NUTRIENT DIGESTIBILITY OF BROILER CHICKENS FED TIGERNUT (*CYPERUS ESCULENTUS*) MEAL AS A SUBSTITUTE FOR MAIZE

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ABSTRACT
A feeding trial6-weekswas conducted to evaluate the effect of substituting Tigernut (Cyperus esculentus) TNMwith maizeon the nutrient digestibility of 150-day-old Abor acre broiler chicks. Five experimental broiler starter and finisher diets were formulated with diet T_1 formulated to contain 0 % Tigernut while diet T_2, T_3, T_4 and T_5 were formulated to contain Tigernut meal at 10, 15, 20 and 25% substituting for maize respectively. Thirty (30) chicks were randomly assigned to the five dietary treatments in a completely randomized designed (CRD). Each treatment consisted of three replicates of ten (10) chicks. The results of crude protein (CP), crude fiber (CF) and ether extract (EE) shows significant ($P<0.05$) while dry matter (DM), Ash and nitrogen free extract (NFE) did not differ significantly ($P>0.05$) among the treatment groups. The highest crude protein, crude fiber and ether extract digestibility of 93.78, 77.99 and 88.28 percent respectively,were obtained in T_5. Therefore, substitution level of Tigernut meal for maize at 25% gives an appreciable nutrient utilization in the diet of broiler chickens. It can be concluded that Tigernut meal can substitute maize up to 25%without adverse effects on nutrient digestibility.
Keywords: Broiler Chickens, Tigernut meal (TNM), Maize, Nutrients Digestibility.

INTRODUCTION

Food insecurityis a major challenge facing most developing countries like Nigeria in Africa, population growth in Nigeria and growing income necessitate the demand for eggs and poultry meat to significantly increase in recent years across large parts of the country (Abeke et al., 2013). Maize is one of the premium energy feed in poultry diets and it is responsible for between 50 and 60 % of the total cost of production (Abeke et al., 2013). Maize as a major component of livestock feedin Nigeria is expensive and inadequate due to its use for human food, livestock feed and industrial purposes. The scarcity and high cost of maize has forced many farmers to explore alternative sources of energy feedstuffs for poultry feeding,Tigernut is an example of such alternatives.Tigernut (Cyperus esculentus) is a perennial grass-like plant (Adel et al., 2015). The metabolizable energy value of Tigernut is 3654.59 Kcal/kg which is higher than that of Maize (3526.42 Kcal/Kg) as reported by (Apel et al., 2016). Crude protein content of Tigernut is 4.33 % (Adel et al., 2015) which is lower than 8.75 % for maize but Oderinde and Tahir (1988) reported a value of 7.00 % which isclose to maize.However, Tigernut has high fibre content. The objective of this study was to investigate the nutrient digestibility of broiler chickens fed Tigernut meal as a substitute for maize.

MATERIALS AND METHODS

Study Area

The experiment was carried out at the Poultry Unit of the Teaching and Research Farm, Department of Animal Science,University of Maiduguri, Maiduguri, Borno Statefor a period of six (6) weeks. Maiduguri lies between latitude 11^0 5' and 12^0 North and between longitude 13^005' and 14^0 East and an altitude of 354 mabove the sea level. The area is characterized by a short rainy season (June to September) with a long dry period of seven (7) to eight (8) months. The hottest month are April and May with a temperature range of 39.4^0c to 41.1^0c under shade. Mean relative humidity ranges from 51.3 to 72% in August but usually low (5%) in December and January (Biu et al., 2012).

Source of Test Materials and Feed Sample Preparation

Tigernut (Cyperus esculentus) was purchased from a Market in Gujungu Local Government Area Jigawa State, Nigeria. The Tigernut was visually inspected and bad ones were manually removed and

discarded. Tigernut was thoroughly washed with clean water, drained and dried for seven (7) days before grinding and diet formulation. The drying process was to reduce excess moisture so as to prevent rancidity of the Tigernut.The nut was ground to produce Tigernut meal with size of 2.00mm. All processing was done by the method described by Umar et al., (2007).The Tigernut contained 6.91% crude protein, 14.65% crude fibre and 3916.56kcal/kg metabolizable energy Titima et. al., (2021).

Experimental diets, design and Dietary Treatments

The experimental diet contained Tigernut which was dried and ground into meal. The Tigernut meals (TNM) were used to substitute maize at 0, 10, 15, 20 and 25% levels in the diets.Complete randomized design (CRD) was used. Different diets with Tigernut at 0% (control), 10, 15, 20 and 25% were designated as T_1, T_2, T_3, T_4 and T_5, respectively.They were formulated to contain 21.43 to 23.37% and 19.88 to 20.88% crude protein and metabolizable energy of 2869.16 to 2979.01 Kcal/Kg and 3039.47 to 3108.46 Kcal/Kg for both broiler starter and finisher diets, respectively. The ingredients composition and calculated analysis of the experimental diets (Starter and Finisher) are presented in (Tables 1 and 2). The diets and clean drinking waterwere provided ad-libitum throughout the six (6) weeks of the experiment. The data measured were initial weight, final weight, weight gain and feed intake while the feed conversion ratio and protein efficiency ratio were calculated accordingly.

