

**EFFECT OF FEEDING DIFFERENT LEVELS OF TIGERNUT (*Cyperus esculentus*)
MEAL ON GROWTH OF BROILER CHICKS.**

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ABSTRACT

The potential of tigernut (*Cyperus esculentus*) meal as substitute of maize in diets for broiler starter chicks has been evaluated. Tigernut tubers were sundried for 5 days and ground. Tigernut meal was used to replace maize at increasing levels (0%, 25%, 50%, 75% and 100% for T₁, T₂, T₃, T₄ and T₅, respectively) in five isonitrogenous diets containing 22% crude protein. The diet containing no tigernut meal was used as control (T₁). Three hundred day-old chicks (Anak strain) were randomly assigned to the five dietary treatments in a completely randomized design to determine the effect of inclusion of tigernut meal on feed intake, weight gain and feed conversion ratio. Results indicated that feed intake was reduced as dietary level of tigernut meal increased ($P<0.05$), similar trend was observed for weight gain. Feed conversion ratio showed no significant difference among experimental groups ($P>0.05$). The findings from this work suggested that tigernut meal can be used to replace maize up to 75% level in diets for broiler starter chicks without compromising growth.

Keywords: Tigernut meal, broiler starter, replacement, growth performance.

INTRODUCTION

Poultry industry occupies a unique position in livestock sector of Nigeria because poultry species are highly prolific and are good converter of feeds. Udedibie *et al.* (2007) suggested that the best solution to Nigerian's protein intake particularly from animal origin is increased poultry production. It has been reported that the major factor limiting the increase sustainable animal production, especially monogastrics such as poultry, rabbits and fishes, is the non-availability of feeds at a competitive price (Esonu *et al.*, 2006; Agbabiaka *et al.*, 2012). Most of the cereal concentrates are very costly being multi-purpose farm products, and staple food for the ever-increasing human population, component of livestock feed and major raw-material in beer-brewing industry (insert a reference). Consequently, the price has continued to rise because the demand far exceeds supply.

In view of this problem, many attempts have been made at sourcing alternatives to maize as energy source in monogastric nutrition; for instance, cassava meal (Udedibie *et al.*, 2004), *Napoleon imperialis* (Uchegbu *et al.*, 2004), cocoyam (Obikaonu and Udedibie, 2006), wild variegated cocoyam (Agbabiaka *et al.*, 2006), maize cob (Anyahie, 2006) with varying degrees of success. Nevertheless, nutritional studies being a dynamic field therefore, necessitates the need to explore and harness the potential of other energy feedstuffs that are environment friendly, cheap and readily available with less competition with humans. One of such plant is tigernut, a tuber crop primarily grown in Nigeria for its vegetable milk. It is rich in n-3 fatty acids and its crude protein content is about 9% (Belewu and Belewu, 2007). There is not enough information on its potential as feedstuff for broiler starter chicks in tropical environment such as Nigeria.

The aim of this work is to evaluate growth performance of broiler starter chicks fed diets with increasing levels of tigernut meal as a substitute of maize.

MATERIALS AND METHODS

Location of the experiment

This study was carried out at the Teaching and Research Farm facilities (Federal University of Technology in Owerri, Imo State, Nigeria). Owerri lies between latitudes 5⁰. 35'N and 6⁰.10'N and longitudes 6⁰.40'E and 7⁰.11'E., 90m above sea level, has annual mean temperature of

61 32.18⁰C, annual rainfall of 192-194mm, and relative humidity of 77-78.42% (Federal Ministry of
62 Aviation, 2001).

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64 **Source and processing of experimental materials**

65 The tigernuts used for the study was purchased from the open market at “AMA-HAUSA” in
66 Owerri. The tigernut seeds were sundried for 4-5 days and ground with a hammer mill to
67 produce tigernut meal. Drying process reduces excess moisture and prevents rancidity of the
68 material and growth of moulds.

