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Nutrient Digestibility of Broiler Chickens Fed Alkaline Treated Soybean Cheese Residue Meal as a Substitute for Soybean Meal

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Abstract: *A feeding trial 6-weekswas conducted to evaluate the effect of substituting Alkaline treated soybean meal with soybean on 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 % Alkaline treated soybean residue meal while diet T_2, T_3, T_4 and T_5 were formulated to contain Alkaline treated soybean meal at 20, 40, 60 and 80% substituting for soybean meal, respectively. Thirty (30) chicks were randomly assigned to the five dietary treatments in a completely randomized design (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 Alkaline treated soybean meal for soybean at 40, 60 and 80% gives an appreciable nutrient utilization in the diet of broiler chickens. It can be concluded that Alkaline treated soybean meal can substitute soybean meal up to 80% without adverse effects on nutrient digestibility.*

Keywords: *Broiler Chickens, Alkaline treated soybean Residue meal, Soybean meal, Nutrients Digestibility.*

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Introduction

Soybean is one the major component of poultry feed in Nigeria and is expensive, competition and inadequate due to its use for human food, livestock feed and industrial purposes. The global population keeps on increasing every day and year round. Developing countries like Nigeria are faced by Animal protein intake deficit as against the federation of Agriculture (FAO) recommendation of 35g daily protein requirement Ogundipe *et al* (2003). However, the shortage and high cost of soybean attributed to the high cost of Animal product, which is the consequence of high cost of production of broiler chickens, Iyagbe *et al.*, (2012). The scarcity and high cost of Soybean has forced many farmers to explore alternative sources of protein feedstuffs for poultry feeding Abeke *et al.*, (2013). Cost of feed accounts for about 60 – 80% of the total production cost of poultry, despite its potential to bridge the demand and supply gap for Animal protein to meet human consumption (Oyewole *et al* 2013 and Padhi, 2016). Insecurity is also one of the key player that hinders crop farming activities couples with herdsmen – farmers crises affects the production of soybean and the decline in the purchasing power of many Nigeria. Soybean cheese residue meal (SCRM) treated with Alkaline. SCRM is being in colour and has a light moist sawdust or

grated coconut and tastes similar to almond (Dikko *et al*., 2018)The objective of this study was to investigate the nutrient digestibility of broiler chickens fed Alkaline treated soybean residue meal as a substitute for soybean meal.

Materials and Methods

Study Area

The experiment was carried out at the Poultry Unit of the Teaching and Research Farm, Department of Animal Production Technology, Ramat Polytechnic Borno State for a period of six (6) weeks. Maiduguri lies between latitude 11^0 5' and 12^0 North and between longitude $13^0$05' and 14^0 East and an altitude of 354 m above 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

Soybean residue meal was purchased from local cheese producers. The soybean residue meal was visually inspected and impurities were manually removed and discarded. Soybean residue was thoroughly drained and dried for seven (7) days before diet formulation. The drying process was to reduce excess moisture so as to prevent rancidity of the test material. All processing was done by the method described by Dikko *et al*., (2012).

Experimental diets, design and Dietary Treatments

The experimental diet contained Alkaline treated soybean residue meal which was dried and ground into meal. The test material was used to substitute soybean meal at 0, 20, 40, 60 and 80% levels in the diets. Complete randomized design (CRD) was used. Different diets with Alkaline treated soybean residue meal at 0% (control), 20, 40, 60 and 80% were designated as T_1, T_2, T_3, T_4 and T_5, respectively. They were formulated to contain 22.02 to 23.07% and 18.88 to 21.54% crude protein and metabolizable energy of 2669.56 to 2679.41 Kcal/Kg and 2939.47 to 2980.46 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 water were 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 difference, using statistical package (Statistix 9.0 version).

Results and Discussion

Nutrient Digestibility of Broiler Chickens Fed Different Levels of Alkaline treated Soybean Meal (ATSRM) in their Diets

The nutrient digestibility of broiler chickens fed diets containing different levels of Alkaline treated soybean residue meal as substitute for soybean meal is presented in Table3. 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 Alkaline treated 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 Oyewole, (2022) who fed broiler chickens graded levels of Soybean residue meal. 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) reported by Oyewole, (2022)

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

Ingredients	ATSRM levels substituting soybean meal (%)				
	0	**20**	**40**	**60**	**80**
Maize	51.50	51.50	51.50	51.50	51.50
ATSRM	-	04.46	08.92	13.38	17.84
Wheat offal	08.00	08.00	08.00	08.00	08.00
Soya bean meal	22.30	17.84	13.38	08.92	04.46
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	23.07	22.79	22.53	22.26	22.02
Crude fibre	3.09	3.23	3.47	3.69	3.87
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)**	2669.56	2652.00	2656.00	2610.30	2679.41

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, Vitamin B_{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)

ATSRM = ALKALINE TREATED SOYBEAN RESIDUE MEAL

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

Ingredients	ATSRM levels substituting soybean meal(%)				
	0	**20**	**40**	**60**	**80**
Maize	61.80	61.80	61.80	61.80	61.80
ATSRM	-	04.34	08.68	13.02	17.36
Wheat offal	06.00	06.00	06.00	06.00	06.00
Soya bean meal	21.70	17.36	13.02	08.68	04.34
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	21.54	21.43	21.32	20.84	18.88
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)**	2939.47	2950.56	2961.00	2975.34	2980.46

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

who fed broiler chickens varying levels of soybean residue meal. 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 (Alkaline treated soybean meal), 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% Alkaline treated soybean meal) recorded the lowest hence, the results of this study were in line with the report of Dikko *et al*. (2012). The results of the study showed that ash and nitrogen-free extract digestibility increased as the level of Alkaline treated soybean 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 Alkaline treated soybean meal does not affect the nutrient digestibility.

Table 3: Nutrient digestibility of broiler chickens fed Alkaline treated soybean meal as a Substitute for soybean meal

	ATSRM levels substituting Soybean (%)					
Nutrients (%)	**T_1(0)**	**T_2(20)**	**T_3(40)**	**T_4(60)**	**T_5(80)**	**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 Alkaline treated soybean residue meal at 80% substitution level for soybean meal it can improved the nutrient digestibility productive of broiler chickens without any adverse effects.

Recommendation

Alkaline treated soybean meal is recommended as good substitute for soybean to enhance optimum nutrient digestibility of broiler chickens and should be exploited in other species of poultry and monogastric animals.

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