GSC Biological and Pharmaceutical Sciences
eISSN: 2581-3250 CODEN (USA): GBPSC2
Cross Ref DOI: 10.30574/gscbps
Journal homepage: https://gsconlinepress.com/journals/gscbps/

(RESEARCH ARTICLE)

Check for updates

Performance and haematological indices of broiler chickens fed varied inclusion level of palm kernel cake

Zekeri, Okpanachi Joseph, Okpe, Alfa Ameh, Ejiwoye, Ouwafemi Amos *, Ajagbe and Adekune David

Department of Anima Production, Prince Abubarkar Audu University, Anyigba, Nigeria.

GSC Biological and Pharmaceutical Sciences, 2022, 21(01), 208–214

Publication history: Received on 29 August 2022; revised on 15 October 2022; accepted on 18 October 2022

Article DOI: https://doi.org/10.30574/gscbps.2022.21.1.0380

Abstract

A total of one hundred and forty four (144) broiler chickens in a 42-day trial were used to evaluate the effect of graded levels of palm kernel cake on the performance and haematological characteristics of broilers. The broilers were randomly allotted to four treatments with 0%, 10%, 20% and 30 % PKC inclusion levels designated as treatments 1, 2, 3 and 4 respectively in a Completely Randomized Design (CRD). Each treatment had three (3) replicates with twelve (12) birds per replicate. Growth performance showed higher significant ($P<0.05$) values of 2073.68 g, 1874.39 g, 44.63 g and 101.49 g respectively for final weight, weight gain, daily weight gain and daily feed intake from birds fed 30 % PKC. Value ranges of 32.14 % to 34.67 % 10.36 g/dl to 11.37 g/dl, 3.17 to 3.49 x1012/l were obtained for packed cell volume, haemoglobin, and red blood cell in birds fed the control and 30 % PKC based diets respectively. This implied PKC has the potential to improved growth performance and haematology of boilers chicken. It was concluded that inclusion of PKC in the broiler's diets significantly improved the performance and haematological parameters of the broiler chickens therefore should be included in the formulation of broilers diets for up to 30 %.

Keywords: Performance; Haematology; Broiler; PKC

1. Introduction

High fibre and low metabolizable energy content of agro-industrial by-product often results in poor response of monogastric animals in term of their growth performance [1]. To make these products acceptable to these animals, there is need to augment them with high energy sources like palm oil or break down the fibre to release more energy [2]. Poultry are not equiped with the required endogenous enzymes necessary for breaking down of non-starch-polysaccharides (NSPs) [3]. These therefore necessitates the use of enzymes in the poultry industries for many years. An increased understanding of the properties of enzymes and their function has led to their introduction in the animal feed industry [4].

Palm kernel meal (PKM) is one of the abundant agricultural by-products that is cheap and readily available. It is afflation-free, palatable and has considerable potential as carbohydrates and protein source. However, due to its low nutritive value, grittiness and potential for deterioration in unhygienic conditions, large amounts of PKM is often discarded and can create environmental problems in the future [5]. The incorporation of PKM in livestock and poultry diets is limited by its high fiber level, gritty nature, level of palatability, relatively low availability levels of amino acids and high copper content [6]. However, early reports indicated that PKM can be fed to starter and finisher broiler chicks at 28% and 35% inclusion levels without a deleterious effect on production [7]. Also [8] showed that broilers fed at 30% PKC diet during the finisher phase were similar in growth rate to their counterparts fed at 0% PKC based diet. Therefore this research is geared at determining the effect of PKC on the growth performance and haematological indices of poultry so as to ascertain the optimum inclusion level in poultry diet.

* Corresponding author: Ouwafemi Amos
Department of Anima Production, Prince Abubarkar Audu University, Anyigba, Nigeria.

2. Material and methods

2.1. Experimental Location

The study was conducted at the Poultry Unit of the Teaching and Research Farm of the Department of Animal Production, Faculty of Agriculture, Prince Abubakar Audu University, Anyigba in Dekina Local Government Area of Kogi State. Which falls within the southern Guinea savanna zone of Nigeria on longitude 07^0 29'N and latitude 07^0 11'E of the Greenwich meridian [9].

