SUST
Journal of Agricultural and Veterinary Sciences
Journal homepage:
http:// journals.sustech.edu

The Effect of Feeding Chemically or Biologically or Untreated Shea Cake on Broiler Pperformance

Mohammed Idris Choua[1*], Rania M. Shamseldin[2]; Mohamed T. Ibrahim[1]

1 Dept. Anim. Prod. Sci. & Tech. Sudan University of Science & Technology
2 Dept. Poult. Prod. Sci. & Tech. Sudan University of Science & Technology
3 Dept. Anim. Prod. Sci. & Tech. Sudan University of Science & Technology
*Corresponding author: Mohamed T. Ibrahim. E.mail: mohdtageldin@hotmail.com.

Received: January 2021 **Accepted: March 2021**

Abstract

Two hundred and eighty one-day unsexed Arbor-acres broiler chicks were used to investigate the effect of treated and untreated Shea Nut Cake (SNC) on broiler performance. Shea cake is a by-product obtained by extraction of Shea butter from the nuts of the Shea tree (Vitellaria paradoxa). The birds were allowed to seven dietary treatments replicated four times with 10 birds for each. Two diets were formed a starter diet for three weeks and finisher diets for three weeks. Three types of SNC in three inclusion rates (zero, 10 and 20%) were used in this study crude (untreated), SNC treated by 0.01M NaOH solution and SNC fermented by yeasts as follows: (T1) contained 0 % SNC, T2 and T3 contained 10% and 20% untreated SNC respectively, T4 and T5 contained NaOH treated SNC 10, 20% respectively and T6 and T7 contained 10 and 20 % yeast fermented SNC. The treated and untreated SNC samples were analyzed to determine the nutrient contents according to the method described by AOAC (1990). The tannin concentration of SNC was determined according the method described by Agbo and Prah (2014). The birds fed 10% of SNC had better performance than those fed on 20%. And the birds fed on treated SNC perform better than those fed on untreated SNC.

Keywords: Tannin, anti-nutritional factor, yeast

Introduction

The poultry industry has played and continues to play a leading role among the agricultural industries in many African countries as it is the main source of animal protein for human consumption. Broiler production as a business like any other enterprise seeks to generate profit which can be done by keeping production costs as low as possible. Ademola and Farinu (2006) found that the feeding cost of broiler in African countries is 70-80% of the total cost of production, 95% of the cost of nutrition is for protein sources. The increasing cost of meat production is one of the most detrimental factors affecting the poultry industry in Africa.

The rise in the cost of animal products attributed to the move towards the use of unconventional feedstuff to formulate rations (Ojewola, and Udom, 2005 and Ayssiwede et al., 2011).

Soybeans and groundnuts cake which are the conventional sources of protein in animal feed formulation in many African countries (Ghadge *et al*., 2009), also used as food by humans (Singh and Singh, 1991). There are many factors such as population growth and rapid urbanization have led to a constant increase in the price of rations as soybean and groundnut and

hence the reason to increase the cost of feed production and the market prices of animal protein (Oboh, 2006).

The Shea tree (Vitellaria paradoxa) is the source of Shea butter. It is one of the major components of the agroforestry parklands in the dry zone of sub-Saharan Africa and is the main indigenous oil-producing plant of this region (Lovett, 2005). The Shea tree produces fruits which are cherished and eaten by humans and animals: the nut of this fruit is processed to give Shea butter, while the residue or by-product is the Shea nut cake (SNC) (Dei *et al*., 2008).

The savanna region of West Africa and Central Africa produce a large quantity of SNC and regarded as useless. Available reports on the nutritional profile of SNC show that it contains a relatively high amount of protein and energy, however it contains some anti-nutritional factors such as tannins, theobromine, and saponins which make it unacceptable to poultry as feed (Oddoye *et al*., 2012). Various strategies for the removal of anti-nutritional factors such as tannins and theobromine include sodium hydroxide, a chemical treatment was recommended as the best strategy for the removal of both tannins and theobromine (Oddoye et al., 2012), and fermentation of SNC using microorganisms was recommended as the most environmentally safe and cost effective method for removal of the anti-nutritional agents in SNC. (Agbo and Prah. 2014). This study aims to determine the effect of feeding treated and untreated SNC on broiler performance.

