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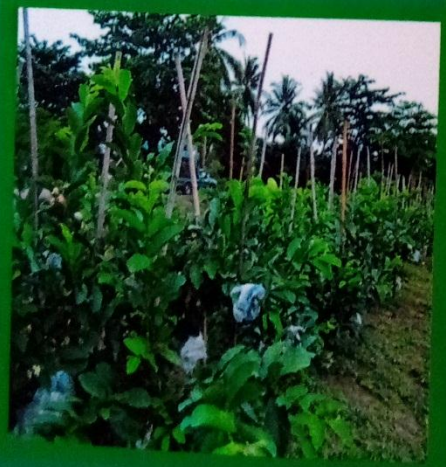

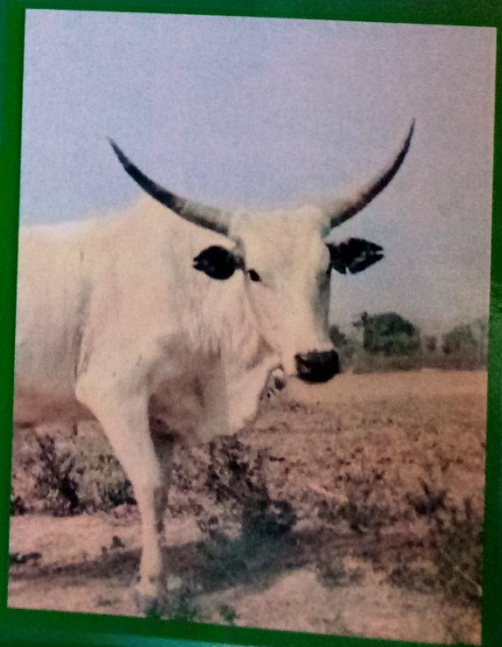

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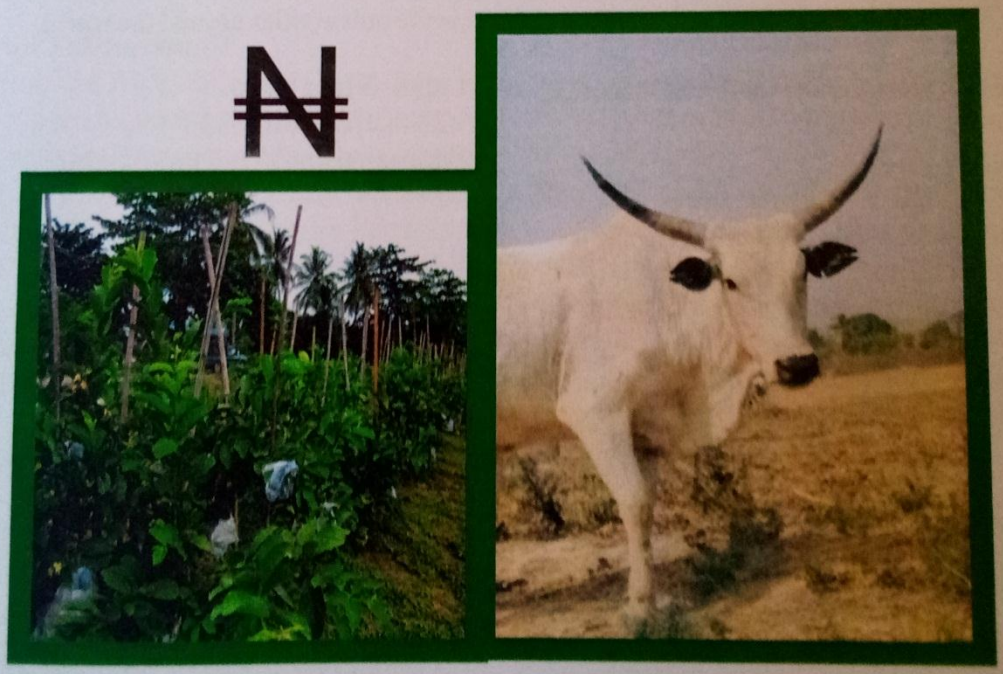

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GROWTH PERFORMANCE AND COST BENEFITS OF BROILER CHICKENS FED GRADED LEVELS OF DRIED SWEET ORANGE PEEL MEAL AT STARTER PHASE