2.2. Experimental Diets

Palm Kernel Cake (PKC) was purchased from palm kernel oil processing plant in Anyigba while, maize and other dietary ingredients were purchased from the open market in Anyigba and its environs. The palm kernel cake was ground using a hammer mill before it was incorporated at four (4) varied inclusion levels of 0, 10, 20 and 30 % in T1, T2, T3 and T4 respectively with Tl being without PKC as control.

Table 1 Percentage Composition of Starter Broilers Experimental Diet Containing Palm Kernel Cake

Ingredients	T1	T2	T3	T4
Maize	43.44	38.44	36.20	30.00
Maize offal	12.60	12.36	11.04	10.00
Soybean	34.50	30.30	27.30	21.50
PKC	0.00	10.00	20.00	30.00
Fish meal	5.50	5.50	5.50	5.50
Bone meal	3.20	3.20	3.20	`3.20
Salt	0.30	0.30	0.30	0.30
Premix	0.26	0.26	0.26	0.26
Lysine	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00

T1, T2, T3 and T4: Control, 10%PKC, 20%PKC and 30%PKC respectively. PKC=Palm kernel cake

Table 2 Percentage Composition of Finisher Broilers Experimental Diet Containing Palm Kernel Cake

Ingredients	T1	T2	T3	T4
Maize	48.44	40.88	34.20	30.00
Maize offal	12.60	12.36	11.04	10.00
Soybean	30.00	27.80	25.80	22.00
PKC	0.00	10.00	20.00	30.00
Fish meal	5.00	5.00	5.00	5.00
Bone meal	3.20	3.20	3.20	`3.20
Salt	0.30	0.30	0.30	0.30
Premix	0.26	0.26	0.26	0.26
Lysine	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00

T1, T2, T3 and T4: Control, 10%PKC, 20%PKC and 30%PKC respectively. PKC=Palm kernel cake

2.3. Experimental Layout and Management of Birds

One hundred and forty four (144) two weeks old broiler chickens were used for the experiment. The birds were weighed and randomly allocated to four diets in a Completely Randomized Design (CRD). Each treatment had thirty six birds (36) such that each replicate had twelve (12) birds which were raised on a deep litter. The experiment lasted for six weeks. Feed and drinking water were provided ad libitum and standard routine management practices were followed.

2.4. Performance Data

The birds were weighed at the beginning of the experiment, and then weekly till the end of the experiment. Performance data collected included daily weight gain, daily feed intake, feed conversion ratio and mortality.

2.4.1. Initial Body Weight

This was determined by weighing the birds per replicate at the beginning of the experiment and values obtained recorded as the initial weight.

2.4.2. Weight Gain

This was determined by subtracting mean initial weight from mean final weight of the broiler chickens.

2.4.3. Average Daily Weight Gain

Average daily weight gain was determined by dividing weight gain by the number of birds and the number of days of the feeding trial.

2.4.4. Daily Feed Intake

It was determined by subtracting the leftover from the quantity of feed offered and value obtained recorded as daily feed intake.

Feed Intake = Feed Offered-Leftover Feed.

2.4.5. Feed Conversion Ratio

This was computed for each replicate during the feed trial as indicated below

$$\text{Feed conversion ratio (FCR)} = \frac{\text{Daily feed intake (g)}}{\text{Daily weight gain (g)}}$$

2.5. Haematological Analysis

On the 42nd day of the experiment, two birds per replicate were randomly selected for blood collection. Blood samples were collected through the wing vein into EDTA bottles for haematological evaluation of the red blood cells (RBC), haemoglobin (Hb), packed cell volume (PCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), mean corpuscular volume (MCV) and white blood cells (WBC), neutrophil and lymphocytes.

2.6. Chemical Analysis

Proximate analysis of dietary samples were conducted as outlined by Official Association of Analytical Chemist [10]

2.7. Statistical Analysis

All data collected were statistically analyzed using the One Way Analysis of Variance (ANOVA) with the aid of SPSS version 16. Where there was significant difference, the values obtained were further subjected to Fisher's Least Significant Difference.