Materials and Methods

Experimental birds:

A total of two hundred and eighty one-day-old unsexed broiler chicks (Arbor Acres) brought from the Arabic Company of chicken's breeds (Ommat). The chicks were divided into seven experimental groups (40 birds /treatment) in complete randomized design (CRD), each treatment was replicated four times with 10 chicks per replicate.

Experimental management:

The experiment was conducted in an open-sided house. The long axis of the house extended east-west facing the wind direction for efficient ventilation. The temperatures generally fluctuated between 15˚C - 42˚C with a mean temperature of 28.3˚C, with the mean day time relative humidity was 22%. The house was divided into 28 experimental sections (replicates) of equal size 1 x1 m and each section was provided with one round metal feeder and a round plastic drinker. The house had efficient light, lamps were lighted during the night to complete with the day hours the duration of light needed. Routine rearing and vaccination program were performed during the experimental period.

Shea nut cake source and preparation:

Shea nut cake (mechanical oil-extraction method) used in this study was brought from Beinamar CO. Ltd., An edible oils manufacturing company located in Koumoura in the Mandoul Region, Chad.

Sodium hydroxide solution treatment:

Sodium hydroxide solution (0.01 M) was prepared by dissolving 0.4 g NaOH in 1 L of water. SNC was sprayed by the NaOH solution in the ratio of (1:1) until it became wet and allowed to dry (air shade drying) (Oddoye *et al*., 2012).

Yeast fermentation:

Baker's yeast (saccharomyces cerevisiae) was mixed with water (25g/L). The SNC was sprayed at the ratio of (1:1) and subjected to anaerobic fermentation in a nylon bag for two weeks, then allowed to dry (air shade drying), as recommended by Alemawor *et al.*, (2009) and Agbo and Prah. (2014).

Experimental diets:

Chicks were divided into seven groups including control negative (T1), two positive control groups fed diets containing 10 and 20% crude SNC (T2) and (T3) respectively, two groups fed diets

containing 10 and 20% NaOH treated SNC (T4) and (T5) respectively, and two groups fed on diets containing 10 and 20 % yeast fermented SNC (T6) and (T7) respectively.

Two rations were prepared broiler starter diet (from 7 to 28 days) and broiler finisher diets (from 29 to 49 days). The starter (Table,1) and finisher (Table, 2) diets were formulated to be approximately iso-caloric and iso-nitrogenous to meet the nutrient requirements for broiler chicks as outlined by the National Research Council (NRC,1994). Feed and water were supplied ad-libitum throughout the experimental period.

Data collection:

Consumed feed was recorded daily and the birds were weighed weekly to determine body weight, feed intake, weight gain and FCR.

Chemical analysis:

Shea nut cake chemical composition:

SNC samples (before and after treatment) were analyzed for proximate composition using standard methods (AOAC, 1990), and metabolizable energy (ME) by the equation as described by Lodhi., *et al*., (1976). (Table, 3)

ME kcal/kg = 370.29 + (24.47 x % CP) + (65.77 x % EE) + (44.07 x % NFE) - (8.15 x % CF).

Determination of Shea nut cake tannin content:

The tannin concentration of SNC was determined according the method described by Agbo and Prah (2014).

Statistical Analysis:

Data collected were subjected to analysis of variance (One-way-ANOVA) and the mean were tested for significance by least significant differences (LSD) according to Steel and Torri (1996) using the statistical package of social science (SPSS) computer program version 24.

Results

The proximate composition of treated and untreated SNC used in this study is presented in table (3). The treatment of SNC by NaOH and yeast reduces the tannin content from 46.04%, to 17.19% and 23.56% respectively.

