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# Response of Broiler Finisher Birds to Different Dietary Levels of Palm Kernel Cake

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***Abstract - This experiment assessed the impact of replacing maize with palm kernel cake on broiler nisher birds as energy source. Sixty marshell breed broiler birds of 28 days old were randomly distributed into four dietary treatments in a completely randomized design (CRD) with three replicates of five birds each. The dietary treatments were: T1 (10% PKC), T2 (20% PKC), T3 (30% PKC), and control T4 (0% PKC). The experiment lasted 28 days. Analysis of the results revealed that the final body weight, weight gain, average daily weight gain, feed conversion ratio (FCR), and feed cost per kilogram of gain were significantly affected (P < 0.05) by the dietary treatment. Birds under T1 (10% PKC) recorded the maximum final body weight (2973.3g), and the maximum gain in growth (1293.0g), with the least FCR (3.21). The control (T4) performed the least in all the above parameters. There was no significant difference(P>0.05) in the mean weight gain. Carcass characteristics showed significant difference(P<0.05) in the heart, liver and intestine. We conclude that palm kernel cake at a 10% inclusion level is a superior energy source in enhancing weight gain and economic efficiency in marshell broiler finisher production.***

***Keywords: Response, Broiler Finisher, Dietary Levels, Palm Kernel Cake***

## I. INTRODUCTION

Broiler production is one of the fastest means of bridging the animal protein gap. Broilers are fast growing meat type birds. Increased cost of feeding is the greatest problem of the poultry farmers (1). Feed cost represents over 66% of the total cost of production (2). The dependency of the poultry industry in most developing countries on imported feed ingredients has been a significant threat to its sustainability (3). The globalization of the food value chain is increasing rapidly, and it is necessary to address the challenges associated with it in a sustainable way. To overcome the challenges, the poultry sector will have to focus more on sustainability of production (4). Animal Production industry is aimed towards turning cheap and available feedstuffs into a more balanced animal feed ration. An economically and environmentally accepted approach to poultry meat production is to produce broilers with faster weight gain and higher final live body weight, while using less feed (5). Slaughter age is a critical factor that significantly influences production and economic performance, carcass yield and meat quality (6). A major constraint of the livestock industry is inadequate and poor-quality feed. This is because of the competition between man, industry and livestock, especially the fast-growing prolific monogastric species (7, 8). The conventional sources of protein and energy such as maize and sorghum are directly utilized by man and have become increasingly expensive. There is need to utilize alternative feed ingredients far removed from human and industrial interest in order to reduce feed cost and poultry production cost. Non-conventional feeds could partially bridge the gap in the feed supply, decrease competition for food between humans and animals (9), and ultimately help reduce the cost of production.

The palm oil tree is one of the greatest economic asset nature has provided. It's importance has not been realized and its potentials not harnessed. The African oil palm produces two main commercial products: The palm oil and the palm kernel oil. When the nut is processed, it yields Palmkernel oil and Palmkernel cake depending on the method of extraction. The Palmkernel cake contains high levels of insoluble

fiber, a coarse texture and gritty appearance and non-starch polysaccharides (NSP) such as mannan, xylem and cellulose. Palmkernel cake has the ability to supply both energy and protein needs of animals.

Palmkernel cake is an agro industrial by-product and its relatively inexpensive. It is one of the non conventional feedstuffs high in fiber, medium proteins and energy. It's cheaper than maize and other conventional feed sources. The Palmkernel cake is obtained from two stages of oil extraction of palm fruits. The first stage is the primary extraction of palm oil from the pericarp portion of the fruit, which also produces the kernel and by-product POS and PPF. The extraction of oil from crushed kernel then results in the production of Palmkernel cake as by-product. It is exported mainly in Europe. It is also used as Biomas fuel in Europe, especially the United Kingdom to provide heat and energy. Palm kernel cake (PKC), a solid by-product of oil palm (Elaeis guineensis) extraction (10) has been extensively used to feed ruminants and poultry (11). PKC can be an alternative feed resource for poultry feed as humans do not use it as food (12). It is highly nutritious, containing about 50.3% carbohydrate, 19.8% protein, 16.7% crude fibre, and 8% oil (13). Despite having a moderate amount of energy and crude protein (CP), PKC utilization in the poultry diet has been limited by several factors such as high crude fibre and indigestible non-starch polysaccharides (NSP), low essential amino acids (AA) concentration, poor nutrient digestibility and less palatability (14,15,16).

Work to evaluate the potential usefulness of Palmkernel cake through chemical and biological determination has been pursed quite extensively by several researchers. Also the inclusion qualities of Palmkernel cake as feed ingredient into broiler ration are not clearly evaluated yet. Therefore, the aim of this study is to evaluate the potential use and suitability of Palmkernel cake as feed ingredient in broiler ration and to find the optimum levels of inclusion into broiler ration.

## II. MATERIALS AND METHOD

### 2.1 Study Site

The experiment was conducted at the Imo State University Research and Demonstration Farm, Owerri, Nigeria. It is located in the sub-humid tropical region, with an annual average rainfall depth of between 2000 and 2454 mm, a relative humidity in the range of 75-80%, and an average temperature of 27 °C. The farm is characterized by a sandy loam type of soil with an average pH of 5.5 (17).