3. Results and discussion

3.1. Performance of Broilers varied inclusion levels of Palm Kernel Cake

Effect of varied inclusion levels of Palm Kernel Cake on the performance of Broilers is presented in Table 3. Result obtained revealed significant ($p<0.05$) influence of palm kernel cake meal on the final weight, weight gain, daily weight

gain, daily feed intake and mortality. However, no significant (P>0.05) difference was obtained for feed conversion ratio. Initial weight ranged from 198.84 g to 200.01 g. Significant (P<0.05) increase in value from 1864.40 g to 2073.86 g was observed for final weight from the control and for the 30 % PKC. Daily weight gain showed significant variation with values ranging from 39.66 g to 44.63 g. Daily feed intake values ranged from 89.04 g to 101.49 g while highest value of 10.00 % mortality was obtained for the 10 % PKC inclusion.

Table 3 Performance of Finisher Broilers Fed Varied Inclusion levels of palm kernel cake in the diets

Parameters	T1 (0%)	T2 (10%)	T3 (20%)	T4 (30%)	SEM	LOS
Initial weight (g)	198.84	200.01	199.24	199.47	1.56	NS
Final Weight (g)	1864.40^{c}	1921.80^{b}	2061.85^{a}	2073.86^{a}	15.83	*
Weight gain (g)	1665.52^{b}	1721.79`	1862.61^{a}	1874.39^{a}	32.24	*
Daily weight gain (g)	39.66^{b}	41.00b	44.35^{a}	44.63^{a}	1.15	*
Daily feed intake (g)	89.04b	93.30^{a}	97.37^{a}	101.49^{a}	2.05	*
Feed conversion ratio	2.25	2.27	2.20	2.27	0.30	NS
Mortality (%)	0.00^{c}	10.00^{a}	6.70^{ab}	3.30^{b}	0.19	*

$^{a, b,c,d}$ means with different superscripts along the same row shows significant difference at p<0.05, SEM= Standard Error of the Mean. T1, T2, T3 and T4=control, 10%pkc, 20%pkc and 30%pkc respectively. LOS=level of significance, *=significantly different, NS=Not Significantly Different.

The steady significant (P<0.05) increase in the value of the final weight observed with increase in the PKC inclusion could implies that there was effective utilization of the diet by the experimental groups. [11] reported similar observations when palm kernel cake meal was fermented with *Aspergillus wentii* for broilers chickens. However, [12] reported a decline in final weight from 2.24 kg to 1.96 kg when untreated palm kernel cake was fed to broiler chicken. Results for final weight obtained is in variance with the belief that the inefficiency of digesting high fibre feeds by broilers, as well as the light and fibrous texture of PKC could limit its utilization by broilers as reported by [13]. More so, this is in line with report of [14] who stated that high crude fibre content of PKC may have negative effect on its digestion, leading to impaired growth performance of broilers. [15] reported that up to 10 % PKC inclusion in broiler feed had no adverse effect on growth performance of broilers. [11] further observed that the inclusion of enzyme helped to improve the digestibility of the PKC and other feed nutrients present in the diet thereby improving the final weight of the birds. However, values obtained for final weight in this study were within values range of 1690.00 g to 2100.18 g reported by [16] when PKC was fed to finisher broilers. [17] reported a range of 1340 g to 2070 g for broilers fed palm kernel cake meal based diets. Daily feed intake showed value ranging from 89.04 g to 101.49 g. Values obtained for daily feed intake were lower than 120 g to 180 g reported by [18] which confirmed the scientific evidence that birds eat to satisfy their energy requirement. Variation could be as a result of the size of the birds as broilers eat a fraction of their body weight as reported by [17]. No significant (P>0.05) difference was obtained in the feed conversion ratio. However, the best feed conversion ratio was observed with the 10 % PKC and 30 % PKC with 2.27 respectively. [19] conducted a study using higher levels of raw PKC at 30, 40 and 50 % in broiler diets and concluded that FCR decreased as the level of dietary PKC increased. [20] reported that poor FCR value might be due to the inefficiency of digesting high fibre feeds by broilers, as well as the light and fibrous texture when PKC was fed to broilers. The no significant (P>0.05) variation observed for FCR implies that the treatment effect did not negatively affect the performance of the broilers. Feed conversion ratio value which ranged from 2.20 to 2.27 were within value range of 1.92 to 2.24 reported by [5] when broilers were fed different combinations of palm kernel cake meal based diet as energy source. The low feed conversion ratio implies efficiency of digesting the experimental diet despite the high fibre present in the high PKC inclusion diets. However, the no clear pattern of variation observed for FCR, this implies that irrespective of inclusion levels, utilization of the experimental diets was not significantly affected.