The overall feed intake (FI) showed that chicks fed on diet T1, T4, and T6 were similar and they are significantly higher than the intake of chicks fed on diet T2, T3, T5, and T7 (Table, 4). The birds fed on diets 0% SNC and 10% treated SNC had significant higher final live body weight (LBW) compared to the birds fed other feed (Table4). The overall body weight gain (BWG) of birds fed on diet (T1, T4, and T6) is comparable and it is significantly higher than that of birds fed other treatment diets (Table, 4).

It can be seen that birds fed on 10% SNC and those fed on treated SNC had better performance (feed intake, weight gain and final weight) compared to those fed on 20% SNC and untreated SNC diets respectively. The overall feed conversion ratio (FCR) for chicks on treatment T4 and T5 was the best and it is significantly better than that of birds fed on the other diets. Also FCR for chicks on treatment T7 was significantly poor compared to chicks fed on other diets (Table, 4). There was no mortality recorded during experimental period.

Discussion

The nutritional composition of untreated SNC in this study was within the range of that reported by Umali and Nikiema (2002) who have given the following ranges of proximate traits of SNC: 48 – 67.5% nitrogen-free extract, 8 – 25% protein, 2 – 20% ether extract, 5 – 12% crude fiber and 5 – 7% ash. The result of SNC treated by NaOH solution showed that there was a slight reduction in dry matter 92.69%, crude fiber 8.64, nitrogen-free extract 48.86 and ether extract 12.77%. There was a reduction in tannin content to 17.90% this finding agreed with those of Oddoye *et al*., (2012) who reported a reduction of NaOH treated SNC tannin content about 70%. The crude

protein 13.65 and ash 6.93 content of NaOH treated SNC was same as compared with untreated SNC. The result of yeast fermented SNC showed a slightly increase in dry matter 95.27%, crude protein 14.10%, ash content 7.11% and crude fiber 11.76%, that might be due to biodegradation of SNC by the yeast, while ether extract and nitrogen-free extract (NFE) was not affected by fermentation. The tannin content 23.56% reduced.

A lower overall performance in this study was observed in birds fed 20% SNC compared to the other birds fed on low SNC levels. The decreased feed intake of broilers fed on diets containing 20% SNC (treated and untreated) may be due to poor palatability of the SNC and the presence of anti-nutritional factors as the inclusion level increased. The decline in feed consumption with increasing levels of SNC in this study is similar to the result of Atuahene *et al* (1998), and Olorede and Longe (1999) during which pullets feed consumption reduced as the inclusion level exceeded 10% SNC in the diet. The birds fed on 10% SNC of both treated NaOH treated and yeast fermented showed the best performance in feed intake that may attributes to the reduction of tannin. This finding is in line with that of Dei *et al*., (2008). The improvement in the live body weight and weight gain of broilers fed the control diet (0%) and 10% treated SNC compared with other dietary treatments may be due to low anti-nutritional factors and palatability of the diets which enhance consumption and hence increase in weight of the broilers. This finding is similar to the findings of Olorede and Longe (1999); Annongu *et al*. (1996). The feed conversion ratio (FCR) for birds in control diets and both treated 10% inclusion level of SNC in this study was relatively low compared to 10% inclusion level of untreated SNC and 20% inclusion level of treated and untreated SNC. Similar results were reported by Zanu *et al*. (2012) for cockerels fed Shea butter diet. Also Dei *et al*. (2008) had reported that the FCR for broiler fed fermented Shea butter was poor compared to that of chicks fed on unfermented Shea butter meal, which agree with the results of the current study. This might be due to the poor palatability of the SNC.

Conclusions

Based on the results obtained from this study SNC could be a potential feed ingredient for broiler chickens due to the high values of protein and energy. It was evident from this study that the tannin concentration of the SNC is sufficiently reduced by NaOH treatment and fermentation by yeast.

References:

Ademola, S.G., and Farinu, G.O. (2006). Performance of laying birds fed diets containing forage Meal of Tithonia diversifolia (Hemsl AG) and antibiotics. Nigerian J. of Animal Production, 33 (1): 58-68.

Agbo. N.W., and Prah. C.D. (2014) Evaluation of fermentation period on the proximate composition and tannin concentration of sheanut (Vitellaria paradoxa) meal, J. of Microbiology and Biotechnology Research,4: 21-27.