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ABSTRACT

The study was conducted at the poultry unit of Animal Production Teaching and Research Farm of Federal University of Technology Minna Niger State in October, 2018, to determine the growth performance and cost benefits of broiler chickens fed graded levels of Dried Sweet Orange Peel Meal (DSOPM). Five different diets (Treatments 'T') namely the control (T_1) and four test diets T2, T3,T4 and T5 in which the DSOPM replace maize at 0%, 5%, 10%, 15% and 20%, respectively. Each diet served as a treatment and each treatment was replicated three (3) times in a complete randomized design. There were ten (10) birds per replicate making a total of one hundred and fifty (150) Broiler birds for the study. The experiment lasted for four (4) weeks. The results obtained showed significant difference ($P< 0.05$) in average body weight, average body weight gain, feed conversion ratio and protein efficiency as the level of DSOPM in the diets increased. Initial body weight, average feed intake as. Feed conversion ratio was negatively affected whereas protein efficiency was positively affected. The value of cost benefit parameters were significantly different from each other ($P<0.05$). The result of this study shows that the inclusion of DSOPM has effect on the growth performance of broiler chicken and lead to reduction in cost benefit as the percentage inclusion of DSOPM increases.

Key words: Broiler, Starter, Growth, Cost, Benefit, Orange peel

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INTRODUCTION

Nutrition and diseases are the major limiting factors in poultry production with feed alone representing about 70 – 80% of variable cost of production in a typical poultry industry (Akinmutimi, 2006). The cost of conventional protein and energy sources such as soya bean, fish meal and maize for poultry in many tropical countries have been on the increase, and this is gradually discouraging the complete use of these conventional feedstuff in formulating poultry feed (Oduguwa *et al.*, 2004). Efforts are being made by animal nutritionists to explore the possibilities of introducing non-conventional feed-stuffs in poultry and livestock production (Idahor *et al.*, 2010). The use of agro-industrial by-products is a way of solving this problem of high cost of feed ingredient, which result to high cost of production since some of this non-conventional feed ingredients are gotten freely (orange peel) and are not in competition with man's dietary needs (Oluremi *et al.*, 2010).

Sweet orange fruits are produce in large quantity in Nigeria, making their peels evidently abundant (Oluremi *et al.*, 2010). Nutritional trials with non-ruminant animals have indicated that meal of sun-dried sweet orange peel can replace up to twenty (20%) of the dietary maize in broiler diet. However, there is paucity of information on the cost benefit analysis of this replacement at the starter phase of broiler production. This study therefore, was set to determine the growth performance and cost benefits of broiler chickens fed graded levels of dried discarded sweet orange peel meal at starter phase.

MATERIALS AND METHODS

The research was conducted at the poultry unit of Animal production Teaching and Research farm of Federal University of Technology Minna, located within the Guinea Savannah zone of Nigeria, around latitude 9°37 North and longitude 6°33 East, characterized by wet (April-October) and dry season (November-March) with mean annual rainfall range of 1,100 – 1,600 mm, and an annual mean temperature range of 21° C-36.5° C (FUTGIC, 2018).

One hundred and fifty (150) day old Arbor acre breed of mixed sexes used in this study were purchase from Agro Bounty Harvest broiler Chicks Company, Ibadan, Oyo state, Nigeria. The chicks were randomly allotted to 5 treatment groups with thirty birds per treatment in a Completely Randomized Design (CRD) arrangement. Each treatment group was further replicated into three, with ten birds par replicate.

Fresh sweet orange peels (*Citrius sinensis*) were sourced from different

orange fruit sellers within Gidan Kwano community, Minna, Niger state. The sweet orange peels were sun-dried for seventy two hours and further oven dried at 50°C for 2 hours to reduce the presence of anti-nutrient. The dried peels were milled using different milling sieve for starter phase and stored in air-tight polythene bag in a store room, for seventy two hours until ready to be used. Feed ingredients were acquired directly from accredited dealers at Kure Market, Bosso, Minna, Niger State.

Five experimental diets were compounded namely; the control diet (0%) which do not contain the test ingredient (dried sweet orange peel) and four (4) other diets at 5%, 10%, 15% and 20% inclusion levels, respectively. The percentage ingredients composition of the diets fed at the starter phase is presented in Table 1. Proximate composition of the dried sweet orange peel meal and the experimental diets were carried out using the procedure of AOAC (2000) as shown on Table 2 and 3, respectively. All routine management practices and vaccination schedules were carried out during the four (4) weeks period of this research work. Growth and cost benefit parameters were determined. The total weight gain and quantity of feed consumed was recorded in Kg. The prevailing market prices (N) of feedstuffs was used to calculate the cost per kilogram of feed in (N/kg). Total cost of feed consumed (N/kg) was determined as total feed intake (kg) × cost per kg of feed. The cost of feed per weight gain was as well determined in (N/Kg) as Total cost of feed consumed / total body weight gain.
Cost saving (%) = A – B/A× 100.
(A =cost/ kg of the control diet, B =cost/kg of the test diet).

