeds on forages, wastes, and agricultural by-products. Rabbit is hardy and well-adapted to the environment and has a short generation interval (Omole *et al*., 2011; Popoola *et al*., 2017). It can survive on a variety of kitchen waste. It can tolerate a high fibre diet than chicken as they perform hindgut fermentation in the characteristically enlarged caecum. The efficiency of feed utilization is high in rabbits.

The price of maize is higher than that of other feed ingredients, hence, there is a need to look for other means of energy sources. Bread waste, a by-product of the bakery industry is rich in energy, low in fibre but high in vitamins and it has been used to substitute maize in the diets of broiler chicken [Dabron *et al.*, 1999; Abdulatif *et. al.*, 2004]. The protein content is 9-11% when compared to that of maize at about 10%. Bread waste is also rich in minerals and vitamins. It is consumable with no anti-nutritional factors but must not be kept in a wet or damp place because of mouldiness (Abdulatif *et al*., 2004). Bread waste tastes better than maize. There are lots of bakery cottage industries in most countries, including Nigeria. There is a scarcity of information on the inclusion of bread waste as an alternative feed ingredients source in the diet of rabbits, and to reduce the cost of other ingredients (maize) for rabbit production this study was carried out to assess the performance, carcass qualities and cost benefits of substituting maize fraction of the diet of growing rabbits with bread waste.

2. MATERIALS AND METHODS

2.1. Study area and experimental animals

The experiment was carried out at the Rabbitry Unit of the Institute of Agricultural Research and Training (I.A.R. & T.), Moor Plantation, Ibadan which is located on Longitude 03°51E, Latitude 07°23N and Altitude 650", lies in the humid zone of the rainforest belt 0703.25 of South-western Nigeria with a mean annual rainfall of 1220 mm and mean temperature of 26 °C. A total of forty-eight (48) crosses of Chinchilla and white California weaned rabbits of mixed sexes of mean weight 543.45 ± 3.6 g were used for this study.

2.2. Diet formulation

The rabbits were quarantined for a week before the commencement of the feeding trial. Waste of the Bread (BW) was purchased from a bakery cottage industry in Ibadan, Oyo State, Nigeria. The waste of the bread was later added up with other feed ingredients. Four diets were compounded to contain BW at zero percent (BW1, control), fifty percent (BW2), seventy-five percent (BW3) and hundred percent (BW4) as substitute for maize in the nutrient of growing rabbits. Each feeding trial was repeated three times with 4 rabbits per replicate. The diets were compounded to contain about 16% crude protein and energy (metabolizable energy, ME) of about 2600 kcal/kg as shown in Table 1.

2.3. Determination of feed intake, weight gain, feed conversion efficiency, carcass quality and proximate composition

Each rabbit was given 30g each of sunflower leaves as a basal diet. On a daily and weekly basis, feed consumption and weight gain respectively were measured with the use of a weighing balance. Feed intake was calculated by deducting the weight of the left-over feed from the feed given while the weight gain was derived by deducting the initial weight from the final weight. The feed conversion ratio was calculated as the ratio of feed intake to weight gain. Feed cost and cost per weight gain were also derived. The digestibility trial was carried out at the end of terminating the feeding trials (12 weeks). Six rabbits from each of the treatments were randomly selected for carcass analysis. The rabbits were deprived of the feed overnight, weighed and slaughtered. The fur, intestine, lung, kidney and heart to the dressed weight were calculated. Proximate composition of the feed was carried out according to the method of A.O.A.C, 1990.

2.4. Statistical analysis

All data were subjected to statistical analysis using analysis of variance and the means were separated if they are significantly different using Duncan Multiple Range Test (SAS, 1999). Data analysis were performed using SAS, 2000 software package.

