GROWTH AND ECONOMIC PERFORMANCE OF BROILER FINISHER CHICKEN FED DIETS CONTAINING GINGER WASTE MEAL AS PARTIAL REPLACEMENT FOR MAIZE

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Abstract

This study was carried out to evaluate the growth and economic performance of broilers fed diets containing ginger waste meal as partial replacement for maize. A total of 100 five-week-old broiler chicks of mixed sexes were utilized for the experiment with 20 birds per treatment and each treatment were subdivided into two replicates of 10 birds each in a Completely Randomized Design (CRD). Five experimental broiler diets serving as Treatments A, B, C, D and E respectively designated as T_A, T_B, T_C, T_D and T_E were compounded to be isonitrogenous (19% crude protein) and isocaloric (3100kcal/kgME) with graded levels of ginger waste meal (GWM) inclusion as partial replacement for maize at 0, 5, 10, 15 and 20% respectively. The birds were fed with the respective diets and water *ad libitum* for four weeks. The result shows that there were differences in weight gain, feed intake, final weight and feed conversion ratio among the treatments ($P<0.05$). Feed intake and final weight increased significantly in broiler finishers fed diets containing ginger waste meal over that of the control. T_B had the highest weight gain per kg feed followed by T_D, T_E, and T_A while T_C had the lowest weight gain per kg feed. The data shows that the birds in T_B had the highest feed conversion ratio of 2.2 while T_C showed the lowest feed conversion ratio with 2.94. T_A, T_D and T_E had the same feed conversion ratio of 2.5. The results show that replacement of up to 5% maize component with ginger waste meal in broiler finisher diets improved the feed efficiency and thus exerted a positive effect on the performance of the birds.

Key Words: *Growth, Economic performance, Ginger waste meal*

Introduction

The high cost of conventional feed ingredients which provide the energy and protein components of feeds, continues to be greatest cost challenge in commercial poultry enterprises in Nigeria (Bratte, 2011). Maize is a major ingredient used in livestock feed but competition between man and livestock for maize has resulted in high cost of the cereal. The high cost of maize has necessitated a search for alternative energy-rich feed ingredients for compounding livestock feed. In Nigeria large quantities of agricultural and agro-industrial by-products are produced and most of them are regarded as waste and classified as nonconventional feed stuffs. The competition between human beings and livestock for available cereal has resulted in high cost of feed production, and consequently higher cost of such livestock. It has therefore become necessary to search for cheaper but equally effective means of making such feed.

The population of Nigeria is increasing exponentially, and there is thus the need for increased supply of dietary protein. A survey conducted by the Food and Agriculture Organization of the united Nations reported by Glatz and Pym (2004) indicated that daily consumption of meat in Nigeria was as low as 20g per capita/day while in countries like United States of America (USA), it was up to 304g per capita/day. Nigeria has not been able to meet the Food and Agriculture

Organization (FAO) recommended protein intake of 65g per person per day (Usman *et al*., 2008).

The acute shortage of animal protein, therefore calls for exploitation of alternative or indirect sources of protein. Although animal protein is usually obtained from cattle, sheep and goats, these animals have not been able to bridge the gap between demand and supply of protein. Given this situation it is important to look into ways of substituting some nonconventional feedstuffs for the conventional ones in broiler diets in a bid to reduce the cost of production. Partial substitution of maize with ginger waste meal as energy source could go a long way to reduce the overall cost of broiler production and in the long run increase the protein consumption level of human populace.

The term nonconventional feed resources (NCFRs) refers to all those feeds that have not been traditionally used in animal feeding and or are not used in commercially produced rations for livestock. NCFRs include commonly a variety of feedstuff from crop, animal and industrial origin (Sontakke *et al*., 2014). Oyelese *et al*., (1999) stated that nonconventional feed resources are credited for being noncompetitive in terms of human consumption, very cheap to purchase. Sontakke *et al* (2014) further stated that nonconventional feed resources could partly fill the gap in the feed supply, decrease competition for food between humans and animals, reduce feed cost and contribute to self-sufficiency in nutrients from locally available feed sources. Chike (1986) stated that there are many nonconventional feedstuff or agricultural by-products with substantial nutritional value and inexpensively available in large quantities, but currently they are in limited use, this is due to lack of adequate nutritional information, other uses or presence of deleterious constituents like alkaloids, toxic amino acids, phenolic compounds, trypsin inhibitors, carcinogens, glucocinolates, etc.