Data analysis

Data collected on growth parameters and cost benefit of the broilers were subjected to one-way analysis of variance (ANOVA) using the Statistical Package for Social Scientists (SPSS version 17.0), where differences occurred, Duncan Multiple Range Test was used to separate

Table 1: Ingredients composition of experimental diets at starter phase (0-4week)

Ingredients	T1	T2	T3	T4	T5
Maize	57.8	54.8	51.7	48.7	45.7
DSOPM	0.00	2.90	5.80	8.70	11.60
Maize offal	3.00	3.00	3.00	3.00	3.00
GNC	11.00	11.00	11.00	11.00	11.00
Fish meal	11.00	11.00	11.00	11.00	11.00
Soyabean meal	11.00	11.00	11.00	11.00	11.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Limestone	2.50	2.50	2.50	2.50	2.50
Salt	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
TOTAL	100	100	100	100	100
Calculated value					
Crude protein	23.01	22.99	23.02	23.00	22.99
Crude fibre	4.06	4.19	4.33	4.41	4.59
M.E (Kcal/Kg)	2896.85	2896.20	2894.90	2894.30	2893.65
Calcium	2.86	2.86	2.86	2.86	2.86
Phosphorus	1.24	1.23	1.22	1.21	1.20

Key: DSOPM (Dried Sweet Orange Peel Meal), GNC (groundnut cake), C.V (calculated value), M.E (metabolisable energy), T1 (0% of dried sweet orange peel), T2 (5% of dried sweet orange peel meal), T3 (10% of dried sweet orange peel meal), T4 (15% of dried sweet orange peel meal), T5 (20% of dried sweet orange peel meal),

Table 2: Proximate composition of dried sweet orange peel meal

Parameters (%)	Percentage Value (%)
Moisture	12.2
Dry matter	87.8
Ash	7.5
Lipid	16.5
Crude protein	8.05
Crude fibre	7.5
Nitrogen free extract	48.3

Table 3: Proximate composition of experimental diets fed at starter

Parameters (%)	T1	T2	T3	T4	T5
Moisture	8.4	8.2	7.6	7.2	8.2
Dry matter	91.6	91.8	92.4	92.8	91.8
Ash	5.0	6.5	5.5	7.0	8.0
Lipid	11.5	10.0	8.0	11.0	7.5
Crude protein	23.1	22.8	22.1	21.4	23.5
Crude fibre	6.0	4.0	4.5	4.5	6.0
NFE	46	48.5	52.3	48.9	46.8

Key: T1= 0 % of dried sweet orange peel meal, T2= 5 % of dried sweet orange peel meal, T3= 10% of dried sweet orange peel meal, T4= 15 % of dried sweet orange peel and T5= 20 % of dried sweet orange peel meal. NFE: Nitrogen free extract.

RESULTS

Proximate composition of dried sweet orange peel meal

The proximate composition of the dried sweet orange peel meal is presented in Table 2. The results revealed the proximate composition of 12.2% (moisture), 87.8% (dry matter), 7.5% (ash), 16.5% (lipids), 8.05% (crude protein), 7.5% (crude fibre) and 48.3% (nitrogen free extract).

Proximate Composition of Experimental Diets Fed at Starter phase (0-4weeks).

The results of the proximate composition of the experimental diets fed to the broiler chickens at starter phase is presented in table 3. The ranges of moisture (7.2 - 8.4%), dry matter (91.6-92.8%), ash (5-8.0%), lipid (7.5-11.5%), crude protein (21.4-23.5%), crude fibre (4-6.0%) and nitrogen free extract (46-52.3%) are contained in the diets.