69 Other conventional feed ingredients such as maize, fish meal, soybean meal, wheat offal, bone
70 meal, palm kernel meal, vitamin-mineral premix, and salt were purchased from Zion Farm Feed
71 Mills (Egbu, Owerri, Imo State). A sample of tigernut meal and experimental diets were
72 subjected to proximate analyses (Tables 1 and 3) using standard procedures according to AOAC
73 (1995). The tigernut meal was further subjected to analysis for anti-nutritional substances using
74 the standard methods described by Enujiugha and Olubunmi (2003).

75

76 **Experimental diets**

77 Five experimental diets were formulated replacing maize by tigernut meal at different levels; 0%,
78 25%, 50%, 75% and 100% for T₁, T₂, T₃, T₄ and T₅ feeds, respectively. The rest of ingredients
79 was similar in experimental diets. Table 2 shows the ingredient composition of experimental
80 diets.

81

82 **Chicks and experimental design**

83 Three hundred day-old Anak broiler chicks were procured from Obasanjo Farms Limited (Ogun
84 State, Nigeria) and reared for two weeks. Animals were feed with commercial broiler starter diet
85 before start of trial. The chicks were divided into five groups of sixty specimens each and
86 randomly assigned to the five diets in a completely randomized design (CRD). Each group was
87 further sub-divided into three replicates of twenty chicks each, and housed in a deep litter
88 compartment measuring 6.0 x 4.0m². Feed and water were provided *ad-libitum* and other routine
89 poultry management practices maintained.

90 **Data collection**

91 Chicks were weighed at the beginning of the experiment and thereafter on weekly basis. Feed
92 intake was determined by obtaining the difference between the quantity of feed given and the
93 quantity leftover the next morning, and feed conversion ratio computed accordingly. Economic
94 analysis was calculated and the trial lasted for 21 days.

95

96 **Statistical analysis**

97 Results are reported as mean $\pm$ SD of triplicates. Data collected were subjected to analysis of
98 variance procedures (Snedecor and Cochran, 1978). When significant differences were observed
99 between treatments, means were compared using Duncan's new multiple range test as outlined
100 by Obi (1990).

101

102 **Table 1: Proximate composition of tigernut meal (%DM)**

103 Parameters	Chemical composition (%)
104 Moisture content	7.62 $\pm$ 1.03
105 Crude protein	8.44 $\pm$ 1.63
106 Ether extract	27.71 $\pm$ 0.05
107 Crude fiber	11.69 $\pm$ 3.11
108 Ash	3.51 $\pm$ 1.03
109 Nitrogen free extract	41.03 $\pm$ 2.03

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115 **Table 2: Composition of experimental diets utilised in the feeding assay with broiler chicks .**

Experimental feed						
Ingredients	T1	T2	T3	T4	T5	
Maize	50.00	37.50	25.00	12.50	0.00	
Tigernut meal	0.00	12.50	25.0	37.50	50.00	
Soybean meal	25.00	25.0	25.0	25.0	25.0	
Wheat offal	8.00	8.00	8.00	8.00	8.00	
Fish meal	3.00	3.00	3.00	3.00	3.00	
Blood meal	2.00	2.00	2.00	2.00	2.00	
Palm kernel meal	8.00	8.00	8.00	8.00	8.00	
Bone meal	3.00	3.00	3.00	3.00	3.00	
Lysine	0.25	0.25	0.25	0.25	0.25	
Methionine	0.25	0.25	0.25	0.25	0.25	
Vitamin-mineral premix ¹	0.25	0.25	0.25	0.25	0.25	
Salt	0.25	0.25	0.25	0.25	0.25	
Cost/25kg feed (N)	2281.25	2240.50	2203.00	2185.50	2128.00	

131 ¹ To provide the following per kg of diet: Vit A; 1000 IU; Vit D; 2000 IU, Vit E; 5 IU, Vit K; 2,250mg, Riboflavin;
 132 5,500mg, vitamin B12; 15mcg, vitamin C; 100mg, panthothenic acid; 7500mg, Nican????;2,750mg, Choline;
 133 300mg, folic acid; 4mg; Mn; 80mg, Zn; 50mg, iodine; 1.0mg; ?????0, 1.2mg, Cu; 10mg, Fe; 20mg.