3. RESULTS AND DISCUSSION

3.1. Composition of experimental diets

The gross composition of the experimental diets in this study was within the range of energy and protein levels, recommended for growing rabbits by Omole *et.al*. (2011) and Popoola *et.al*. (2017). The proximate composition of the test ingredient and experimental diets are shown in Table 2. The protein content of bread waste is numerically greater than that of maize while the fibre level was low compared to maize. The protein content of bread waste (Table 2) used in this study is similar to that of Dabron *et al.* (1999) and Abdulatif *et al.* (2004).

3.2. Effect on performance

The mean daily feed intake (Table 3) increased as the bread waste added up from zero percent to hundred percent ($P<0.05$). The highest daily feed intake of 85.71g was recorded in BW4 which was relatively the same as that of BW2 and BW3 ($P>0.05$). The increase in feed intake could be due to increased palatability and low fibre content of bread waste as compared to maize (Table 1). The daily feed intake reported in the study was close to the report of Omole *et al.,* (2011).

Table 1. Gross composition of the experimental diets

Ingredient (%)	BW1 (0% BW)	BW2 (50% BW)	BW3 (75% BW)	BW4 (100% BW)
Maize	32.0	16.0	8.0	0.0
Bread waste	0.00	16.0	24	32.0
*Others	68.0	68.0	68.0	68.0
Total	**100.0**	**100.0**	**100.0**	**100.0**
Cost/kg feed (N/kg)	**41.32**	**40.01**	**37.61**	**35.20**
Calculated analysis				
Crude protein (%)	16.13	16.25	16.38	16.44
Metabolizable energy (kcal/kg)	2628.1	2614.65	2609.3	2587.67

**Other fixed ingredients: Wheat offal-24, BDG, 25, Fish meal-0.5, Soya bean meal-5.55, Ground nut cake-7.0, Bone meal-1.50, Oyster shell-4.2, Premix-0.25.*

The mean daily weight gain across the treatments was not significantly influenced by the addition of bread waste in the diet (P>0.05), the values ranged between 18.10g in BW4 and 19.2g in BW3 as shown in Table 3. The weight gain recorded in this study was relatively closer to the observation of Omole *et.al*. (2011) and Fayenuwo *et.al*. (2018). The weight gain reported was relatively higher than that reported by

Table 2. Proximate compositions of maize, bread waste and experimental diets

Parameters	Maize	Bread waste	BW1 (0% BW)	BW2 (50% BW)	BW3 (75% BW)	BW4 (100% BW)
Dry Matter	97.66	98.77	95.92	94.38	94.89	93.80
Crude Protein	9.76	11.34	16.02	16.14	16.34	16.44
Crude Fibre	6.77	5.72	11.36	11.12	11.03	11.02
Ether Extract	5.18	7.36	5.82	5.91	5.98	6.25
Ash	7.98	10.98	12.11	12.32	12.59	12.97
Nitrogen Free Extract	70.31	64.60	54.69	54.9	54.51	53.32

Table 3. Performance of weaned rabbit fed different levels of bread waste (BW)

Parameters	BW1 (0% BW)	BW2 (50% BW)	BW3 (75% BW)	BW4 (100% BW)	± SEM (pooled)
Total feed intake (g)	7317.0 ^{b}	7425.0 ^{b}	7506.0 ^{ab}	7713.9 ^{a}	67.43
Daily feed intake (g)	81.3 ^{b}	82.5 ^{ab}	83.4 ^{ab}	85.71 ^{a}	4.2
Initial weight (g)	432.1	430.3	435.1	433.4	5.89
Final weight (g)	2125.9	2136.7	2163.1	2125.4	45.23
Total weight gain (g)	1693.8	1706.4	1728.0	1692.0	38.67
Daily weight gain (g)	18.82	18.96	19.2	18.10	2.76
Feed conversion ratio	4.32 ^{b}	4.32 ^{b}	4.34 ^{b}	4.73 ^{a}	0.21

Values are mean values; Means along rows with different superscript are significantly different from each other (P<0.05)

