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GROWTH PERFORMANCE AND COST BENEFIT ANALYSIS OF BROILER CHICKENS FED GRADED LEVELS OF TOASTED WATERMELON (*Citrulluslanatus*, Thumb) SEED MEAL AS PARTIAL REPLACEMENT FOR SOYA BEAN

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ABSTRACT
Water melon seed is a tropical protein-oil rich seed which could replace the costly soya bean in poultry diets. A study was conducted to investigate the growth performance and financial benefit of broilers fed graded levels of full-fat watermelon (*Citrulluslanatus*, Thumb) seed (WMSF) based diets. Five diets were formulated in which roasted watermelon seed replaced soyabean at 0, 10, 20, 30 and 40% levels coded as diets 1, 2, 3, 4 and 5 respectively. Two hundred (200) day old Anak broiler chicks were randomly allotted to the dietary treatments with four replications of 10 birds each in a completely randomized design. The results showed no significant ($P>0.05$) difference in feed intake, daily weight gain and FCR among the treatments at the starter phase. However, feed intake and weight gain were influenced ($P<0.05$) by dietary levels of WMSF at both the finisher phase and overall performance, while FCR was not affected. The feed cost per kilogram decreased with increasing levels of WMSF and the lowest feed cost naira per kilogram body weight gain was obtained in diet 4 (30% WMSF). It can be concluded that WMSF can replace 30% of soya bean in the diets of broiler chickens without compromising performance, however 30% inclusion levels was the most economical.
Keywords: *Broiler, Performance, Watermelon seed, Soya bean meal.*

INTRODUCTION

The major hindrance to commercial Poultry Production in Nigeria is the high cost of feed which according to Ahaotu and Ekanem (2009) accounts for 70-85% of total production cost. This is because of competition between man and animals for the available cereal and legume grains which are major sources of energy and plant proteins respectively.

In view of the stiff competition between man and animals for these conventional legumes like soya bean and ground nuts, efforts are being channelled towards the use of non-conventional feedstuffs especially legumes available locally for livestock feeds. It is expected that these alternatives should have comparative nutritive values to the conventional ones be easy to cultivate as well as cheap to afford (Nwokolo, 1986).

Watermelon (*Citrulluslanatus*, Thumb) crop is extensively cultivated throughout Northern Nigeria (Oji, *et. al.*, 1999), mainly for its fruit which is used as a dessert and the seeds thrown away. These seeds that are normally discarded pose the menace of environmental pollution and there is paucity of information on the utilization of watermelon seed (Nwokolo and Smartt, 1996). However, water melon seed when defatted can be incorporated in biscuits making and consumed by human (Abufoul, 2004), but information is required on the level of its inclusion that may be safe in poultry diets.Unextracted (full-fat) water melon seeds are rich sources of energy (oil content of 51-55%) and crude protein (32.5-38.7%) (Oyenuga and Fatuga, 1975; Al-khalifa, 1996). In a feeding experiment with chicks, it was revealed that the birds showed normal growth with up to 20% whole watermelon seed inclusion in the diet (Shazali, *etal*., 2013).

Therefore, this study investigated the growth performance and cost benefit of broiler chickens fed diets containing various levels of toasted (full-fat) water melon seed as partial replacement for soya beans.

Materials and Methods

Two hundred (200) day old Anak broiler chicks were housed in 20 pens with 10 birds in each pen of 2.6m x 3m dimension of a cement floor covered with wood shavings. The chicks were brooded for a week and fed commercial diet. Heat was provided by 200w electric bulbs and kerosine heated stove. The birds were randomly allotted to five dietary treatments and replicated four times in a completely randomized design with 10 birds per replicate.

The birds were fed and offered clean drinking water on*ad libitum*basis during the experiment which lasted eight weeks. Five experimental diets for both starter and finisher phases were formulated in which (full-fat) water melon seed replaced soya bean (full-fat) at 0(control), 10, 20, 30, and 40% levels of inclusion. The dried water melon seed was purchased from the local market of Bara in Bauchi, Nigeria. It was then winnowed using trays, handpicked to remove grits and dirt. The seeds were toasted until a change in colour is observed and a 'toasted' aroma of the seed was obtained. Maize, soya bean and watermelon seeds were milled using hammer mills before incorporation into the various diets. The percentage composition of experimental diets for both starter and finisher phase is as shown in Tables 1 and 2. All routine vaccinations and medications were carried out.

