

GROWTH RESPONSE OF BROILER STARTER ON TIGERNUT (*Cyperus esculentus* L) MEAL BASED DIETS

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ABSTRACT

An investigation into the replacement value of tigernut meal as substitute for maize in diets of broiler starter was studied. Tigernut tubers were sundried for 5 days and milled to produce tigernut meal. This was used to replace maize at dietary levels of 0%, 25%, 50%, 75% and 100% represented by T₁, T₂, T₃, T₄ and T₅ respectively in five isonitrogenous diets containing 22% crude protein; the control diet (0%) contained no tigernut meal. Three hundred day-old (Anak strain) chicks were randomly assigned to the five dietary treatments in a completely randomized design to determine the effect of the test ingredient on feed intake, body weight changes and feed conversion ratio. Result indicated that feed intake reduced as dietary level of tigernut increased in the diets ($p < 0.05$), similar trend was observed for body weight changes. There was no significant difference among treatment groups for feed conversion ratio ($p > 0.05$).

Key words:- Tigernut meal, broiler starter, replacement, 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 (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 militating against increased poultry production and/or sustainable animal agriculture especially monogastrics such as poultry, rabbits and fishes is the non-availability of feed at economic price (Esonu, 2006; Agbabiaka, 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. Consequently, the price has continued to rise because the demand far outweighed 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 (Anyaehe, 2006) with varying degrees of success. Nevertheless, nutritional studies being a dynamic field therefore, necessitates the need to explore and harness the potentials 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 Omega 3

fatty acids with crude protein of about 8.80% (Belewu and Belewu, 2007). There is paucity of information on its potential as feedstuff for broiler starter in tropical environment such as Nigeria.

This experiment was aimed at investigating the growth response of broiler starter chicks on tigernut based diets.

MATERIALS AND METHODS

Location of the Experiment

This study was carried out at the Teaching and Research Farm, Federal University of Technology, Owerri, Imo State of Nigeria. Owerri lies between latitudes 5° 35'N and 6° 10'N and longitudes 6.40'E and 7° 11'E, 90m above sea level and has annual mean temperature of 32.18°C, annual rainfall of 192-194cm and relative humidity of 77-78.42% annually (Federal Ministry of Aviation, 2001).

Source and Processing of Experimental Materials

The tigernuts used for the study were purchased from the open market at "AMA-HAUSA" in Owerri. The tigernut seeds were sundried for 4-5 days and passed through a hammer mill, to produce tigernut meal. The drying process was to reduce excess moisture so as to prevent rancidity of the material and growth of moulds.

Other conventional feed ingredients such as Maize, fish meal, soya bean meal, wheat offal, bone meal, palm kernel meal (PKM), vitamin-premix, and salt were procured from Zion Farm Feed Mills, Egbu, Owerri, Imo State. A sample of tigernut meal and trial diets were subjected to proximate analyses (Tables 1 and 3) using standard procedures according to AOAC, 1995. The tigernut meal was further subjected to phytochemical analysis for Anti-nutritional inhibitors using standard methods (Table 4).

Experimental diets

Five broiler starter experimental diets were formulated such that tigernut meal replaced maize at 0%, 25%, 50%, 75% and 100% dietary levels respectively. Other ingredients were similar in all the diets. Table 2 shows the ingredients composition of the experimental diets.

Experimental birds and design

Three hundred (300) day-old Anak broiler chicks were procured from Obasanjo Farms Limited Ogun State, Nigeria and reared for two weeks; feeding them with commercial broiler starter diet before the commencement of the trial. The birds were divided into five groups of sixty (60) birds each and randomly assigned to the five treatment diets in a completely randomized design (CRD). Each group was further sub-divided into three replicates of twenty birds each and housed in a deep litter compartment measuring 6.0 x 4.0m². Feed and water were provided *ad-libitum* and other routine poultry management practices maintained.

Data collection

Birds were weighed at the beginning of the experiment and thereafter on weekly basis. Feed intake was determined by obtaining the difference between the quantity of feed given and the

quantity leftover the next morning, and feed conversion ratio computed accordingly. Economic analysis was calculated and the trial lasted for 21days.