Alemawor F, Dzogbefia V.P, Oddoye E.O.K, and Oldham J.H. (2009). Effect of Pleurotus ostreatus fermentation on cocoa pod husk composition: Influence of fermentation period and Mn2+ supplementation on the fermentation process. African J. of Biotechnology, 8: 1950-1958.

Annongu, A.A., Termeulen, U., atteh, J.O., and Apata, D.F. (1996). Toxicological assessment of native and industrial fermented sheabutter cake in nutrition of broilers. Archiv fur Geflugelkunde, 60: 221-226.

AOAC (Association of Official Analytical Chemists). (1990). Official

Methods of Analysis, 15th edition., Arlington, VA, USA.

Atuahene, C. C., Donkoh, A., and Asante, F. (1998). Value of shea nut cake as a dietary ingredient for broiler chickens. Animal Feed Science and Technology, 72: 133 -142.

Ayssiwede, S.B., Zanmenou, J.C., Issa, Y., Hane, M.B., Dieng, A., Chaysostome, and C. A. A.M., Missohou. (2011). Nutrient Composition of same Unconventional and Local feed resources available in Senegal and Recoverable in Indigenous Chickens for Animal feeding. Pakistan J. of Nutrition, 10, 707-717.

Dei, H. K., Rose, S. P., Mackenzie, A. M., and Amarowicz, R. (2008). Growth performance of broiler chicken fed diets containing Shea nut (*Vitellaria paradoxa*, Gaertn.) meal fermented with *Aspergillus niger*. Poultry Science, 87: 1778-1778.

Ghadge, V. N., Upase, B. T., and Patil, P. V. (2009). Effect of Replacing Groundnut cake by soyben meal on performance of broiler. Veterinary World, 2(5), 183-184.

Lodhi G. N., Daulat S, and Ichhponani J. S. (1976). Variation in nutrient content of feedingstuffs rich in protein and reassessment of the chemical method for metabolizable energy estimation for poultry. J. agric. Sci., Oamb. 86: 293-303

Lovett P.N. (2005). Shea butter industry expanding in West Africa, Inform AOCS
magazine, 16 (5): 269-300.

NRC national research council. (1994). Nutrient requirements of poultry, 9th revised edition. Washington, DC, National Academy Press.

Oboh, G (2006). Nutrient Enrichment of Cassava Peels Using Mixed culture of Saccharomyces cervisiae and Lactobacillus spp. Solid Media Fermentation Techniques. J. of Biotechnology, 9(1): 312-319.

Oddoye, E. O. K., Alemawor, F., AgyenteBadu, K., and Dzogbefia, V. P. (2012). Proximate analysis of Sheanut kernel cake/meal samples from industry and cottage industry and some methods of removal of antinutritional factors. International J. of Biochemistry and Biotechnology, 1: 239-242.

Ojewola, G. S., and Udom, S. F. (2005). Chemical Evaluation of the Nutrient Composition of same Unconventional Animal Protein Source. International J. of Poultry Science, 4(10), 745-747.

Olorede, B. R., and Longe, O. G. (1999). Growth, nutrient retention, haemato-logy and serum chemistry of pullet chicks fed Shea butter cake in the humid tropics. Arch. Zootec, 49: 441-444.

Singh, B., and Singh, U. (1991). Peanut as a source of Protein for Human Foods. Plant for Human Nutrition, 41(2), 165-177.

Steel, R.G. D. and Torri, G. H. (1996). Principles of Statistics: Biomedical Approach. Mc Grow- Hill Book Company, New York.

Umali B.E., and Nikiema A. (2002). Vitellaria paradoxa C. F. Gaertn. Record from Protabase. Oyen, L P A and Lemmens, R H M J (Editors). PROTA, Wageningen, the Netherlands.

Zanu, H.K., Adom S.O., and Appiah-Adu, P. (2012). Response of cockerels to diets containing different levels of sheanut cake. *Agricultural Sciences Research J.* 2 (7): 420-423.