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Table 3. Proximate composition of experimental diets used in the feeding assay with broiler chicks.

Parameters	T1	T2	T3	T4	T5
Crude protein	22.91	22.15	22.20	21.98	20.73
Crude fat	4.33	4.52	4.77	4.60	5.07
Ash	5.30	5.43	5.60	6.68	6.51
Crude fiber	4.45	4.94	5.05	5.15	5.20
Nitrogen free extract	42.09	42.52	42.13	36.79	35.09
ME (Kcal/kg)*	2781	2863	2945	3027	3069

*ME = Estimated metabolizable energy.

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Table 4. Anti-nutritive factors contained in tigernut meal.

Antinutrient	mean $\pm$ SD
Tannin (%)	1.59 $\pm$ 1.11
Saponin (%)	1.23 $\pm$ 0.03
Phytate (mg/g)	18.12 $\pm$ 3.02
Phytin Phytate (mg/g)	6.11 $\pm$ 1.02
Phenols (%)	1.31 $\pm$ 0.04

RESULTS

The proximate composition of tigernut meal is shown in Table 1. The crude protein content (CP) of tigernut meal is 8.44%, while values of 27.71, 11.69, 3.51 and 41.03% were obtained for crude lipid, crude fiber, ash and soluble carbohydrate (NFE), respectively.

The chemical analysis of the experimental diets is presented in Table 3. Control diet (T₁) had the highest crude protein value of 22.91%, while (T₂), (T₃), (T₄), and (T₅) have values of 22.15%, 22.20%, 21.98% and 20.73%, respectively. The crude fat was lowest in the control diet (T₁) and

highest in (T₅) with the value of 4.33%, and 5.07, respectively. Crude fiber content of the feeds followed same trend as ether extract with the highest in T₅ (5.20%) and lowest in T₁ (4.45%).

The growth performance of chicks is summarized in Table 5. There was a significant ($P < 0.05$) difference in feed intake among the experimental groups. The groups on the 0% and 25% replacement levels recorded the highest feed intake while the group on 100% replacement level showed the lowest value. There was significantly difference ($P < 0.05$) in body weight gain among the treatment groups. The group fed T₂ recorded the highest average daily weight gain while the group fed on T₅ recorded the lowest body weight gain. The feed conversion ratios showed no significant difference among experimental groups ($P > 0.05$). The group fed on 50% replacement level recorded the best feed conversion ratio while the group fed diet without tigernut meal recorded the poorest feed conversion ratio.

DISCUSSION

The feed intake of the experimental birds was influenced by dietary levels of protein, energy and fiber. The control diet (T₁) recorded the highest daily feed intake while the lowest value was recorded from chicks fed on 100% tigernut based diet (T₅). The feed intake of the broiler chicks decreased when dietary level of tigernut meal was increased (Table 5). This agrees with the fact that voluntary feed intake of chickens or monogastrics varies in function of dietary fiber content (Sundu *et al.*, 2005; Fetufe *et al.*, 2007). Replacing maize with wheat offal beyond 50% in broilers also reduced feed intake in chicken (NAPRI, 1985). It has been reported that feeding chicks on diet containing feedstuffs with high fiber content filled the gut too early and declined feed intake (Dairo *et al.*, 2010). In this sense, the results obtained in the present work may be explained in the same way.