Growth performance of broiler chickens fed graded levels of dried sweet orange peel Meal at starter phase

The results of the growth performance of broiler chickens fed diets containing graded level of dried sweet orange peel at starter phase is presented in table 4. The results indicates that all parameters measured were significantly different ($P<0.05$). T1 recorded the highest final body weight of 312.08g/birds. Final body weights of T2 (261.98g / bird), T3 (235.65g/ bird), T4 (220.28g/bird). The average body weight of T3 (133.14g/ bird), T4 (132.24g/bird), T5 (121.85g/bird) were also statistically similar while T1 (179.55g) record the highest value. The average body weight gain was significant different ($P<0.05$) among the treatment groups. T1 (83.41g/bird) was the highest value recorded while T2 (38.88g/bird), T3 (36.09g/bird), T4 (34.67g/bird) were statistically similar among the treatment groups. There was no significant difference ($P<0.05$) in the average feed intake recorded among the treatment groups. However, birds in T1 recorded the most average feed intake of 166.10g/bird, while T2 (105.15g/bird), T3 (98.39g/bird), T4 (81.95g/bird) and T5 (84.71g/bird). Feed conversion ratio was significantly different ($P<0.05$) among treatment groups. T1 recorded the best feed conversion ratio of 2.17 while T5 (5.05) recorded the least value. Also the value recorded by T2 (2.68) was statistically the same as T1, while T3 (3.25) and T4 (3.60) were statistically similar. Protein efficiency ratio was significantly different ($0<0.05$) among the treatment groups. The highest protein efficiency ratio was recorded in T4 (0.67), while T1 (0.46) had the least protein efficiency ratio. The protein efficiency ratios of T2 (0.63) and T5 (0.63) were statistically similar and the value for T3 (0.52) was also similar to that of T2 (0.63) and T5 (0.63).

Table 4: Growth Performance of Broiler Chickens Fed Graded Levels of Dried Sweet Orange Peel meal at Starter Phase

Parameters	Treatment					SEM	LS
	T1	T2	T3	T4	T5		
IW (g/b)	54.13	54.07	54.13	53	54.13	0.03	NS
FW (g/b)	312.08	261.98	235.65	220.29	179.67	15.76	NS
ABW (g/b)	179.55^{a}	158.65^{ab}	133.14^{b}	132.24^{b}	121.85^{b}	5.78	*
ABWG(g/b)	83.41^{a}	38.88^{b}	36.09^{b}	34.67^{b}	31.40^{b}	2.81	*
AFI (g/b)	166.10	105.15	98.39	81.95	84.71	5.49	NS
FCR (g/b)	2.17^{a}	2.68^{ab}	3.25^{b}	3.60^{b}	5.05^{c}	0.31	*
PER	0.46^{c}	0.63^{ab}	0.52^{b}	0.67^{a}	0.63^{ab}	0.02	*

Key: IW (initial body weight), ABW (average body weight), ABWG (average body weight gain), AFI (average feed intake), FCR (feed conversion ratio), PER (protein efficiency ratio), FW (final weight), SEM (standard error of mean) LS (level of significance), * (significance at $p<0.05$), NS (Not Significance), T1 (0% of Dried Sweet orange peel meal), T2 (5% of dried sweet orange peel meal), T3 (10% of dried sweet orange peel meal), T4 (15% of Dried sweet orange peel and T5 (20% of dried sweet orange peel meal)

Cost Benefits of Broiler Chickens Fed Diets Containing Dried Sweet Orange Peel Meal at Starter Phase (0-4 weeks)

The cost benefit indicators of broiler chickens fed graded levels of discarded dried sweet orange peel meal at starter phase is presented in table 5. The results indicated that the cost benefit parameters (feed intake, cost per kilogram of feed, total cost of feed intake, cost per kilogram weight gain and percentage savings) measured were significantly different ($P<0.05$) between the treatment groups. Total feed intake was significantly different ($P<0.05$) among treatment groups. T1 (4.84kg) recorded the highest feed intake and T5 (3.06kg) recording the least, T4 (3.18kg) were statistically similar to T2 (3.39kg). The cost per kilogram of feed was as well significantly different ($P<0.05$) among the treatment groups. T1 (N172.02) records the highest value followed by T2 (N169.13) while the values of T3 (N166.05), T4 (N163.04) and T5 (N160.31) were statistically similar. The total cost of feed consumed was also significantly different ($P<0.05$) among treatment groups. T1 (N833.15) recorded the highest and T5 (N489.90) recorded the least but statistically similar

to T4 (N518.95), while T3 (529.70) was similar to T2 (573.06). More so, the cost of feed per kilogram body weight gained recorded was significantly different ($P<0.05$) among the treatment groups. The value in Naira range from 54.01 - 139.28, with T1 (N139.28) being the highest and T5 (N54.01) being the lowest. Percentage savings recorded in the study was significantly different ($P<0.05$) among treatment groups. T5 (6.81 %) recorded the highest percentage saving followed by T4 (5.22 %), T5 and T3 (3.47%) while T1 (1.68 %) had the least percentage savings.