Table (1) proximate composition of treated and untreated Shea Nut Cake (SNC):

Shea nut cake Composition	Crude Shea nut cake	Shea nut cake treated by NaOH	Shea nut cake fermented by yeast
D.M%	94.30	92.69	95.27
C.P%	13.46	13.65	14.10
C.F%	9.75	8.64	11.76
N.F.E%	51.38	48.86	50.70
E.E%	13.09	12.77	13.44
Ash %	6.62	6.93	7.11
Tannin%	46.04	17.19	23.56

Values are means of duplicate samples

Table (2): composition (%) of the experimental starter diets:

Treatment Ingredient	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**
Sorghum	66.4	56.3	45.64	56.54	46.5	56.74	46.3
Ground nut cake	26.74	26.64	26.7	26.5	26.39	26.6	26.49
Crude Shea nut cake	0	10	20	0	0	0	0
NaOH treated Shea nut cake	0	0	0	10	20	0	0
Fermented Shea nut cake	0	0	0	0	0	10	20
Super concentrate*	5	5	5	5	5	5	5
Lime stone	0.4	0.5	0.6	0.6	0.7	0.6	0.6
Di calcium phosphate	0.7	0.6	0.6	0.4	0.2	0.3	0.6
Vegetable oil	0	0.2	0.6	0.2	0.45	0	0.25
Methionine	0.1	0.1	0.2	0.1	0.1	0.1	0.1
Lysine	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Anti-fungal	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Anti-coccidian	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Colene chloride	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Organic acids	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Premix	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Salt	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Total	100	100	100	100	100	100	100
calculated analysis of the experimental starter diets:							
ME kJ/kg	12.99	12.98	12.98	12.99	12.99	12.99	12.99
CP %	22.04	22.02	22.01	22.01	22.02	22.03	22.02
CF %	4.82	5.48	6.09	5.36	5.91	5.58	6.54
Ca %	0.99	0.98	0.99	0.97	0.98	0.96	0.99
Available Phosphorous %	0.56	0.54	0.54	0.50	0.49	0.49	0.53
Lysine %	1.27	1.28	1.26	1.28	1.25	1.28	1.25
Methionine %	0.53	0.51	0.58	0.51	0.50	0.51	0.50

ISSN (text): 1858-6724 e-ISSN (online): 1858 6775

Table (3): composition (%) of the experimental finisher diets:

Treatment Ingredient	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**
Sorghum	67.64	57.34	46.74	57.64	47.75	58.24	47.5
Ground nut cake	24	24	24.1	23.9	23.69	23.7	23.79
Crude Shea nut cake	0	10	20	0	0	0	0
NaOH treated Shea nut cake	0	0	0	10	20	0	0
Fermented Shea nut cake	0	0	0	0	0	10	20
Super concentrate*	5	5	5	5	5	5	5
Lime stone	0.5	0.5	0.6	0.6	0.7	0.6	0.6
Di calcium phosphate	0.7	0.6	0.6	0.4	0.2	0.3	0.6
Vegetable oil	1.5	1.8	2.1	1.7	1.9	1.4	1.75
Methionine	0.1	0.1	0.2	0.1	0.1	0.1	0.1
Lysine	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Anti-fungal	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Anti-coccidian	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Colene chloride	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Organic acids	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Premix	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Salt	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Total	100	100	100	100	100	100	100
calculated analysis of the experimental finisher diets:							
ME kJ/kg	13.41	13.42	13.40	13.40	13.40	13.40	13.41
CP %	21.00	21.00	21.02	21.02	21.01	21.00	21.01
CF %	4.59	5.25	5.86	5.14	5.68	5.45	6.31
Ca %	0.98	0.97	0.97	0.96	0.93	0.94	0.97
Available Phosphorous %	0.54	0.52	0.52	0.50	0.49	0.47	0.52
Lysine %	1.27	1.25	1.23	1.25	1.24	1.24	1.22
Methionine %	0.51	0.50	0.53	0.51	0.49	0.50	0.48

Table (4) The overall performance of broiler chicks fed on treated and untreated SNC (values are mean±SD) (N=40/treatment)