Statistical analysis

Data collected were subjected to analysis of variance procedures (Snedecor and Cochran 1978). When significant differences were observed between treatments, means were compared using Duncan's new multiple range test as outlined by Obi (1990).

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

Parameters	Concentration (%)
Moisture content	7.62
Crude protein	8.44
Ether extracts	27.71
Crude fiber	11.69
Ash	3.51
NFE	41.03

Table 2: Composition of experimental diets fed to the broiler starter

Dietary levels					
Ingredients	0%	25%	50%	75%	100%
Maize	50.00	37.50	25.00	12.50	0.00
Tigernut meal	0.00	12.50	25.0	37.50	50.00
Soyabean 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
PKC	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/min. Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Total	100.0	100.0	100.0	100.0	100.0
Cost/25kg feed(N)	2281.25	2240.50	2203.00	2185.50	2128.00

To provide the following per kg of diet:

Vit A; 1000Iu; Vit D;2000 Iu, Vit E; 5Iu, Vitk, 2.5mg, Ribofiavin, 5.5mg, vitamin 12, 0.01mg, vitamin z, 0.01mg
 panthothenic acid; 6mg, Nican, 5mg, chlorinem 3mg, folic, 4mg, mn, 8mg, zn; 0.5mg, iodine, 1.0mg; 0, 1.2mg, Cu,
 10mg, Fe; 20mg.

Table 3. Proximate analysis of the treatment diets fed broiler chicks

Parameters	Dietary levels of Tigernut				
	0%	25%	50%	75%	100%
Crude protein	22.91	22.15	22.20	21.98	20.73
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
NFE	42.09	42.52	42.13	36.79	35.09
*ME (Kcal/kg)	2781	2863	2945	3027	3069

* ME = Metabolisable energy calculated

Table 4: Anti-nutrients of raw tigernut

Parameters	Quantity
Tannin (%)	1.59
Saponin (%)	1.23
Phytate (mg/g)	18.12
Phytin Phytate (mg/g)	6.11
Phenols (%)	1.31

RESULTS

The proximate composition of tigernut is shown in table 1, while the chemical analysis of the experimental diet is presented on table 3. The performance of the experimental birds is summarized on table 5.

Proximate composition of the test ingredient

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 fibre, Ash and soluble carbohydrate (NFE) respectively.

Proximate analysis of trial diets.

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 trial feeds followed same trend as ether extract with the highest in T₅ (5.20%) and lowest in T₁ (4.45%).

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190 **Feed intake**

191 There was a significant ($P<0.05$) difference in feed intake among the treatment groups. The feed
192 intake values of the groups were 90.00g, 90.00g, 76.67g, 83.33g and 70.00g for 0%, 25%, 50%,
193 75% and 100% respectively. The groups on the 0% and 25% replacement levels recorded the
194 highest feed intake values of 90.0g each while the group on 100% replacement level recorded the
195 lowest feed intake value of 70.0g.

196 **Body weight gain**

197 There was significantly difference ($P<0.05$) in body weight gain among the treatment groups.
198 The daily body weight gain of the groups were 34.76g, 36.67g, 34.29g, 32.39g and 27.14g for
199 0%, 25%, 50%, 75% and 100% respectively. The group on 25% recorded the highest average
200 daily weight gain of 36.67g while the group on 100% replacement level recorded the least body
201 weight gain of 27.14g.

202 **Feed conversion ratio**

203 The feed conversion ratios of the birds were 2.59, 2.45, 2.24, 2.57 and 2.58 for 0%, 25%, 50%,
204 75% and 100% respectively. There was no significant different ($P>0.05$) among the treatment
205 groups. The group on 50% replacement level recorded the best feed conversion ratio of (2.24)
206 while the group on 0% replacement level recorded the poorest feed conversion ratio (2.59).

