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308 Lasani Town, Sargodha Road, Faisalabad - Pakistan  
Mob: +92 300 3008585, Fax: +92 41 8815544  
E-mail: editorijps@gmail.com

## **Partial Substitution of Soyabean Meal with Breadfruit (*Artocarpus altilis*) Seed Meal in Broiler Starter Diets: Effects on Performance, Water Consumption and Carcass Characteristics**

Nwokoro, Smart O. and Joseph O.I. Obasuyi

Department of Animal Science, Faculty of Agriculture, University of Benin, Benin City, Nigeria

**Abstract:** The study was initiated to ascertain the effect of partial substitution of soyabean meal with breadfruit (*Artocarpus altilis*) meal in broiler starter chickens diets reared in a tropical environment. 300 broilers chicks were used for the study and they were divided into 15 replicate groups such that three replicates were allocated to a diet. Five broiler starter diets (3000 Kcal MEK<sup>-1</sup> and 24% CP) were formulated such that the Soya bean meal in the diet were replaced with breadfruit seed meal at 0, 10, 20, 30 and 40% levels. The birds were fed and watered *ad libitum* for the 4 weeks of the study. Results indicated that final live weights of birds, weight gain, feed and water intakes, daily nitrogen retention, packed cell volume and back wholesale carcass cuts of the broilers indicated significant ( $P < 0.05$ ) differences. It also showed that birds on control diet (diet 1) recorded significantly ( $P < 0.05$ ) higher body weight, weight gain, feed intake than those of other diets (10, 20, 30 and, 40 % breadfruit seed meal based) which were not different from each other. There were consistent decrease in feed and water consumption with increasing breadfruit meal level of dietary inclusion. Results for the nitrogen retention revealed that the best values were recorded in diets 3 and 4 followed by diet 5, while the least were obtained in diets 1 and 2. Results for the blood metabolites indicated that only PCV and globulin showed significant differences, where only diet 5 (for PCV) were different from all other diets. Other parameters measured were not consistent. The value for the carcass back cut indicated a decreasing back cut between diet 1 and 5 with the exception of diet 3. Treatments had no effect on mortality.

**Key words:** Soyabean meal, breadfruit meal, broiler starter diet

### **Introduction**

Nutrition is the science of nutrients intake, utilization and systems relevance. In livestock feeding, feed is one of the greatest suspects in meeting the nutritional relevance. According to numerous investigators (Egbewande and Olorede, 2003; Ikhatua, 2000; Nwokoro and Tewe, 1996; Olomu, 1996; Fetuga, 1984; Olyemi and Roberts, 1979) in our region, feed accounts for between 60 and 80 percent of costs of production of livestock under intensive or standard management systems. These have been attributed (Amaefule and Obioha, 2001; Tewe, 1998; Olomu, 1995) to inadequate production of relevant feed resources, competition between man and livestock, poor quality feed ingredients among others. Udedibie (1997) reported that there is constant quest for improving current popular protein sources and finding ways of exploiting the neglected and underutilized ones. The soyabean apart from being a major human food staple in our zone, is very expensive as larger quantity are imported. In addition, it is the main plant protein ingredient used for feeding monogastrics. Breadfruits are the wild abundant crop types found in our zone, which had not gone through any form of improvement. Consequently, the need for exploration of alternative feed resources or ingredients with less competition and costs have been

major sustainable avocations. Hence, this study was initiated to ascertain the effects of partial replacement of soyabean meal with breadfruit seed meal in broiler starter ration.

### **Materials and Methods**

**Processing of Breadfruit seed meal:** The well-matured seeded breadfruits (*Artocarpus altilis*) were harvested in our study zone where our Laboratory is located. The fruits were opened and sundried (30-35°C), thereafter the seed coat were removed. This was followed by defatting using the solvent (N-hexane) extraction and then the chemical compositions (AOAC, 1990) were determined. The defatted samples were properly stored before usage for the feeding trial.

**Experimental diets:** Five isonitrogenous and isocaloric experimental diets, each containing 24% CP and 3,000KcalME/Kg diet were formulated (Table 1). The soyabean meal in the Control diet (Diet 1) was partially substituted with breadfruit seed meal at 10, 20, 30 and 40 percent (weight for weight).