Table 4. Cost analysis of weaned rabbit fed different levels of bread waste (BW)

Parameters	BW1 (0% BW)	BW2 (50% BW)	BW3 (75% BW)	BW4 (100% BW)
Total feed intake (kg)	7.32	7.43	7.51	7.71
Total weight gain (kg)	1.69	1.71	1.73	1.69
Cost/kg feed (N)	42.31	40.15	37.21	34.51
Total feed cost (N/kg)	309.71	298.32	299.44	266.1
Cost/weight gain (N/kg)	183.3	174.5	161.5	157.4

Table 5. Carcass analysis of weaned rabbit fed with different levels of bread waste (BW)

Parameters	BW1 (0% BW)	BW2 (50% BW)	BW3 (75% BW)	BW4 (100% BW)	± SEM (pooled)
Live-weight (g)	2120.9	2131.2	2162.4	2123.3	41.3
Defurred weight	1537.65	1547.3	1567.9	1536.83	34.9
Fur weight %	5.38	5.34	5.31	5.29	1.23
Dressing %	72.5	72.6	72.51	72.39	2.12
Heart weight %	0.78	0.78	0.79	0.77	0.12
Liver weight %	2.78	2.76	2.76	2.77	0.21
Lung weight %	1.81	1.83	1.82	1.81	0.03

Means along rows with different superscript are significantly different from each other (P<0.05)

Babatunde *et.al*.(2001) when the latter replaced maize with kola-nut (nut of the species *Cola acuminat*e and *Cola nitida*) pod and this could be since that kola-nut pod contain anti-nutritional factors which could affect the nutrient utilization and consequently hampered the growth of the rabbit. Again kola-nut pod contains high fibre content than bread waste. The feed efficiency was relatively the same in the diet that contained 75% BW (4.34) as a substitute for maize (BW3) and the control (4.32). No mortality was reported across the treatments. Zero mortality recorded in all the treatments suggests that BW is not toxic or harmful to rabbits. Also, good management practices were strictly adhered to according to different authors (Babatunde *et al*., 2001; Etim and Ogunke, 2011).

3.3. Cost-benefit analysis of maize substitution

The cost analysis result shows that the feed cost reduced as the level of bread waste in the diet increased from BW1 to BW4 as presented in Table 4. High valued cost per weight gain was recorded in the control diet while the lowest cost per weight was recorded in BW4 as shown in Table 4. The reduction in feed cost and cost per weight as the level of waste of bread in the diets increased was similar to the report of other authors that used different alternative feed resources to feed livestock (Babatunde *et al*., 2001; Fanimo, and Oduronbi, 2006).

3.4. Effect on carcass quality

The result of carcass analysis (Table 5) indicates that the dressing percent of the rabbit across the treatments was not significantly different from one another (P>0.05). The values ranged between 72.39% in BW4 and 72.6% in BW2. The dressing percent recorded in these feeding trials was similar to the observation of Fasanya and Ijaiye (2002) but lower than the report of Babatunde *et al*. (2001) and it could be due to reasons discussed earlier. The percent weight of lungs, kidneys and the heart were not significantly influenced by the addition of bread waste in the diets. As reported by Babatunde *et al*. (2001), and Etim and Ogunke (2011), an increase or decrease in organ weights such as lung, liver and kidney could be a symptom of diseases; it could be supported again that bread waste had no negative effect on the health status of the rabbit.

5. CONCLUSION

Bread waste improved the feed intake of the rabbits. The mean daily weight gain across the treatments was not significantly influenced by the varying levels of BW in the diet. The feed cost was reduced as the level of bread waste in the diet increased. The dressing percentage was relatively the same across the treatments and bread waste had no negative implication on the health status of the rabbits. Hence, it could be concluded that bread waste can be used to substitute maize up to 100% in the diet of weaned rabbits to reduce the price of feed without any health challenges on performance characteristics of rabbits.

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