207 **DISCUSSION**

208 The feed intake of the experimental birds was influenced by dietary levels of protein, energy and
209 fibre. The control diet (T_1) recorded the highest daily feed intake 90.0g while the least value of
210 70.0g was recorded from birds on 100% Tigernut based diet T_5 . The feed intake of the broiler
211 chicks decreased with increased dietary level of Tigernut as replacement for maize in the diets
212 (Table 5). This agrees with the reports that voluntary feed intake of chickens or monogastrics
213 have been established to be a function of dietary fibre characteristics(Sundu *et al*, 2005; Fetufe *et*
214 *al*, 2007).Replacing maize with wheat offal beyond 50% in broilers has also been reported to
215 reduce chicken feed intake (NAPRI, 1985). Feeding of high fibre feedstuff such as Tigernut
216 might have resulted in gut filling in birds, hence, the observed decline in feed intake (Dairo *et al*,
217 2010).

218 Nevertheless, control diet, (T_1) contained relatively low metabolisable energy (ME) value of
219 2781 kcal/kg, while T_2 , T_3 , T_4 and T_5 have ME values of 2863, 2945, 3027 and 3069 kcal/kg
220 respectively. This may also be responsible for the variations in feed intake as birds will continue
221 to eat until the energy requirement is met (Esonu, 2001). There was a significant difference ($p<$
222 0.05) in feed intake between birds fed control diet and those fed Tigernut based diet beyond 75%
223 dietary level. The body weight gain of the birds showed similar pattern as the feed intake. There
224 was a significant difference ($p< 0.05$) between the birds fed control diet and those fed 100%
225 Tigernut based diet. It was observed that T_5 (100% Tigernut) diet has crude protein value
226 (20.73%) slightly below the recommended crude protein value of 23 ± 1.0 crude protein (CP)
227 (Onwudike, 1983; Olomu and Offiong, 1980; and Fetuga, 1984).

The reduction in crude protein content of the trial feeds might be due to the inferior crude protein content of Tigernut (8.44%) as compared to maize (10%CP) according to Aduku, (1993) thereby reducing the dietary crude protein level as Tigernut inclusion was increased in the experimental feeds especially in T₅ with 100% dietary inclusion of Tigernut. Consequently, the poor performance of the birds in T₅ may have been due to inadequate dietary protein content of the feed coupled with high calorie level beyond the 3000 kcal/kg metabolisable energy recommended for broiler chicks in tropics (Fetuga, 1984; Onwudike, 1983). The relatively high calorie feed increases heat increment of birds hence, reduces feed intake.

The relatively high metabolisable energy of tigernut based diets is attributed to high carbohydrate and crude fat content of the Tigernut (Table.3) with value of 4087 kcal/kg compared to 3432 kcal/kg ME of maize (Aduku, 1993). The poor performance of birds on 100% tigernut diet (T₅) may also be traced to the dilution of available nutrients by high fibre feedstuffs such as tigernut, which impair digestion and consequently unavailability of nutrients to the animals (monogastrics) fed such diets. The inherent anti-nutrients in tigernut such as Trypsin inhibitors, Tannins and phytate (Eteshola, 1996, Oladele, *et al*, 2001) may also contribute to the poor performance of broilers fed high dietary level of tigernut in their diets.

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

Table 5: Performance of Broiler Starter fed graded levels of tigernut based diets

Parameters	Replacement levels					SEM
	0%	25%	50%	75%	100%	
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 change(g)	730.00 ^a	770.00 ^a	720.00 ^a	680.00 ^a	570.00 ^b	8.20
Daily weight change (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}Means rows with different superscripts are significantly different (P<0.05)