Nevertheless, control diet (T₁) contained relatively low metabolisable energy (ME) when comparing to the rest of experimental diets. This fact may also be responsible for the variations in feed intake as birds need eating until the energy requirements are met (Esonu, 2001). There was a significant difference ($P < 0.05$) in feed intake between birds fed control diet and those fed tigernut based diet beyond 75% dietary level. The body weight gain of the birds showed similar pattern as the feed intake. There was a significant difference ($P < 0.05$) between the birds fed

194 control diet and those fed 100% tigernut based diet. It was observed that T₅ (100% tigernut) has
195 crude protein value (20.73%) slightly below the recommended crude protein value for broiler
196 chicks (23 ± 1.0% crude protein) (Onwudike, 1983; Olomu and Offiong, 1980; Fetuga, 1984).

197 The reduction in crude protein content of the experimental feeds might be due to the inferior
198 crude protein content of tigernut (8.44% CP) as compared to maize (10% CP). As appointed
199 Aduku (1993), a reduction in the dietary crude protein level as tigernut inclusion increased in the
200 experimental feeds, especially in T₅, was observed. Consequently, the poor performance of
201 chicks fed on T₅ may be due to inadequate dietary protein content together with a high level of
202 dietary calories. The recommended metabolisable energy for broiler chicks in tropics is 3000
203 kcal/kg (Fetuga, 1984; Onwudike, 1983). A feed with high content in calories may increase body
204 heat in birds hence, reduce feed intake.

205 The relatively high metabolisable energy of tigernut based diets is attributed to its high
206 carbohydrate and crude fat content (Table 3), with value of 4087 kcal/kg compared to 3432
207 kcal/kg ME of maize (Aduku, 1993). The poor performance of birds fed on T₅ may be also
208 explained by the dilution of nutrients by utilization of high-fiber feedstuffs, such as tigernut,
209 which impair digestion, and consequently reduces bioavailability of nutrients when animals are
210 fed on such diet. The inherent anti-nutrients in tigernut such as tannins and phytate may also
211 contribute to the poor performance of broilers fed high level of dietary tigernut (Eteshola, 1996;
212 Oladele *et al.*, 2001).

213 In order to determine the effect of feed intake and feed conversion ratio on body weight gain of
214 broiler starter, a multiple regression analysis was applied. The coefficient of multiple
215 determination was 0.881 (88.1%) implying that the explanatory variables (feed intake and feed
216 conversion ratio) jointly explained 88.1% of the variation in the dependent variable (body weight
217 gain). The F-ratio (7.423) which determines the overall significance of a regression is not
218 significant ($P = 0.119$). Consequently, the interpretation of the regression indicates that feed
219 intake had a positive and significant effect on body weight gain of broiler starter chicks. This
220 implies that as the feed consumed increased, the body weight gain of broiler starter chicks
221 increased too; and vice versa. Also, feed conversion ratio had a negative and insignificant effect
222 on body weight gain of broiler starter chicks. This implies that as the feed conversion ratio
223 increased the body weight gain of broiler starter decreased; and vice versa.

To conclude, tigernut meal can be used to replace maize up to 75% level in diets for broiler starter chicks without compromising growth.

Table 5: Performance of broiler starter chicks fed graded levels of tigernut based diets.

Parameters	Replacement levels					
	T1	T2	T3	T4	T5	SEM
Initial body weight (g)	220.00 ^a	230.00 ^a	230.00 ^a	230.00 ^a	230.00 ^a	1.44
Final body weight (g)	950.00 ^a	1000 ^a	950.00 ^a	910.00 ^a	800.00 ^b	6.32
Body weight gain (g)	730.00 ^a	770.00 ^a	720.00 ^a	680.00 ^a	570.00 ^b	8.20
Daily weight gain (g)	34.76 ^a	36.67 ^a	34.29 ^a	32.39 ^a	27.14 ^b	1.38
Daily feed intake (g)	90.00 ^a	90.00 ^a	76.67 ^b	83.33 ^a	70.10 ^b	2.0
Feed conversion ratio	2.59 ^a	2.45 ^a	2.24 ^a	2.57 ^a	2.50 ^a	0.30 ^a

^{ab} Mean values in the same row with different superscripts are significantly different ($P < 0.05$)

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