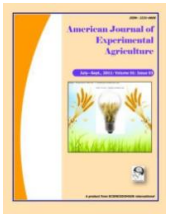

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Performance and Carcass Evaluation of Broilers fed Whole Millet Meal in a Humid Tropical Environment

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Authors' contributions

This work was carried out in collaboration between all authors. Authors LAFA, OAE and CCE jointly designed the study, managed the collection of data and performed the statistical analysis. All authors read and approved the final manuscript.

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ABSTRACT

This study was conducted using 96 day old broiler chicks, to assess the most appropriate level of inclusion of whole millet meal as a substitute for maize. The inclusion levels of the whole millet were 0, 20, 40 and 60% of the maize content of the control diet. The birds were randomly assigned to four dietary treatments which were replicated four times using Completely Randomized Design (CRD). The study lasted for 56 days. Feed and water were provided *ad libitum* during the study. The weight of the birds, daily feed intake, feed cost per treatment and mortality records were kept. At the end of the experiment, one bird per replicate was randomly selected for carcass and organ evaluation. These were expressed as percentages of the body weight. Data collected were subjected to Statistical Analysis System (SAS) and errors were presented as standard errors of means (SEM). The inclusion of whole millet significantly influenced feed intake and feed conversion ratio. Significant differences were not observed in carcass, organ and other parameters measured. It was observed from this study that the performance, carcass and organ yield of broiler fed up to 60% whole millet in the diets as substitute for maize were equivalent to those fed the control diet. However, the 20% whole millet inclusion which gave the best feed conversion ratio and had similar final weight compared with the others was recommended for best broiler performance in a humid tropical environment.

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Keywords: Whole millet; broiler; carcass; organ; humid environment.

1. INTRODUCTION

Maize, a conventional dietary energy source is the most expensive ingredient in poultry feeds because of the quantity required for inclusion [1] which constitute about 50-70% of the total feed ingredients in broiler ration. Several attempts had therefore been made to reduce, maintain or regulate the cost of feed production by replacing part of the maize in diet with industrial by-products and others [2].

Pearl millet which is also called Gero or Maiwa or Dauro is a cereal with superior amino acid balance and higher protein content than corn [3,4,5]. It has higher oil content than other cereals [4,6] and a better source of linolenic acid. The findings of [7] exonerated millet from anti-nutritional properties (phytate and tannins) while [8] reported that millet has no tannin, contains 5-7% oil and has higher protein and mineral than maize. The concentration of anti-nutritional factors in pearl millet is generally lower than in other cereals and in general, anti-nutritional factors are not a problem with pearl millet [9]. The phytate content of pearl millet is similar to sorghum and maize in the range of 1.7-3.3 g/kg [10]. According to [11] millet contains 2984Kcal/kg metabolizable energy (ME), 11.55 crude protein (CP), 3.6% crude fibre (CF), 6.5% fat, 3.2% ash, 0.23% lysine and 0.15% methionine.

The use of whole pearl millet (up to 50%) in the temperate region gave equivalent or better results when the performance and carcass yield of broiler were evaluated [12,13]. This finding improved the feasibility of using pearl millet in poultry diet since it can be utilized successfully in whole form. It was therefore necessary to assess the suitability of using whole millet in broiler diet in the humid tropics (since the cost of grinding will be eliminated) with reference to performance, carcass and organ yield and feed cost.

2. MATERIALS AND METHODS

2.1 Experimental Location

The research was conducted at the Poultry Unit of the Teaching and Research Farm of Rivers State University of Science and Technology, Port Harcourt, Rivers State, Nigeria. Port Harcourt lies between longitude 6º55N to 7º10E and latitude 4º35N to 4º54N of Greenwich meridian, covering a total area of 804 km^2 [14].

2.2 Experimental Feed

The feed ingredients were obtained from the open market (Oyigbo market). The whole millet was incorporated into broiler starter and finisher diets at 0, 20, 40 and 60% in four treatments (T1-T4), to replace the maize content in the control (T1). The metabolizable energy (ME), crude protein (CP), fat and crude fibre (CF) of the diets were calculated while proximate analysis was conducted to obtain the analyzed values of CP, fat and CF using the method of [15]. All diets were isocaloric (2700 Kcal/kg and 3000 Kcal/kg) and isonitrogenous (20.60% and 18.20%) for starter and finisher diets respectively (Tables 1 and 2).

2.3 Experimental Birds

A total of 96 day old broilers were used for the study which lasted for 8 weeks. They were randomly assigned to the 4 treatments on arrival in a Completely Randomized Design (CRD). Each treatment had 4 replicates with 6 birds each (24 birds per treatment). Feed and water were provided *ad libitum* throughout the study period. Birds were fed the starter and finisher diets for 4 weeks each. Routine vaccination and management practices were duly carried out throughout the period.