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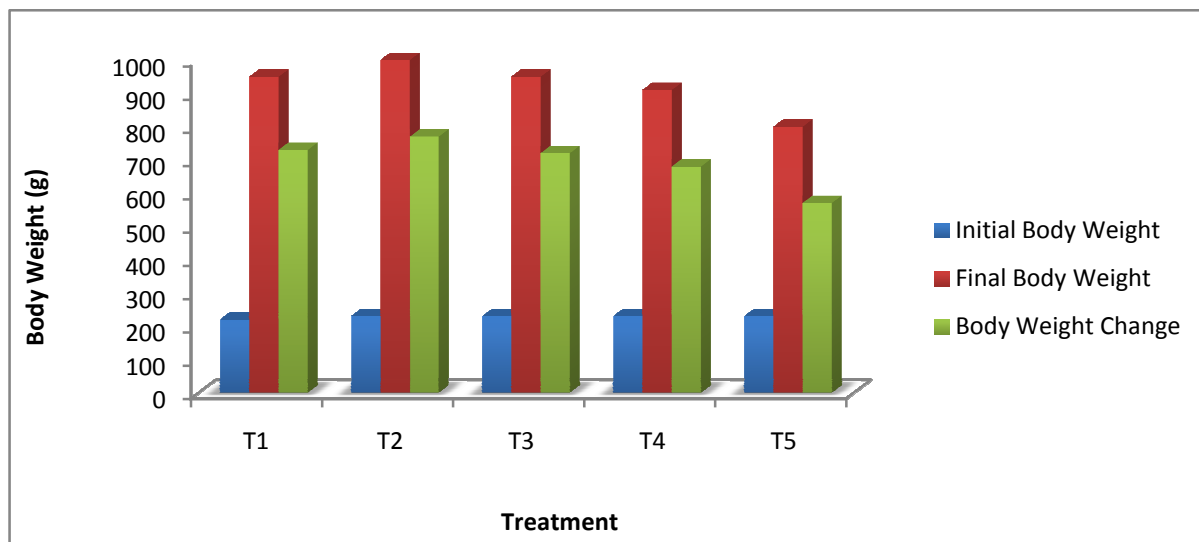


Figure 1: Bar chart representing the initial body weight, final body weight, and body weight change of broiler starter chicks against the treatments

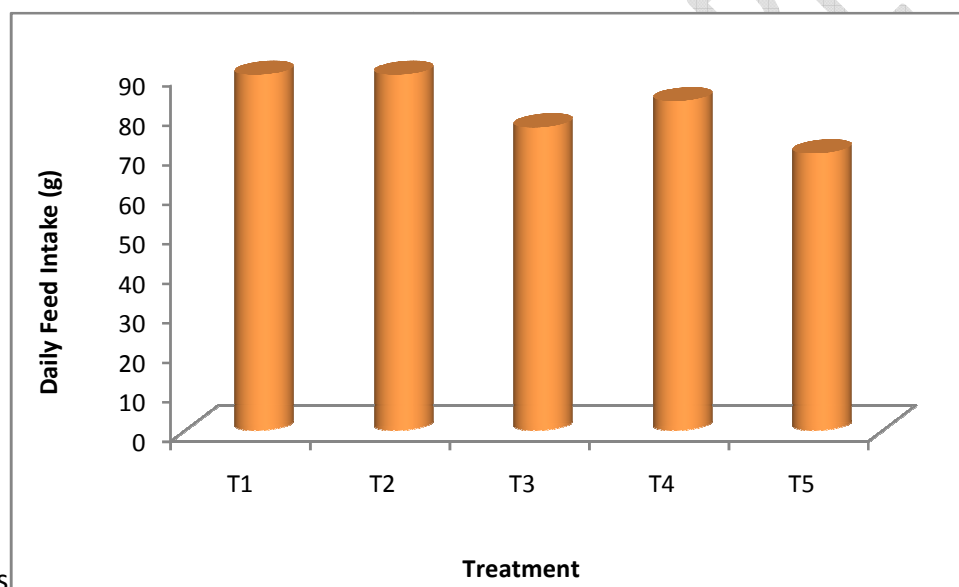


Figure 2: Bar chart representing the daily feed intake of broiler starter chicks against the treatments