3.2. The effect of varied palm kernel cake inclusion on the haematology of broilers

Effect of varied inclusion levels of Palm Kernel Cake on the haematological Parameters of Broilers is presented in Table 4.

Result obtained showed significant (p<0.05) influence of PKC across treatment on the packed cell volume, haemoglobin, red blood cell, mean corpuscular haenmoglobin, neutrophils and lymphocytes. Values range of 32.14 to 34.67 o were obtained for packed cell volume. Haemoglobin values obtained ranged from 10.36g/dl to 11.37g/dl. While RBC, MCH, MCHC, Neutrophil and lymphocytes had value ranged of 2.06-3.64 and 96.93-98.44% respectively were obtained.

Table 4 Haematology of Broilers fed varied inclusion level of palm kernel cake in the diets

Parameters	T1 (0%)	T2 (10%)	T3 (20%)	T4 (30%)	SEM	LOS
Packed Cell Volume (%)	32.14^{b}	32.33^{ab}	33.00^{ab}	34.67^{a}	0.82	*
Haemoglobin (g/dl)	10.36^{b}	10.43^{b}	11.00^{a}	11.37^{a}	0.45	*
White blood cell ($x10^{9}$/l)	231.19	230.83	233.19	231.74	3.28	NS
Red Blood cell ($x10^{12}$/l)	3.17^{b}	3.26^{b}	3.28^{ab}	3.49^{a}	0.04	*
Mean Corpuscular Volume (fl)	115.95	113.64	116.00	115.67	2.96	NS
Mean Corpuscular Heamoglobin (pg)	38.31^{c}	39.47^{b}	40.22^{a}	40.94^{a}	0.67	*
Mean Corpuscular Haemoglobin Concentration (g/dl)	34.39	34.47	34.36	33.96	0.71	NS
Neutrophils (%)	3.49^{a}	3.64^{a}	2.06^{b}	3.44^{a}	0.48	*
Lymphocyte (%)	97.41^{b}	98.02^{a}	98.44^{a}	96.93^{b}	0.37	*

$^{a, b,c,d}$ means with different superscripts along the same row shows significant difference at $p<0.05$, SEM= Standard Error of the Mean. T1, T2, T3 and T4=control, 10%pkc, 20%pkc and 30%pkc respectively. LOS=level of significance, *=Significantly different, NS=Not Significantly Different.

PCV value range of 31.33 to 34.33 % were within reference values of 24 % to 32 % reported by [21] when palm kernel cake were fed to broiler at inclusion range of 0 to 25 %. [22] reported a range of 33 % to 35 % on feeding high fibrous feed to broiler chickens. This signifies that there are no symptoms of physiological anemia in the experimental birds. A range of 10.36 g/dl to 11.37 g/dl obtained for haemoglobin were within reference values of 9.00 to 13.00 g/dl as reported by [23] This implies that the birds had no respiratory stress as enough iron was present in the blood for oxygen and CO_2 transportation. [24] reported values between of 10 -13 g/dl for haemoglobin of birds fed ginger root meal. No significantly ($P>0.05$) varied values were obtained for the white blood cell (WBC). However, value ranging between 230.83 to 233.19 $x10^{9}$/1 obtained implies that the birds had enough antibodies to withstand pathogenic stress [23]. Values obtained for WBC in this study were in harmony with value within 167.12 to 198.94 $x10^{9}$/l reported by [25] for healthy chickens. Red blood cell value steadily increased with increase in the inclusion of PKC. Value range of 3.17 to 3.49 $x10^{12}$/l obtained were within reference range of 2- 4x 10^{12}/1 reported by [26] This implies birds were not anemic as reported by [27]. Value ranging between 38.31 to 40.94 pg and 33.96 to 34.47 g/dl obtained for MCH and MCHC were within reference values of 35.00 to 45.00 pg and 32.00 to 39.00 g/dl as reported by [28] for broiler Chicken on feeding wheat-based diets. Values obtained implies no nutritional deficiency was observed with inclusion of PKC at all inclusion level within the dietary treatments. More so values obtained for neutrophils and lymphocytes showed neutrophils ranging between 2.06 to 3.64 %, while lymphocytes values were between 96.93 to 98.02 %. Lower value obtained in the 20 % PKC inclusion in the neutrophil was compensated for in the lymphocyte. Obtained values imply high immunity of the birds against infections. [29] opined that values lower than 2.00 % for neutrophil results in decreased hardiness of the birds, as birds become susceptible to pathogenic stress especially in new territories [24].