**Birds and management:** 300 broiler chicks (Anak breeds) obtained at day old were used for the study. The chicks were randomly allotted into three groups of 20

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Table 1: Composition of experimental diets (percent)

Ingredient	Diets (% Replacement)				
	1 (0)	2 (10)	3 (20)	4 (30)	5 (40)
Maize	31.60	31.60	31.60	31.60	31.60
Breadfruit seed meal <sup>1</sup>	-	3.47	6.94	10.41	13.88
Soyabean meal	34.70	31.23	27.76	24.29	20.82
Fish meal	9.70	9.70	9.70	9.70	9.70
Wheat	13.00	9.60	6.60	3.60	0.60
Brewer's dried grain	6.60	10.00	13.00	16.00	19.00
Bone meal	2.50	2.50	2.50	2.50	2.50
Limestone	1.30	1.30	1.30	1.30	1.30
Common salt (NaCl)	0.35	0.35	0.35	0.35	0.35
Premix <sup>2</sup>	0.25	0.25	0.25	0.25	0.25
<b>Composition</b>					
Crude protein (%)	24.00	24.00	24.00	24.00	24.00
ME (Kcal kg-1)	3000	3000	3000	3000	3000
Crude fibre(%)	5.20	6.20	6.80	7.30	7.90
M + C (%)	0.94	1.09	1.20	1.22	1.30
Lysine (%)	1.61	1.54	1.49	1.36	1.32

<sup>2</sup>Composition of vitamin – mineral premix per kg of diet: vit A., 5,000 IU; Vit. D<sub>3</sub>, 800IU; Vit E. 12mg; vit. B<sub>6</sub>, 1.5mg; Niacin, 12mg; pantothenic acid, 5mg; Biotin, 0.02mg; vit. B<sub>12</sub>, 0.01mg; Folic acid, 0.3mg; chlorine chloride, 150mg; manganese, 60mg; iron, 10mg; zinc, 15mg; 15mg; copper, 0.8mg; iodine, 0.4mg; cobalt, 0.08mg; selenium, 0.04mg; antioxidants, 40mg.

<sup>1</sup>Breadfruit seed meal contained the following (%), DM (95.68), CP (27.93), EE (1.62), CF (15.37), Ash (2.75), NFE (48.03).

birds per group such that each experimental diet was allocated to three replicate groups in a completely randomized design pattern.

The birds were housed in the open-sided dwarf walled poultry house partitioned into equal-sided pens (2.24m x 1.2m) by wire netting and wooden structures such that a space of 0.13m<sup>2</sup> per bird was allocated. Other management practices including brooding were as recommended by Oluyemi and Roberts (1979). The birds were vaccinated against New Castle Disease (Day 1) and Infectious Bursal Disease (week 3). Birds were fed and watered *ad libitum* and the study was terminated at the end of the 4<sup>th</sup> week. The body weights of birds were taken at the beginning of the study, weekly thereafter until the end of the experiment. The feed intake was measured on daily basis while the nitrogen balance study and serum metabolites were determined in the 4<sup>th</sup> week. The carcass measurements were carried out on the last day of the study.

**Nitrogen retention:** Three birds per replicate of known weights were transferred to individual metabolism cages (15cmx15cmx15cm), where feed and water were provided *ad libitum*. Four days was allowed for adjustment, while data was collected 3 days subsequently, such that the metabolic study lasted for 7 days. The collection of droppings and processing before analyses were as recommended by Nwokoro and Tewe (1996). The samples of feeds and faeces were analyzed (AOAC, 1990) for DM, CP, and this was followed with usual computation for nitrogen retention.

**Water consumption:** The water intakes were measured

daily. A correction factor of measure of water evaporation in the poultry house during the periods of measurements were deducted from the total water consumption per treatment group.

**Measurement of blood metabolites:** At the end of the trial, blood samples were collected from each group of birds and processed accordingly (Maurya *et al.*, 1998). Thereafter, the pack cell volume, blood sugar, total protein, albumin, and globulin were determined (Skye, 1978).

**Carcass measurements:** Slaughtering and processing of the experimental birds were carried out in the University Farm Slaughter Slab. The procedures employed including partitioning into wholesale cuts and separation of relevant organs were as described by Nwokolo (1985) and, Oluyemi and Roberts (1979).

**Study environment:** The experiment was carried out in Edo State, Nigeria. The area is a typical rainforest zone bounded by Savanna (on the North) and South (by Swamp) and characterized by wet and dry Season. It is situated between Latitude 7° and 8° North of the Equator and has an annual rainfall between 175cm and 200cm with mean temperature of 34°C.

**Data analyses:** All data collected during the entire experiment were subjected to analysis of variance (Steel and Torrie, 1980) and significance between means using Duncan's multiple range tests at 5% level of probability.