Ginger is a plant rich in many phenolic compounds hence the spicy aroma, taste, fragrance. In the root rhizome are naturally high plant based chemicals known as phytochemicals believed to possess anti-bacterial and anti-viral agents that protect the plant from natural flora. The rhizome ginger a plant a plant extensively cultivated in Nigeria and many other countries of the world is processed into various products for human consumption. The by-product here is referred to as ginger waste meal (Onimisi *et al.*, 2006). Omage *et al.*, (2007) stated that ginger waste meal is obtained from the extraction of oleoresin using ethanol. Spent ginger obtained after the extraction of oleoresin constitute more than 90% of the material and is rich in carbohydrate (Konar *et al.*, 2013) and could therefore be a cheap and locally available substitute for maize in livestock diets (Omage *et al*., 2007).

This research work was designed to determine the effect of ginger waste meal on the growth performance of finisher broilers and therefore look at the possibility of partially substituting ginger waste meal for maize while also meeting their nutritional requirements. This study will further provide a fair knowledge for farmers and the feed industry at large on how to economically substitute maize and other grains with ginger waste meal in broiler finisher diets, thus reducing the cost of producing the feed and overall cost of production.

Materials and Methods

This research was carried out at the National Veterinary Research Institute Vom in Jos South Local Government Area of Plateau State. A total of one hundred 5-week old broiler chickens were utilized for this work with 20 birds per treatment. Each treatment was subdivided into two replicates of ten birds each in a completely randomized design (CRD). Five experimental broiler finisher diets T_A, T_B, T_C, T_D, and T_E were compounded to be isonitrogenous (20% crude protein) and isocaloric (2800 Kcal/kg ME) with varying levels of ginger waste meal (GWM) inclusion as partial replacement for maize. The experimental diets were formulated such that ginger waste meal replaced maize at 5%, 10%, 15% and 20% levels for treatment A, B, C, D and E respectively. Other ingredients were included at recommended levels for each treatment to meet the nutrient requirements of the birds. The experimental diet and water was provided *ad libitum* and the experiment lasted for four weeks. Routine vaccination and medication of the experimental animals were strictly adhered to in the course of the study. Analysis of the ginger waste meal presented results as shown below:

Sample	Moisture	Crude protein	Crude fibre	Crude fat	Ash	NFE	Calcium	Phosphorus
Ginger waste meal	11.30	8.37	21.08	4.70	17.50	36.33	1.00	0.11

Weights of the birds were taken at the beginning of the experiment, and thereafter data on feed intake and weight gain were collected weekly. Data collected for feed intake, weight gain, and FCR were subjected to analysis of variance as described by Steel and Torrie (1980). The Duncan's Multiple Range Test (Duncan, 1955) was used to separate the means for significant difference.

RESULTS

Table 1 Composition of experimental diets

Ingredient	A	B	C	D	E
Maize	55	52.25	49.5	46.75	44
GWM	-	2.75	5.5	8.25	11
Full fat soya	30	31	32	33	34
Wheat offal	10.65	9.65	8.65	7.65	6.65
Fish meal	1.0	1.0	1.0	1.0	1.0
Bone meal	1.5	1.5	1.5	1.5	1.5
Lime stone	1.0	1.0	1.0	1.0	1.0
Common salt	0.25	0.25	0.25	0.25	0.25
Vit./Min. premix*	0.2	0.2	0.2	0.2	0.2
Lysine	0.2	0.2	0.2	0.2	0.2
Methoinine	0.2	0.2	0.2	0.2	0.2
Total (kg)	**100**	**100**	**100**	**100**	**100**