Experimental Stocks and Management

One hundred and fifty (150) day old Abor acre strain were bought from Amor hatchery Jos, Plateau State and used for the study. The chicks were brooded for fourteen days and allotted to commercial broiler starter mash during the period. Later, the chicks were divided into five (5) groups of thirty (30) chicks containing three (3) replicates of ten (10) chicks each, fed the experimental starter diet for two weeks and switched to experimental finisher diets throughout the finishing phase of four weeks. The chickens were housed in cemented floor pens with wood shavings as litter material.The birds were vaccinated against Gumboro at $2^{nd}$and 4^{th} weeks and Newcastle at 3^{rd} week of rearing period.

Statistical analysis

All data obtained were subjected to Analysis of Variance (ANOVA) appropriate to Completely Randomized Design (CRD) (Steel and Torrie 1980). Differences between treatment means were determined using the least significant. The parameters assess difference (LSD) at ($P<0.05$) level of significant, using statistical package (Statistix 9.0 version).

RESULTS AND DISCUSSION

Nutrient Digestibility of Broiler Chickens Fed Different Levels of Tigernut Meal (TNM) in their Diets

The nutrient digestibility of broiler chickens fed diets containing different levels of Tigernut meal as substitute for maize is presented in Table3. are Crude protein,(CP), Crude fiber (CF), Ether extract (EE), Ash, and Nitrogen free extracts (NFE). There were significant ($P<0.05$) differences in the nutrient digestibility of crude protein, crude fibre and ether extract, the differences may be attributed to varying levels at which TNM substituting maize or as a result of differences in the adaptation of the diet by the birds used in study. However, dry matter, ash and nitrogen-free extract were not significantly ($P>0.05$) different among the treatment groups by implication all the TNM based groups where similar to the control which is an indication of efficient use of the diets. The dry matter digestibility recorded in this study (79.16 to 88.61%) were similarly to the values (80.23 to 90.00%) reported by Bamgbose et al. (2005) who fed broiler chickens graded levels of Tigernut. Conversely, Udedibie et al. (2004) and Khempaka et al. (2009) revealed that high level of fibre in diets may reduce dry matter digestibility. Probably the processes undergone by the fibre source was responsible for this contrary observation in this study. The crude protein digestibility recorded in this study were better in broiler chickens fed T_3, T_4 and T_5, but similar to those fed T_1 while the poorest was obtained in those fed T_2 which is an indication of efficient use of the diets by broiler chickens. However, the protein digestibility in this study (91.11 to 93.94%) were similar to the values (90.24

Table 1: Ingredient composition and calculated analysis of experimental broiler starter diets (%)

	Tigernut levels substituting maize (%)				
Ingredients	**0**	**10**	**15**	**20**	**25**
Maize	51.50	46.35	43.76	41.20	38.62
Tigernut meal	-	05.15	07.74	10.30	12.88
Wheat offal	08.00	08.00	08.00	08.00	08.00
Soya bean meal	22.30	22.30	22.30	22.30	22.30
Groundnut cake	10.00	10.00	10.00	10.00	10.00
Fish meal	5.00	7.00	7.00	7.00	7.00
Bone meal	2.50	2.50	2.50	2.50	2.50
Premix*	0.20	0.20	0.20	0.20	0.20
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Salt (NaCl)	0.30	0.30	0.30	0.30	0.30
Total	**100**	**100**	**100**	**100**	**100**
Calculated Analysis (%)					
Crude protein	23.43	22.79	22.23	21.68	21.22
Crude fibre	3.09	3.73	4.07	4.39	4.67
Ash	3.13	3.30	3.48	3.65	3.65
Ether extract	4.55	6.89	9.22	11.56	13.89
NFE	68.46	67.81	66.37	65.32	64.43
ME (Kcal/Kg)**	2810.06	2852.00	2856.00	2910.00	3005.00

NFE =Nitrogen free extract ME =Metabolizable energy, *****Composition of broiler premix supplying the following per kg of feed: Vitamin A = 3,400IU, Vitamin D_3= 600IU, Vitamin E = 4,000IU, Vitamin K_3 600mg, Vitamin B_1 = 640mg, Vitamin B_2 = 1,600mg, Niacin = 8,000mg, Vitamin B_6 = 600, VitaminB_{12} = 4mg, Choline + Chloride = 7,0000mg, Cobalt = 80mg, Copper = 1,200mg, Iodine = 400mg, Iron = 8000mg, Manganese = 1,6000mg, Selenium = 80mg, Zinc = 1,2000mg and Antioxidant = 500mg ****Calculated according to Pauzenga (1985)**