Daily records of feed intake were taken while body weights were measured on weekly basis. Records of mortality were also recorded. Data obtained on daily feed intake and daily weight gains were used to determine the feed conversion ratio (FCR) and financial benefit of partial replacement of soya bean with WMSF. Data on daily feed intake, weight gain, final live weight, feed conversion ratio, and mortality were analysed using Analysis of Variance (ANOVA) techniques as described by Steel and Torrie (1980). Difference between treatments means were separated using Duncan Multiple Range Test (Duncan,1955).

Table 1: Ingredients and composition of experimental diets fed to broilers at the starter phase (1-4 weeks)

	Diets				
Ingredients	1	2	3	4	5
Maize	38.33	38.33	38.33	38.33	38.33
Soya bean (FF)	40.97	36.87	32.78	28.68	24.58
Watermelon (FF)	0.00	4.10	8.19	12.29	16.39
Wheat offal	13.00	13.00	13.00	13.00	13.00
Fish meal	4.00	4.00	4.00	4.00	4.00
Bone meal	3.00	3.00	3.00	3.00	3.00
+Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00	100.00
Calculated Analysis					
CP (%)	23.42	23.21	23.01	22.80	22.59
ME (kcal/kg)	3025.00	3033.20	3041.38	3049.58	3057.78
CF (%)	4.88	4.96	5.05	5.15	5.26
Ca (%)	1.47	1.46	1.46	1.45	1.33
Total P. (%)	0.87	0.78	0.81	0.84	0.87

+A bio-organics nutrient supplement containing Vit. A; 4000000 i.u,Vit. D3; 800000 i.u, Vit. E; 9200mg; Niacin 11000mg; Vit.B2 2000mg; Vit.B6, 1200mg; Vit.B12 6mg; Vit. K3 800mg; Pantothenic acid 3000mg; Biotin 24mg; Folic acid 300mg; Choline Chloride 120000mg; Cobalt 80mg; Copper 1200mg; Iodine 400mg; Iron 8000mg; Manganese 16000mg; Selenium 80mg; Zinc 12000mg; Anti-oxidant 500mg. FF= Full-fat, CP= Crude Protein, ME= Metabolizable energy, CF= Crude fibre, Ca=Calcium, P= Phosphorus.

Table 2: Ingredients and composition of experimental diets fed to broilers at the finisher phase (5-8 weeks)

	Diets				
Ingredients	1	2	3	4	5
Maize	41.16	41.16	41.16	41.16	41.16
Soya bean (FF)	38.14	34.33	30.51	26.70	22.88
Watermelon (FF)	0.00	3.81	7.63	11.44	15.26
Wheat offal	15.00	15.00	15.00	15.00	15.00
Fish meal	2.00	2.00	2.00	2.00	2.00
Bone meal	3.00	3.00	3.00	3.00	3.00
+Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00	100.00
Calculated Analysis					
CP (%)	20.72	20.47	20.28	20.09	19.90
ME (kcal/kg)	3008.93	3016.55	3024.19	3031.81	3039.45
CF (%)	4.99	5.07	5.15	5.24	5.34
Ca (%)	1.28	1.34	1.33	1.33	1.33
Total P. (%)	0.72	0.74	0.74	0.75	0.75

+Premix: A bio-organics nutrient supplement containing Vit. A 3600000 i.u; Vit. D3 600000 i.u; Vit.E 4000mg;Biotin H-2 300mg; Vit. B1 640mg;Vit.B2 1600mg; Vit. K3 600mg;Pantothenic acid 2000mg; Folic acid 200mg;Cholin Chloride 70000mg; Cobalt 80mg; Copper 1200mg;Iodine 400mg; Iron 8000mg; Manganese 16000mg; Selenium 80mg; Zinc 12000mg; Anti-oxidant 500mg.FF= Full-fat, CP= Crude Protein, ME= Metabolizable energy, CF= Crude fibre, Ca=Calcium, P= Phosphorus.