2.4 Data Collection

The initial weight of the birds was taken on arrival while the final weight record was taken at the end of the experiment. The feed left over was subtracted from the quantity offered to determine the daily feed intake. The weight gain by the birds, feed conversion ratio (total feed consumed per bird/total weight gain per bird) and feed cost per treatment were computed while mortality record was taken daily. Data collection was done in accordance with the rules of the Ethics Committee of the Faculty for animal research.

2.5 Carcass and Organ Evaluation

At the end of the experiment, one bird was randomly selected per replicate for carcass and organ evaluation. They were fasted for 8 hours, bled, scalded, de-feathered, eviscerated and dissected for the determination of carcass and

organ weights. Cut parts and organs were weighed on fresh basis using a sensitive scale (Metler balance) but were recorded as percentages of the life weight.

2.6 Data Analysis

All the data collected were subjected to analysis of variance using [16]. Significant differences between the means were separated using Duncan's Multiple Range Test as outlined by [17].

3. RESULTS AND DISCUSSION

The result of the performance of broilers fed the various levels of whole millet in diet is shown in Table 3. There were no significant ($p > 0.05$) differences between the birds fed the control diet and the whole millet diets in final weight, weight gain and mortality. This may be due to the uniformity in the nutrient content of diets. This finding was in line with [13] who reported that the performance and carcass yield of broilers fed diets containing whole millet were equivalent to those fed a typical corn-soybean meal diet. The birds fed the 20% whole millet diet had significantly better total feed consumption per bird and feed conversion ratio. This was similar to the report by [12] who stated that the performance and carcass yield of broilers fed diets containing up to 50% ground pearl millet were equivalent or better than those fed typical corn-soybean meal diets. The use of 20% whole millet in diets for broilers in the humid tropics, thus seem to be of advantage from this study. The numerical value obtained from the cost of feed per bird in each treatment was similar even though the actual cost of maize was N85/kg and millet N110/kg. This similarity in cost of feed per bird across the treatment was attributed to the elimination of grinding cost for millet since the whole grain was used. The mortalities of birds were not significantly different in the treatments. The mortalities recorded occurred within the 2 days of arrival and could be attributed to the stress of transportation.

Table 1. Composition of experimental starter diet

Ingredients (%)	T_1 (0%WM)	T_2 (20% WM)	T_3 (40%WM)	T_4 60%WM)
Maize	44.0	35.2	26.4	17.6
Whole millet	0.0	8.8	17.6	26.4
Soya bean meal (44%CP)	20.0	18.0	18.0	18.0
Palm kernel cake	17.0	20.0	21.0	22.0
Fish meal (63%CP)	5.0	5.0	5.0	5.0
Wheat bran	9.9	8.9	7.9	6.9
V/tm premix	0.25	0.25	0.25	0.25
Bone meal	3.0	3.0	3.0	3.0
DL methionine	0.03	0.03	0.03	0.03
Salt	0.8	0.8	0.8	0.8
Lysine	0.02	0.02	0.02	0.02
Nutrient composition (%/kg)				
ME (Kcal/kg)	2721.52	2709.00	2702.15	2701.04
Crude protein (calculated)	20.61	20.60	20.62	20.69
Crude protein (analysed)	20.52	20.56	20.51	20.53
Fat (calculated)	3.57	3.60	3.61	3.61
Fat (analysed)	3.58	3.59	3.60	3.60
CF (calculated)	5.85	6.10	6.09	6.20
CF (analysed)	5.72	5.98	5.93	6.00
Lysine (calculated)	1.05	1.04	1.02	1.02
DL-Methionine(calculated)	0.41	0.42	0.42	0.43
Available phosphorus (calculated)	1.03	1.03	1.02	1.02

Vitamin and Trace Mineral Premix: Vitamin A, 551 IU; Vitamin D3, 110 IU; Vitamin E, 1.1 IU; Vitamin B12, 0.001 mg; riboflavin, 0.44 mg; niacin, 4.41 mg; D-panthotenic, 1.12 mg; choline, 19.13 mg; menadione sodium bisulfate, 0.33 mg; pyridoxine HCL, 0.47 mg; thiamine, 2.2 mg; D-biotin, 0.011 mg; and ethoxyquin, 12.5 mg. Mn, 6.0; Zn, 5.0: Fe, 3.0; I, 1.5; Se, 0.5