Calculated Nutrient Level

MEKcal/kg	3139.59	3124.83	3105.83	3084.35	3062.61
CP g/kg	18.78	19.06	19.32	20.51	19.76
CF g/kg	3.74	4.28	4.80	5.32	5.83
EE g/kg	8.02	8.18	8.35	8.52	8.69

***Premix (Biomix) per kg**

Biomix provided per kg of diet: Vitamin A 10,000,000.00iu, Vitamin D 2,000,000.00iu, vitamin E 23,000.00iu, vitamin K 2000mgr, vitamin B 1,800mgr, Vitamin B_2 5000mgr, Niacin 27,5000mgr, panthotenic acid 75,750mgr, Biotin h27 60mgr, chloride 300,000mgr, cobalt 200mgr, manganese 40,000mgr, selenium 200mgr, zinc 30,000mgr, antioxidant, 1,250mgr.

Table 2: Cost (₦) of Experimental Diets (100Kg)

Ingredient	**A**	**B**	**C**	**D**	**E**
Maize	2915.00	2769.25	2623.50	2477.75	2332.00
GWM	0.00	88.00	176.00	264.00	352.00
F.F.S	4200.00	4340.00	4480.00	4620.00	4760.00
W.O	276.90	250.90	224.90	198.90	172.90
FM	600.00	600.00	600.00	600.00	600.00
BM	84.00	84.00	84.00	84.00	84.00
LS	20.00	20.00	20.00	20.00	20.00
C/Salt	24.00	24.00	24.00	24.00	24.00
Vit/min Premix	275.00	275.00	275.00	275.00	275.00
Lysine	120.00	120.00	120.00	120.00	120.00
Methoinine	260.00	260.00	260.00	260.00	260.00
Total	**100**	**100**	**100**	**100**	**100**
Cost/100kg	8774.9	8831.15	8887.4	8943.65	8999.9
Cost/kg	87.749	88.3115	88.874	89.4365	89.999

Table 3 Growth and economic performance of broiler finishers fed diets containing ginger waste meal as partial replacement for maize

Parameters	T_A	T_B	T_C	T_D	T_E
Total Wt gain (kg)	1.51	1.73	1.69	1.67	1.87
Total feed Consumed	3.71	3.83	4.97	4.16	4.67
Cost /kg feed	87.749 8	8.3115	88.874	89.4365	89.999
Total cost of feed consumed	325.55	338.24	441.71	372.06	420.29
Wt gain/kg feed	0.41	0.46	0.35	0.41	0.41
Cost/kg wt gain	219.37	203.12	245.29	222.69	224.99
FCR	2.46	2.21	2.94	2.94	2.94
Feed Efficiency	2.46	2.21	2.94	2.94	2.94

Table 4: ANOVA Table for growth and economic performance of broiler finishers fed diets containing ginger waste meal as partial replacement for maize

Parameters	A	B	C	D	E	SEM	P-value
Average initial wt./bird/(g)	840	720	850	890	850		
Av .final wt./bird (g)	2350^{e}	2450^{d}	2540^{c}	2560^{b}	2720^{a}	31.42	0.000
Total feed intake/bird(g)	3710^{e}	3830^{d}	4970^{a}	4160^{c}	4670^{b}	15.916	0.000
Av. Total wt. gain/bird(g)	1510^{e}	1730^{b}	1690^{c}	1670^{d}	1870^{a}	13.166	0.000
FCR	2.46^{b}	2.2^{c}	2.94^{a}	2.49^{b}	2.49^{b}		0.001

Note: Means with different superscripts on same row are statistically significant ($p<0.05$)

Discussion

Data for cost per kg feed are presented in Table 2. Data for total quantity of feed consumed per bird, final weight gain per bird, weight gain per kg feed, cost per kg weight gain, and feed conversion ratio are presented in Table 3; while data on the analysis of variance for growth and economic parameters are presented in Table 4.