RESULTS AND DISCUSSION

The percentage compositions of the experimental diets as shown in Tables 1 and 2 indicated that the diets are adequate and meets the requirement of broilers in the tropical environment (NRC, 1994; Oluyemi and Roberts, 2000; and Olomu, 2011). The results of the performance characteristics of broiler chicks at the starter, finisher and overall phases are shown in Tables 3, 4 and 5 respectively. The result at starter phase showed that none of the parameters measured were significantly (P>0.05) influenced by the treatment diets. This observation is in agreement with the result of Oloyede, *etal*., (2014) who reported that processing watermelon seed by cooking and fermentation before its inclusion into broiler diets makes the protein in the diet more available and well utilized. However, the results of the performance characteristics at the finisher as well as overall phases shows that daily feed intake (DFI) and daily weight gain (DWG) were significantly (P<0.05) different, the values obtained showed that birds on diet 2 (10%) had the highest (111.36 and 88.00g) DFI, and DWG of (22.74 and 38.30g) and lowest values were obtained from diet 5 (40%) (97.62 and 78.68g), DFI and DWG of (18.93 and 29.11g), respectively. The values obtained in diets 2 and 4 also were good and superior over the remaining diets and this in agreement with the findings of Shazali, *et. al*., (2013) who observed that full-fat water melon seed if properly processed could be incorporated in to the broiler diets, although they recommended an inclusion level of full-fat watermelon seed to a lesser level of up to 20%,while Bolu*etal*., (2011) recommended 10% levels,which is contrary to the findings of Oruwari*etal*., (1999) who reported that when toasted water melon seed could be utilized at high plant protein level (as sole source of plant proteins), with an increase in live weight and protein efficiency ratio (PER). There was no significant (P>0.05) different regarding mortality rate, however even the 5% mortality experienced during the experiment could not be attributed to the effect of the dietary treatment since it do not follow a definite pattern. Results of cost benefit analysis (Table 6) showed that diet 4 (30%) is the most economical with a least feed cost #/kg gain (#164.69).

Table 3: Performance of broilers fed experimental diets at the starter phase (1-4 weeks)

Parameters	Diets					
	1	2	3	4	5	SEM
Daily Feed Intake (g)	56.81	56.86	55.41	60.50	53.43	2.15^{NS}
Daily Weight Gain (g)	20.84	22.74	24.29	23.58	18.93	1.42^{NS}
FCR	2.74	2.51	2.30	2.59	2.88	0.14^{NS}
Mortality (%)	2.00	1.00	1.00	2.00	2.00	0.72^{NS}

NS=Not Significant, SEM=Standard error of mean

Table 4: Performance of broilers fed experimental diets at the finisher phase (5-8 weeks)

Parameters	Diets					
	1	2	3	4	5	SEM
Daily Feed Intake (g)	99.33^{c}	111.36^{a}	102.29^{bc}	107.33^{ab}	97.62^{c}	2.04^{*}
Daily Weight Gain (g)	28.93^{b}	38.30^{a}	31.70^{b}	34.91^{a}	29.11^{b}	2.00 *
FCR	3.51	2.92	3.24	3.08	3.39	0.16^{NS}
Mortality (%)	2.00	2.00	3.00	2.00	3.00	0.69^{NS}

^{abc} Means bearing different superscripts within the same row differ (*=P<0.05), NS=Not Significant, SEM=Standard error of mean.

Table 5: Pooled performance of broilers fed experimental diets at the overall phase (1-8 weeks)

Parameters	Diets					
	1	2	3	4	5	SEM
Daily Feed Intake (g)	81.02^{b}	88.00^{a}	82.20^{b}	86.19^{a}	78.68^{b}	2.84^{*}
Daily Weight Gain (g)	25.46^{b}	31.63^{a}	28.52^{b}	30.05^{ab}	24.75^{b}	1.63 **
FCR	3.11	2.79	2.89	2.88	3.22	0.13^{NS}
Mortality (%)	4.00	4.00	4.00	4.00	5.00	0.79^{NS}

^{abc} Means bearing different superscripts within the same row differ (*=P<0.05), (**=P=0.01)NS=Not Significant, SEM=Standard error of mean.

Table 6: Cost benefit analysis of performance of broilers fed water melon based diets

Parameters	Diets				
	1	2	3	4	5
Total Feed Intake (kg)	3.97	4.31	4.03	4.22	3.86
Feed Cost (N/kg)	62.26	60.78	59.14	57.37	55.41
Total Feed Cost	247.17	261.96	238.33	242.10	213.8
Total Weight Gain (kg)	1.25	1.55	1.40	1.47	1.21
Feed Cost N/kg Gain	197.74	169.01	170.23	164.69	176.76

Conclusion

In conclusion, full-fat toasted water melon seed can be efficiently used to replace part of soya bean meal. Therefore, if properly processed water melon seed can replace the costly soya bean up to 30% level of inclusion in the diets of broilers without depression on performance and with concomitant reduction on feed cost.

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