Table 5:Cost Benefits of Broiler Chickens Fed Diets Containing Dried Sweet Orange Peel Meal at Starter Phase.

Treatment	T1	T2	T3	T4	T5	SEM	LS
Tfi (kg)	4.84^{a}	3.39^{b}	3.19^{bc}	3.18^{bc}	3.06^{c}	1.80	*
Cf/kg (₦)	172.02^{a}	169.13^{b}	166.05^{c}	163.04^{d}	160.31^{e}	1.12	*
Tcfc (₦)	833.15^{a}	573.06^{b}	529.70^{bc}	518.95^{c}	489.90^{c}	33.83	*
Cf/bwg (₦)	139.28^{a}	72.06^{bc}	82.97^{b}	61.86^{c}	54.01^{c}	8.54	*
% Saving	-	1.68^{d}	3.47^{c}	5.22^{b}	6.81^{a}	0.65	*

Key: TFI (Total feed intake), CF/KG (cost per kilogram of feed), TCFC (total cost of feed consumed), CF/BWG (cost of feed per body weight gain), SEM (standard error of mean) and LS (level of significance), * (Significance at $p<0.05$), T1 (0 % Dried sweet orange peel meal), T2 (5% Dried sweet orange peel meal, T3 (10% Dried Discarded sweet orange peel meal, T4 (15% Dried Sweet orange peel meal), T5 (20% of dried sweet orange peel meal).

DISCUSSION

Feed intake declined significantly as a result of the inclusion of dried sweet orange peel (DSOPM) at varying levels of inclusion. This finding was in agreement with the reports of (Agu *et al*., 2010; Oluremi *et al*., 2007; Oluremi *et al*., 2010). The decrease in feed intake at various treatment levels despite heat treatment of the test material could be suggestive of the presence of high concentrations of heat-stable phenolic metabolites such as condensed Tannins present in orange peels as they are known to reduce palatability and depress digestibility of livestock feed (Markkar

2003).

The depressed final body weight and body weight gain recorded due to the inclusion of sweet orange peels in the broiler starter diets could have been due to the decrease feed intake earlier stated. The observations made from this study was similar to the report of (Agu *et al.*, 2010) who reported that growth performance of broilers chickens can likely be affected by the presence of anti-nutrients that evidently affect palatability which could in turn affect the feed intake indirectly. Ani *et al*., (2011) also opined that consumption of diets containing anti-nutrients by poultry birds can results into decline in weight gain of birds as a result of depressed feed intake and lower efficiency of feed utilization.

Protein efficiency ratio and efficiency of feed conversion and utilization were observed to have declined at the 10% sweet orange peel inclusion level. This observation agreed with the findings of Kumar and Grueling (1971) which showed that dried sweet orange pulp when incorporated into the diet of rabbits had a significant effect on protein efficiency ratio.

The low cost per feed intake and cost per kg body weight gain recorded in this study could be due to minimal cost implication of moving around to collect sweet orange peels from orange sellers used to replace maize, whose prices have been soaring as an energy source. This findings is in agreement with the report of (Ani *et al.*, 2012) which showed that broiler chickens fed diets containing graded level of raw Bambara nut waste had significant lower costs of daily and total feed intake. Thus the farmer is made to save more money for it inclusion.

Poultry farmer could use dried sweet orange peel meal up to 15% inclusion as a replacement of maize without any effect on final weight of birds, however 5% inclusion can be used to attain an appreciable body weight.

Further research should be carried out on other methods of reducing the anti-nutritional factor present and proper laboratory examination of the phytochemicals in the peel so as to encourage the use of dried sweet orange peel meal in broiler feed formulation and production.

CONCLUSION

Based on the findings of this research work, it is therefore concluded that:

The incorporation of dried sweet orange peel meal into the feed of broiler chickens at the starter phase at 0- 5% results into a better growth performance and FCR of the experimental birds.

The inclusion of dried sweet orange peel meal in the diet of broiler chickens at starter phase up to 20% in replacement for maize lead to a reduction in the cost benefits incurred in raising broiler chickens, as the level of DSOPM tends to increase.

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