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Table 2: Performances of the broilers fed graded levels of breadfruit seed meal diets

PARAMETER	Diets (% Replacement)					SEM
	1 (0)	2 (10)	3 (20)	4 (30)	5 (40)	
Initial weight (g/bird)	40.30	40.50	40.00	40.30	40.00	0.14
Final weight (g/bird)	589.50 <sup>a</sup>	486.90 <sup>b</sup>	461.00 <sup>b</sup>	487.50 <sup>b</sup>	369.50 <sup>c</sup>	15.46
Weight gain (g/bird)	19.70 <sup>a</sup>	16.00 <sup>bc</sup>	15.10 <sup>c</sup>	16.00 <sup>bc</sup>	11.80 <sup>d</sup>	0.35
Feed intake (g/bird/day)	36.90 <sup>a</sup>	33.20 <sup>ab</sup>	31.30 <sup>b</sup>	31.30 <sup>b</sup>	22.90 <sup>c</sup>	1.03
Feed/gain ratio	1.90	2.20	2.20	2.10	2.20	0.02
Water intake (mls/bird/day)	72.90 <sup>a</sup>	61.60 <sup>a</sup>	61.10 <sup>a</sup>	60.30 <sup>a</sup>	47.10 <sup>b</sup>	3.46
Water/feed ratio	2.10	1.80	2.00	2.00	2.10	0.10
Protein efficiency ratio	2.40	2.00	1.90	2.10	2.20	0.12
Daily nitrogen retention (%)	67.40 <sup>a</sup>	66.10 <sup>b</sup>	84.80 <sup>b</sup>	86.10 <sup>b</sup>	77.00 <sup>c</sup>	0.23
Mortality (%)	2.50	5.00	2.50	2.50	7.50	0.74

abcd Means on the same row with different superscript are significantly (P<0.05) different.

Table 3: Hematocrit and some plasma metabolites of birds

Parameters	Diets (% Replacement)					SEM
	1 (0)	2 (10)	3 (20)	4 (30)	5 (40)	
Pack Cell Volume (%)	26.50 <sup>a</sup>	24.50 <sup>a</sup>	26.50 <sup>a</sup>	25.00 <sup>a</sup>	15.00 <sup>b</sup>	1.53
Blood sugar (mgdl <sup>-1</sup> )	59.00	51.50	50.50	51.00	60.00	10.30
Total protein (mgdl <sup>-1</sup> )	4.30	5.70	4.60	5.10	6.80	0.70
Albumin (mgdl <sup>-1</sup> )	2.80	3.70	2.90	2.80	3.80	0.84
Globulin (mgdl <sup>-1</sup> )	1.50	2.00 <sup>ab</sup>	1.70 <sup>a</sup>	2.40 <sup>ab</sup>	3.00 <sup>b</sup>	0.25

ab Means on the same row with different superscript are significantly (P<0.05) different.

**Results**

The study was to ascertain the nutritive value of breadfruit seed meal for broiler starter chickens. The performances of birds are presented in Table 2, while the haematological indices and carcass characteristics are indicated in Tables 3 and, 4 respectively.

Performance parameters (Table 2) revealed that the final live weights of birds, weight gain, feed intake, water consumption and, daily nitrogen retention were significantly (P< 0. 05) affected by dietary treatments. It also indicated that broiler birds fed diet 1 (Control) recorded significantly higher final body weight, weight gain, feed intake than those (Diets 2, 3, and 5) whose diets contained breadfruit meal. However, the feed to gain ratio, water to feed ratio, and protein efficiency ratio were not significantly (P > 0.05) affected by dietary treatments. Broiler starter chickens fed diets containing 40% level of replacement (Diet 5) recorded the least final live weight, feed consumption, feed per gain ratio, and water intake.

Results indicated that the breadfruits based diets recorded lower final body weight, weight gain, feed intake and water consumption in comparison with the control. But that the diets 2(30), 3(20), and 4(30) were not different from each other. The best feed per gain ratio (though not significant) was recorded in Diet 1 while the least (2.20) were recorded in Diets 2, 3, and 5. However, the results for the nitrogen retention showed that broiler birds on Diets 3, 4 and 5 recorded significantly higher retention than the control (except for those on diet 2)

where the least (66.10%) was obtained. The highest retentions were obtained in diets 3 and, 4 and these were followed by those on diet 5.

Although the mortality patterns were not consistent with the diets, the highest level (7.5%) was found in the 40% breadfruit seed meal diet (Diet 5). This was however, followed by that for diet 2(10% level).

The results for the haematological indices revealed that only the packed cell volume and globulin (Table 3) indicated some level of significance. Also, the value for the packed cell volume showed that only those of broilers reared on Diet 5 (40% replacement diet) were significantly different from other Diets (1,2,3, 4), which were similar, while the values for diets 2,3, and 4 were not significant from that of diet 5. Results for the blood sugars, total protein and albumin were not significantly (P> 0.05) different from each other.

Table 4 shows the values for the carcass characteristics of the broiler starters. It indicated that apart from the back whole sale cuts (calculated as percent of live weight), there was no significant differences for all other parameters (dressing percentage, eviscerated weight, leg, head, neck, wings, breast, drumstick, thigh, and giblets) measured. In the values for the back cut, it indicated a decreasing back cut (except diet 3) with increasing level of breadfruit seed meal in the diet (Table 4).