	Control diet	Crude SNC		SNC treated with NaOH		SNC treated with yeast		sig
Performance parameters	Zero % SNC	10%	20%	10%	20%	10%	20%	
Initial weight(g)	107.1±0.3	107.0±0.3	107.2±0.3	107.0±0.2	107.0±0.3	107.1±-.2	107.0±0.3	NS
Feed intake (g/bird)	3277.2±73.4^{ab}	3023.5±66.7^{bc}	2808.1±127.8^{cd}	3256.8±157.8^{ab}	3054.8±179.9^{b}	3294.2±275.3^{a}	2711.8±125.9^{d}	**
Live body weight (g)	1528.5±40.1^{ab}	1397.0±78.5^{c}	1286.1±35.6^{d}	1622.1±38.3^{a}	1502.1±110.4^{b}	1565.9±90.8^{ab}	1167.1±46.0^{e}	**
Weight gain (g)	1421.4±39.8^{ab}	1290.0±78.3^{c}	1178.9±35.5^{d}	1515.1±38.4^{a}	1395.1±110.5^{b}	1458.8±90.7^{ab}	1060.1±46.3	**
FCR (g feed/g gain)	2.31±0.1^{b}	2.35±0.1^{b}	2.38±0.1^{b}	2.15±0.1^{c}	2.19±0.1^{c}	2.26±0.1^{bc}	2.6±0.1^{a}	**
Mortality %	0.00±0.0	0.00±0.0	0.00±0.0	0.00±0.0	0.00±0.0	0.00±0.0	0.00±0.0	NS

NS: not significant

**: significant different at ($p \leq 0.01$)

a,b : mean within the same row followed by different superscripts are significantly ($p<0.05$) different

أثر استخدام امباز الشيا المعالج كيميائيا و حيويا و الغير معالج على الاداء الانتاجي للدجاج اللاحم

محمد ادريس شوا[1]، رانيا محمد شمس الدين[2] و محمد تاج الدين ابراهيم[1]

1جامعة السودان للعلوم و التكنولوجيا، كلية علوم و تكنولوجيا الانتاج الحيواني، قسم علوم وتكنولوجيا الانتاج الحيواني
2جامعة السودان للعلوم و التكنولوجيا، كلية علوم و تكنولوجيا الانتاج الحيواني، قسم علوم وتكنولوجيا انتاج الدواجن

المستخلص

تم استخدام 280 كتكوت لاحم (Arbor–acres) عمر يوم لدراسة اثر امباز الشيا المعالج وغير المعالج على الاداء الانتاجي للدجاج اللاحم. امباز الشيا هو احد مخلفات استخلاص زبدة الشيا من ثمار شجرة الشيا (Vitellaria paradoxa). تم وضع الطيور في 7 مجموعات علفية تحوي 4 مكررات بواقع 10 طيور لكل مكرر. تم عمل علائق البادئ (3 اسابيع) والنهائي (3 اسابيع). تم ادخال امباز الشيا بثلاث مستويات (صفر, 10 و 20%) لثلاث انواع من الشيا وهي الخام (غير معالج)، معالج ب (0.01 م) هيدروكسيد الصوديوم والثالث معالج بالخميرة على النحو التالي: (T1) و تحتوي على 0% امباز شيا، (T2, T3) تحتويان على 10 و 20% امباز شيا غير معالج، (T4, T5) تحتويان على 10 و 20% امباز شيا معالج ب هيدروكسيد الصوديوم بينما كانت المعاملتين (T6, T7) تحتويان على 10 و 20% امباز شيا معالج بالخميرة . تم تحليل عينات من امباز الشيا المعالج و غير المعالج لمعرفة التركيب الكيميائي حسب (AOAC, 1990). تم تقدير تركيز ال tannin باستخدام الطريقة التي وصفها (2014) Agbo وPrah. كان الاداء الانتاجي للطيور التي غذيت ب 10% افضل من تلك التي غذيت ب 20% امباز شيا وان الطيور التي غذيت بالامباز المعالج كان اداؤها افضل من تلك التي غذيت بالامباز غير المعالج.