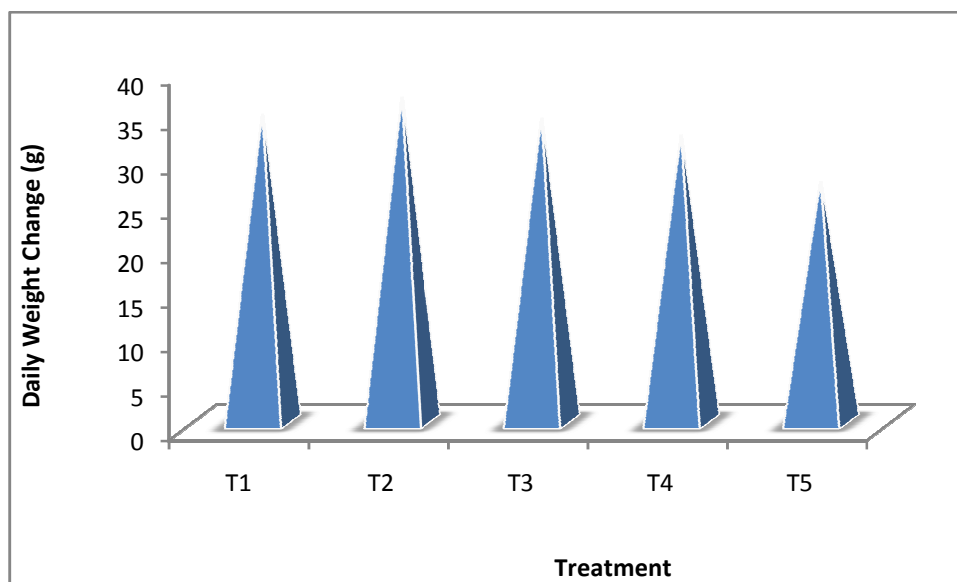


Figure 3: Bar chart representing the daily weight change of broiler starter chicks against the treatments

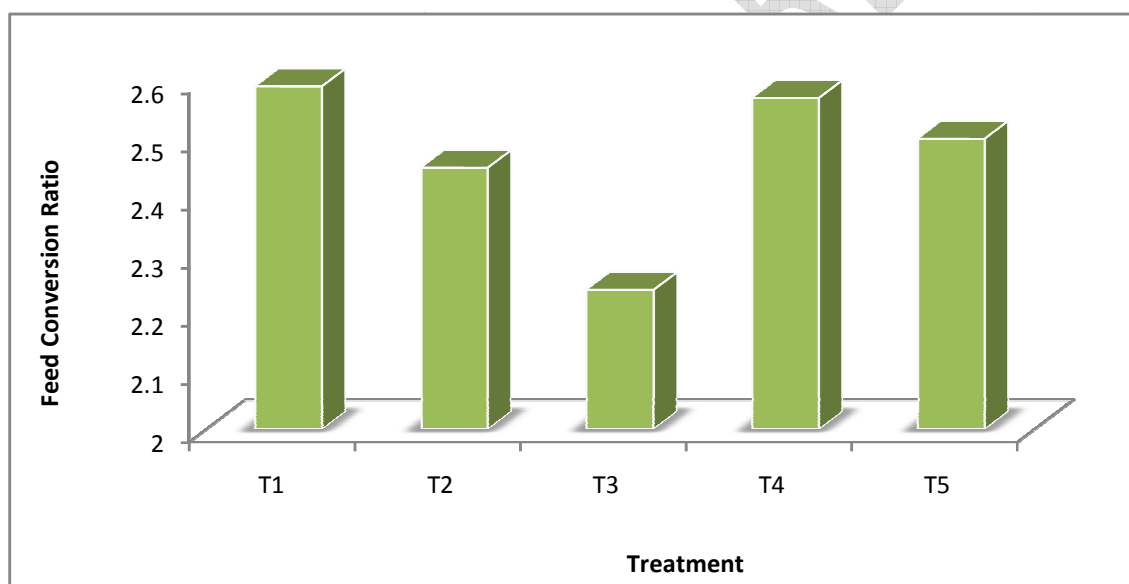


Figure 4: Bar chart representing the feed conversion ratio of broiler starter chicks against the treatments

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