Cost of Feed

Data presented in table 2 show the cost per kg feed (₦) for the various treatments as follows: in T_A 87.75, T_B 88.31, T_C 88.87, T_D 89.43 and T_E 89.99. The data indicates that the diet for T_E had the highest cost per kg followed by T_D, T_C and T_B respectively while T_A had the lowest cost per kg. The reason could be adduced to the fact that as the inclusion level of ginger waste increased, it had to be commensurately balanced by increasing the major protein source to make up for the shortfall in both energy and protein.

Feed Consumption

Data presented in table 3 show the total feed consumed (kg) for the various treatments as follows; in T_A 3.71, T_B 3.83, T_C 4.97, T_D 4.16 and T_E 4.67. T_C had the highest total feed consumed followed by T_E, T_D, and T_B respectively, while T_A had the lowest total quantity of feed consumed. There were significant differences in feed intake across the treatments ($p<0.05$). Feed intake increased significantly in the broiler finisher diets containing GWM over those of the control diet. The reason for the increase in the feed consumption with increase in ginger waste inclusion could be adduced to the fact that ginger waste is fibrous in nature, hence the birds had to consume more to meet up with their body requirements. This result is in line with that of Ademola *et al*., (2014), who reported higher feed intake in broilers on dietary supplementary ginger inclusion. The increased intake could have been due to lower concentration of energy per volume of feed. This is occasioned by increased level of intake as the level of ginger waste meal increased, and corroborates the findings of Omage *et al*., 2007.

Weight gain

Data presented in table 3 show the total weight gain (kg) for the various treatments as: T_A 1.5, T_B 1.7, T_C 1.6, T_D 1.67 and T_E 1.87. Birds in T_E had the highest total weight gain followed by T_B, T_C, and T_D respectively while T_A had the lowest weight gain. This trend in weight gain could be attributed to the fact that the birds consuming the diets containing ginger waste meal in their diets had a higher intake, with commensurate increase in their weight gain. It is also possible that the active ingredients in ginger waste meal encourage better feed conversion (Minh *et al*., 2010).

Weight Gain per kg Feed

Data presented in table 4 show the weight gain (kg) per kg feed for various treatments: T_A 0.41, T_B 0.4, T_C 0.35, T_D 0.41 and T_E 0.41. T_B had the highest weight gain per kg feed followed by T_D, T_E, and T_A while T_C had the lowest. This result is aligns with the work of Minh *et al* (2010) who reported that supplementation of ginger to broiler diets led to improved performance.

Feed conversion ratio (FCR)

The data presented in table 4 show the feed conversion ratio (FCR) for the various treatments as follows: T_A 2.46, T_B 2.2, T_C 2.94, T_D 2.49 and T_E 2.49. The data shows that the birds in T_B had the highest feed conversion ratio, followed by T_A, T_D and T_E while T_C had the lowest feed conversion ratio.

Cost per kg weight gain

Data presented in table 4 show the cost per kg weight gain (₦) for various treatments as follows; in T_A 219.37, T_B 203.12, T_C 245.29, T_D 222.69 and T_E 224.99. The results indicate that the diet for T_C gave the highest cost per kg weight gain followed by T_D, T_E, and T_A respectively, while T_B gave the lowest cost per kg weight gain. This result follows the same trend and also justifies that obtained for the feed conversion ratio.

Conclusion

From the results obtained from this research work, it is obvious that broiler finishers in T_B performed best, followed by T_A, T_B, T_D and T_E while T_C gave the poorest returns on investment. Though T_E and T_D incurred the highest cost, they also had the highest total weight gain which is a better performance. However, T_B showed the best feed conversion ratio thus being the most efficient in both cost and benefits.

Recommendations

Based on the results obtained from this research work, it is recommended that for optimum performance and returns on investment, ginger waste meal can conveniently be substituted for up to 5% of the maize component in broiler finisher diets. Digestibility tests should also be carried out to ascertain the actual effect of ginger meal on nutrient utilization in broiler finisher chicken.

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