4. Conclusion

Based on the observed results, PKC inclusion significantly improved the performance characteristics and haematoogical indices of broiler chickens, therefore, should be incorporated into the diet of broiler chickens up to 30%.

Compliance with ethical standards

Acknowledgments

The authors acknowledge the effort put into this work by the Prince Abubakar Audu Livestock Teaching and Research Farm Staff.

Disclosure of conflict of interest

All authors declared that there exists no conflict of interest of any kind on the publication of this manuscript.

References

[1] Atteh, J.O., (2004). Response of broilers to skip a day (SAD) feeding. Nigerian Journal of Animal Production 30: 163-172.

[2] Fadipe, U.I. (1996). Palm Kernel Cake as Substitute for Maize in Broiler Finisher Diet. Int. J. Poult. Sci., 8:1206–1208.

[3] Noraini, S., Vikineswary, D.M., Jaafar, D.M., Azizul, I., Ahmad, A. and Poovasagam, S. (2004). Biosynthesis of β-mannanase from Aspergillus niger by solid substrate fermentation (SSF) using palm kernel cake (PKC) as the basis of solid substrate. In: Proceedings of the International Seminar on Solid State Fermentation, Penang, Malaysia.

[4] Chen, W.L., Liang, J.B., Jahromi, M.F., Abdullah, N. Ho, Y.W., Tufarelli, V. (2015). Enzyme treatment enhances release of prebiotic oligosaccharides from palm kernel expeller. BioResources Journal. 10:196-209.

[5] Sundu, B., Kumar. A. and Dingle, J. (2006). Palm kernel meal in broiler diets: Effect on chicken performance and health. World's Poultry Science Journal. 62: 316-325.

[6] Okeudo N.J., Onyike I.L., Okoli C.V. and Chielo I.L. (2006). Production performance, meat quality and feed cost implications of utilizing high levels of palm kernel cake in broiler finisher diets. International Journal of Poultry Science. 5 (12): 1160-1163

[7] Onwudike, O.C. (1998). Palm kernel meal as a feed for poultry. 2. Diets containing palm kernel meal for starter and grower pullets. Animal Feed Science Technology. 18: 187-194

[8] Saenphoom, P., Liang, Y.W., Ho, T.C., Loh, M. and Rosfarizan, J.B. (2013). Effects of enzyme treated palm kernel expeller on metabolizable energy, growth performance, villus height and digesta viscosity in broiler chickens. Asian Australia Journal for Animal Science. 26: 537.

[9] Ifatimehin, O.O., Musa, S.D. and Adeyemi, J.O. (2006). Managing land use transformation and land surface temperature change in Anyigba Town, Kogi State, Nigeria. Journal of Geography and Geology, 3:77 – 85.

[10] AOAC. (1990). Official Methods of Analysis Association of Official Analytical Chemists, 14th Association of Official Analytical Chemists, 14th Edn, Washington DC., pp: 1141.

[11] Muangkeow, N. and Chinajariyawong, C. (2009). Determination of true amino acid digestibility and metabolizable energy in fermented palm kernel meal with Aspergillus wentii TISTR 3075 for chickens. Walailak. Sci. Technol. 6:231-241.

[12] Mateos, G.G., Jiménez-Moreno, E., Serrano, M.P. and Lázaro, R.P. (2012). Poultry response to high levels of dietary fiber sources varying in physical and chemical characteristics. Appl. Poult. Res. 21, 156-174.