Table 2: Ingredient composition and calculated analysis of experimental broiler finisher diets (%)

	Tigernut levels substituting maize (%)				
Ingredients	**0**	**10**	**15**	**20**	**25**
Maize	61.80	55.62	52.53	49.44	46.35
Tigernut meal	-	06.18	09.27	12.36	15.45
Wheat offal	06.00	06.00	06.00	06.00	06.00
Soya bean meal	21.70	21.70	21.70	21.70	21.70
Groundnut cake	02.00	02.00	02.00	02.00	02.00
Fish meal	05.00	05.00	05.00	05.00	05.00
Bone meal	02.50	02.50	02.50	02.50	02.50
Premix*	0.50	0.50	0.50	0.50	0.50
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.20	0.20	0.20	0.20	0.20
Salt (NaCl)	0.20	0.20	0.20	0.20	0.20
Total	**100**	**100**	**100**	**100**	**100**
Calculated Analysis (%)					
Crude protein	20.68	20.43	20.22	19.84	19.53
Crude protein	3.80	4.01	4.52	5.42	7.17
Crude fibre	3.58	4.07	4.25	4.42	5.02
Ash	3.08	3.97	4.15	4.32	4.63
Ether extract	3.76	5.58	6.24	7.66	9.37
NFE	68.68	66.01	64.87	62.76	59.30
ME (Kcal/Kg)**	2916.18	2950.56	2984.96	3019.34	3053.74

* Same as in Table 1, ** Same as in Table 1

reported by Bamgbose *et al.* (2005) who fed broiler chickens varying levels of Tigernutmeal. Broiler chickens fed T_4 and T_5 utilized the crude fibre in their diets better than those fed other groups while the poorest was obtained in those fed control diet (T_1).The utilization of crude fibre increased steadily with the increase of the test material (Tigernut), in this study which disagreed with the report of Abioye *et al.* (2006) who reported that crude fibre in diets increases bulkiness and limits weight of feed taken by the bird because it imposes physical limitation to intake of the digestible nutrients. However, in this study feed intake was not adversely affected. The result shows ether extract was higher in broiler chickens fed T_2, T_3, T_4 and T_5 but T_1 (0% Tigernut) recorded the lowest hence, the results of this study were in line with the report of Agbabiaka *et al.* (2012). The results of the study showed that ash and nitrogen-free extract digestibility increased as the level of Tigernut meal increased in the diets. This is contrary to the findings of Abioye *et al.* (2006) who reported that fibre content in diets decreased digestibility. The results of this study also disagreed with the findings of Abioye *et al.* (2006) who observed that higher fibre levels in diets of chickens decreased feed intake, crude protein digestibility and ash utilization. However, this study revealed fibre content in TNM does not affect the nutrient digestibility.

Table 3: Nutrient digestibility of broiler chickens fed Tigernut Meal as a substitute for Maize

	Tigernut levels substituting Maize (%)					
Nutrients (%)	**T_1(0)**	**T_2(10)**	**T_3(15)**	**T_4(20)**	**T_5(25)**	**SEM**
Dry matter	79.16	81.76	88.61	87.02	86.42	0.21^{NS}
Crude protein	90.31^{ab}	91.11^{b}	93.94^{a}	92.32^{a}	93.00^{a}	0.78*
Crude fibre	47.17^{c}	63.75^{b}	64.52^{b}	76.19^{a}	77.99^{a}	1.77*
Ether extract	74.31^{b}	84.18^{a}	85.77^{a}	87.23^{a}	88.28^{a}	0.34*
Ash	80.85	92.32	92.36	95.94	96.78	0.96^{NS}
NFE	50.47	50.28	52.50	56.83	59.02	1.98^{NS}

a, b, and c = Means in the same row bearing different superscripts differ significantly($P<0.05$), NS = Not Significant ($P>0.05$)* = Significant ($P<0.05$), SEM = Standard error of means, NFE = Nitrogen Free Extract

CONCLUSION

The result of this study revealed that Tigernut meal at 25% substitution level for maize it gives final live weight of 2025.67 g and improved the productive performance of broiler chickens without any adverse effects.

RECOMMENDATION

Tigernut (*Cyperus esculentus*) is recommended as good substitute for maize to enhance optimum nutrient digestibility of broiler chickens especially in areas where it is cheaper than maize, and should be exploited in other species of poultry and monogastric animals.

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