**Discussion**

Results obtained (Table 2) showed that final body weight, weight gain and feed intake of birds were

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Table 4: Carcass characteristics of experimental birds diets (%replacement)

Characteristics	1 (0)	2 (10)	3 (20)	4 (30)	5 (40)	SEM
Dressing percentage	74.90	73.90	77.40	75.20	74.60	1.67
Eviscerated weight (g)	510.60	420.90	417.60	414.00	321.30	9.04
Leg (*PLW)	5.70	5.20	6.20	5.90	6.60	0.42
Head (PLW)	4.50	4.30	4.60	4.70	4.40	0.73
Neck (PLW)	4.40	4.80	4.40	4.10	3.70	0.22
Wing (PLW)	9.00	8.40	8.40	7.50	7.90	0.32
Breast (PLW)	15.10	16.00	15.50	16.60	14.60	0.59
Back (PLW)	18.20 <sup>a</sup>	17.10 <sup>b</sup>	17.40 <sup>ab</sup>	15.70 <sup>c</sup>	14.20 <sup>d</sup>	0.27
Drumstick (PLW)	10.40	10.10	10.60	9.80	10.10	0.34
Thigh (PLW)	9.40	9.60	9.90	9.70	9.30	0.77
Giblets (PLW)	7.00	6.30	6.40	7.30	7.70	0.78

\* PLW = Percentage of live weight. abcd Means on the same row with different superscript are significantly (P<0.05) different.

significantly (P<0.05) affected by increasing level of breadfruit meal in the rations. The broiler starter chickens fed control diets exhibited body weight gain and feed intake higher than those obtained with similar (same energy and protein) diets containing breadfruit seed meals. This may be indicative that the level of nutrition was less for breadfruit seed meal diets compared to the control. This is similar to that observed by Emenalon (2004) and Esonu (2001) when broiler starters were fed graded levels of *Mucuna pruriens* seed meals. Also, Offiong (1984) observed that a group of birds with lower feed intake values than the control were on diets containing high level of crude fibre than the control diets. Thus noted that the diets with the crude fibre must have decreased nutrient density. Hence, under the observed growth depression in broiler chickens fed rations containing test ingredients may be indicative of depressant factor(s). The higher crude fibre level of inclusion may be contributory (Adeniji, 2005; Fanimo *et al.*, 2005; Farrel, 2005; Carre, 2004; Onifade and Babatunde, 1997a,b).

The same energy and protein levels (3000KCa/MEKg<sup>-1</sup> and 24% CP) were fed to the birds. This may indicate a level of uniformity of diets for their optimal performance. This ME and CP levels in the experimental diets met the requirements for broiler chickens between 0 and 4 weeks of age in the tropics (Amubode, 1981; Fetuga, 1984; Olomu, 1995). But the differences in observed growth performance in this study may be alleviated by dealing with the performance depressing factors after identification. Also, Oluyemi and Roberts (1979) and Bragg and Sharby (1970) reported that the reduction in feed intake of birds might also indicate that one or more amino acids were limiting for optimum performance.

It was observed from the study that water consumption of birds were not significantly (P>0.05) affected up to 30% level (Diet 4) of breadfruit seed meal inclusion in the diets. The highest mean water intake (72.90 mls bird<sup>-1</sup>day<sup>-1</sup>) was recorded in the control diet, while the least (47.10mls birds<sup>-1</sup>day<sup>-1</sup>) was found in the 30% level broiler diet. Thus revealing that water consumption decreased with increasing dietary inclusion of breadfruit seed meal. This observed trend under the conditions of this study may be due to corresponding reduction in feed

intake as similar trend like the water consumption was observed for the water to feed ratio up to 30% level of feed meal inclusion in the diets. This general trend of water and feed intake are inline with previous reports (Olomu, 1995; Oluyemi and Roberts, 1979). But not in agreement with that reported by Patrick and Schaible (1980) that rations which are high in fibre increases the water requirements of chickens.

The discrepancies observed in the broiler starter chickens performances in the study despite the isocaloric and isonitrogenous diets may be due to some growth depressant that may be found in the breadfruit seed meal. Among the suspected depressing factors include higher fibre resulting from processing (Obasuyi and Nwokoro, 2004; Aguilera *et al.*, 1973), poor palatability and probably hydrolyzed essential amino acids.

The packed cell volumes (PCV) were similar for all the birds except for those in Diet 5(40% inclusion) where the least was recorded. But other parameters (blood sugar, albumin, globulin and total protein) did not follow same trend. Previous report by Babatunde and Pond (1988) indicated that lowered PCV for rats fed rubber seed meal (RSM) was suggestive of haemolytic factors in RSM so as to reduce the factor and cause porphyrinuria. They thus suggested that their observation had significant implication in cases of long-term feeding of high levels of RSM. The observed results of PCV in this study may indicate that not more than 30% of breadfruit seed meal may be substituted for 34.7% soyabean meal in starter broiler chickens.

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