[13] Fabunmi, T.B., Arotupin, D.J., Adegunloye, D.V., Orunmuyi, M. and Odole, B.S. (2019). Effects of Kolanut Husk Formulated Feed at Graded Levels on Growth Performance and Health of Ross Broilers with and Without Enzyme Inclusion". Acta Scientific Agriculture 3(2): 105-113.

[14] Ezieshi E.V. and Olomu J.M. (2014) Comparative performance of broiler chicken fed varying levels of palm kernel cake and maize offal. Pakistan Journal of Nutrition. 3: 254-257

[15] Soltan, M.A. (2009). Growth performance, immune response and carcass traits of broiler chicks fed on graded levels of palm kernel cake without or with enzyme supplementation. Livest. Res. Rural Dev. 21: 37–55.

[16] Ojewola, G.S. and Ozuo, I.K. (2006). Productive and economic response of broiler chickens to diets containing different types of oil. Tropical Journal of Animal Science. 10(1-2): 115-119.

[17] Zakaria, Z., Rahman, K.H. and Yusof, S.J. (2016). Broilers production from palm oil agro-industrial wastes supplemented with Aspergillus terreus UniMAP AA-1 Pertanika. J Trop Agric Sci. 39:29–39

[18] Aderemi, F.A., Alabi, O.M. and Lawal, T.F. (2014). Utilisation of whole cassava leaf meal by egg-type chicken. Proceedings of the 11th Annual Conference of Animal Science Association of Nigeria (ASAN). Sept.18 – 21, 2006, I. A. R. & T. Ibadan, Nigeria. Pp. 153 – 155

[19] Panigrahi, Z.A., Powell, S. (1991). Haematology, Serum Chemistry and Electrocardiographic Evaluation in Native Chicken of Kashmir. International Journal of Poultry Science. 6(8): 578-582.

[20] Zulkifli, I., Rahayu, H.I., Alimon, A., Vidyadaran, M. and Babjee, S. (2009). Gut microflora and diets intestinal morphology of commercial broiler chickens and red jungle fowl fed diets containing palm kernel meal. Archiv für Geflügelkunde. 73:49-55.

[21] Khadijat, B.M., Enoch, O.O. and Suleiman, B.E. (2012). Performance, carcass characteristics and blood composition of broilers fed varying levels of palm kemel meal (Elaise guinensis) supplemented with different levels of fish meal. International Journal of Poultry Science. 11: 73-77.

[22] Idahor, M., Rothschild, M.F., Persia, M.E. (2010). Efects of high fiber ingredients on the performance, metabolizable energy and fiber digestibility of broiler and layer chicks. Anim ood C: Torhnl. 100.A6

[23] Mehala, C, and Moorthy, M. (2008) Effect of Aloe vera and Curcuma longa (Turmeric) on carcass characteristics and Biochemical parameters of broilers. International Journal of Poultry Science. 7(9):857-861.

[24] Arkan, B., Mohamed, M.A., Al-Rubaee, J.M. and Ali, Q.J. (2010) Effect of Ginger on performance and Blood Serum Parameters of Broiler. International Journal of poultry Science 11(2):143-146.

[25] Oguntoye M.A., Bako, J., Adamu, F., Daniel, D.K., Daniel, B. and Joseph, E. (2018). Effect of maize and yam peel based diet supplemented with xylanase, Amylase and Protease Multi-Enzymes on serum biochemistry and haematological indices of starter broiler chickens. Nigerian journal for animal science. 20(4):355-363

[26] Mitruaka, B.M. and Rawnsley, H.M (1977). Clinical Biochemistry and Haematological reference value in normal experimental animals publishing Inc. pp106-112

[27] Mitruaka, B.M. and Rawnsley, H.M (1977). Clinical Biochemistry and Haematological reference value in normal experimental animals publishing Inc. pp106-112

[28] Gao, F, Jiang, Y., Zhou, G.H. and Han, Z.K. (2008). The effects of xylanase supplementation on performance, characteristics of the gastrointestinal tract, blood parameters and gut microflora in broilers fed on wheat-based diets. Anim. Feed Sci. Technology. 142, 173-184

[29] Togun, V.A. and Oseni, B.S. (2005). Effects of chronic lead administration on the haematological parameters of rabbits – a preliminary study (p. 341). Proceedings of the 41st Conferences of the Agricultural Society of Nigeria.