Table 2. Composition of experimental finisher diet

Ingredients (%)	T_1 (0% WM)	T_2 (20% WM)	T_3 (40% WM)	T_4 (60% WM)
Maize	52.8	42.2	31.68	21.12
Whole millet	0.0	10.6	21.12	31.68
Soya bean (44%)	14.2	13.2	11.0	10.0
Palm kernel (63%)	20.4	21.4	22.6	23.6
Fish meal (63%)	5.0	5.0	6.0	6.0
Palm oil	3.0	3.0	3.0	3.0
V/TM Premix	0.25	0.25	0.25	0.25
Bone meal	3.5	3.5	3.5	3.5
DL methionine	0.03	0.03	0.03	0.03
Salt	0.8	0.8	0.8	0.8
Lysine	0.02	0.02	0.02	0.02
Nutrient composition (%/kg)				
ME (KCal/kg)	3049.27	3044.24	3037.90	3032.11
Crude protein (calculated)	18.22	18.23	18.20	18.21
Crude protein (analysed)	18.20	18.21	18.17	18.19
Fat (calculated)	6.65	6.70	6.80	6.80
Fat (analysed)	6.63	6.68	6.72	6.73
CF (calculated)	5.30	5.77	5.90	5.90
CF (analysed)	5.31	5.72	5.81	5.82
Lysine (calculated)	0.91	0.90	0.89	0.88
DL-methionine (calculated)	0.38	0.38	0.39	0.39
Available phosphorus (calculated)	0.99	0.99	1.00	1.01

Vitamin and Trace Mineral premix: Vitamin A, 551 IU; Vitamin D3, 110 IU; Vitamin E, 1.1 IU; Vitamin B12, 0.001 mg; riboflavin, 0.44 mg; niacin, 4.41 mg; D-panthotenic, 1.12 mg; choline, 19.13 mg; menadione sodium bisulfate, 0.33 mg; pyridoxine HCL, 0.47 mg; thiamine, 2.2 mg; D-biotin, 0.011 mg; and ethoxyquin, 12.5 mg. Mn, 6.0; Zn, 5.0: Fe, 3.0; I, 1.5; Se, 0.5

Table 3. Effect of whole millet diets on broiler performance

Parameters	T1 (0% WM)	T2 (20% WM)	T3 (40% WM)	T4 (60% WM)	SEM
Initial weight (g/bird)	40.00	40.00	40.00	40.00	
Final weight (g/bird)	2080	2070	2070	2080	0.03
Weight gain (g/bird)	2040	2030	2030	2040	11.00
*TFC (g/bird/day)	4356.80^a	3528.00^b	4239.20^a	4300.80^a	72.50
Feed conversion ratio	2.14^a	1.74^b	2.09^a	2.11^a	0.35
Feed cost/bird (N)	388.77	385.62	383.10	376.24	
Mortality (%)	0.48	0.48	0.00	0.24	

**TFC = Total Feed Consumed, SEM = Standard Error of Mean, WM = Whole millet; *a,b – Means within each row that ear different superscript differ significantly; No. of replicates /treatment = 4*

Tale 4. Effect of whole millet diets on carcass and organ yield of broilers

Parameters (%)	T1 (0% WM)	T2 (20% WM)	T3 (40% WM)	T4 (60% WM)	SEM
Breast	21.03	20.99	20.97	20.94	0.47
Back	17.32	17.01	17.00	16.99	0.45
Thigh	14.62	14.98	14.60	14.53	0.19
Neck	5.23	5.24	5.18	5.20	0.30
Shank	5.11	5.12	5.09	5.10	0.28
Wing	9.37	9.35	9.32	9.30	0.18
Heart	0.74	0.73	0.74	0.72	0.14
Liver	2.08	2.03	2.02	2.05	0.12
Gizzard	4.25	4.19	4.20	4.22	0.13

SEM – Standard Error of Mean; No. of replicates /treatment = 4

The carcass weight of birds expressed as the percentage of the live weight was not significantly different ($p > 0.05$) in the various treatments (Table 4 above). This may be as a result of the non-significant difference recorded in the final weight and weight gain of birds in all the treatments. The organ weight (heart, liver and gizzard) of birds recorded as percentage of the live weight had similar trend like the carcass weight. The gizzard weight of birds fed the whole millet diets which were not significantly different from birds fed the control diet was contrary to the finding of [18,19,20] who found increase in gizzard weight when whole grain such as wheat, triticale, millet and barley were fed to broilers. The similarity in the percentages of the gizzard in this study may either be attributed to the uniformity in the crude fibre (CF) content of the diets or to the small number of birds sampled in the current research.

4. CONCLUSION

The inclusion of 20 – 60% whole millet diet supported broiler production in the humid tropics as it gave equivalent result with those fed the control diet. But the 20% whole millet inclusion which gave better feed conversion confirmed the feasibility of using whole millet in poultry diet in this region. More importantly, the use of the whole millet in broiler diet which eliminated the cost of grinding as well as some extra work that could have been done during the grinding process will be of interest to farmers.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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