### 2.2 Experimental Animals and Their Management

Sixty (60) marshell breed broiler birds were bought from a trusted farm. Upon arrival, the birds were conditioned for two weeks and provided with a basal ration before the commencement of the experiment. The birds were kept in well-ventilated deep little pens (60 cm x 60 cm x 45 cm) in an intensive system. A pen had a filling of wood shaving of 5cm depth that served as bedding material. The bedding material was changed every three days to ensure hygiene and prevent the accumulation of faeces and mucus.

### 2.3 Experiment Design and Diets

The birds were randomly distributed in a complete randomized design (CRD) into four dietary treatment groups with a replicate of three per treatment and a replicate of 5 snails per replicate.

Four isonitrogenous diets were prepared:
T1: Diet containing 10% Palmkernel cake (PKC)
T2: Diet containing 20% Palmkernel cake (PKC)
T3: Diet containing 30% Palmkernel cake (PKC)
T4: Diet containing 0% Palmkernel cake (PKC)

The ingredients and nutrient compositions of the test diets are presented in Table 1. Proximate compositions of experimental diet were determined in (Table 2) using standard methods (18).

### 2.4 Feeding and Data Collection

They birds were fed thrice daily. Ad libitum fresh, clean water was provided at all times. Consumption of feed was estimated daily by subtracting the remaining feed from the offered feed. They birds were weighed in groups per replicate on a weekly basis before feeding. The experiment ran for 28days.

The following parameters were estimated:
Weight Gain (g) = Final Weight - Initial Weight
Average Daily Weight Gain (ADWG, g/day) = Total Weight Gain / 28 days
Feed Conversion Ratio (FCR) = Total Feed Intake / Total Weight Gain
Feed Cost per kg Gain (#) = FCR × Feed Cost per kg diet
Carcass Evaluation- heart, liver, Gizzard, intestine
Assessment of 6 birds from each of the treatments (two per replicate) were randomly selected post-

feeding trial, weighed and fasted for 24 hours before being humanely sacrificed and the following internal organs- heart, liver, Gizzard, intestine were separated and weighed. Live weight, dressed weight and percentage dressing were computed.

2.5 Statistical Analysis

All data collected were statistically analysed using one-way analysis of variance (ANOVA) through SPSS software. Duncan's New Multiple Range Test at a 5% probability level ($P < 0.05$) was used to distinguish the means of the treatments where significance existed.

Table 1: Nutrient and chemical Composition of experimental diet

| Ingredients | T1 (%) | T2 (10%) | T3 (20%) | T4(30%) |
|---|---|---|---|---|
| Maize | 44 | 34 | 24 | 0 |
| Palmkernel cake | 10.00 | 20.00 | 30.00 | 0.00 |
| Soyabean meal | 10 | 10 | 10 | 10 |
| Fishmeal | 4 | 4 | 4 | 4 |
| Wheat offal | 15 | 15 | 15 | 15 |
| Bone Meal | 4 | 4 | 4 | 4 |
| GNC | 12 | 12 | 12 | 12 |
| Feed premix | 0.25 | 0.25 | 0.25 | 0.25 |
| Salt | 0.25 | 0.25 | 0.25 | 0.25 |
| L-Lysine | 0.25 | 0.25 | 0.25 | 0.25 |
| L-Methionine | 0.25 | 0.25 | 0.25 | 0.25 |
| Total | 100 | 100 | 100 | 100 |

Calculated Chemical Composition

| | T1 | T2 | T3 | T4 |
|---|---|---|---|---|
| CP | 20.15 | 20.75 | 21.55 | 22.35 |
| CF | 3.33 | 4.33 | 5.33 | 6.33 |
| ME (Kcal/kg) | 2839 | 2714 | 2588 | 2461 |

Table 2: Proximate composition of the protein sources used in the experimental diets.

| D.M | C.P | C.F | ASH | LIPID |
|---|---|---|---|---|
| 94 | 18 | 22 | 5 | 15 |

Analysis was conducted on the raw ingredients prior to diet formulation.

## III. RESULTS AND DISCUSSION

3.1 Growth Performance

The weight gain and economic data of Marshall breed of broiler finisher birds, maintained on different dietary levels of Palmkernel cake, are presented in Table 3. The body weights of the animals at the commencement of the experiment for all the treatment groups were statistically similar ($P > 0.05$), indicating a uniform starting point for the experiment. The final body weight and the cumulative gain in body weight were significantly influenced by the dietary treatments ($P < 0.05$). Birds from the T1 (10% PKC) ration had the overall best final weight (2973.3g) and gain in body weight. Performances of the birds in T2 (20% PKC), T3 (30% PKC), were statistically similar ($P>0.05$) to each other but superior to the control. Such superior weight is in line with the report of (19) who stated that Palmkernel cake not only increases the bird's productivity and economic efficiency but also improves their health. Such superior weight gain is thought to emanate from the optimal utilisation of the necessary amino acids, primarily lysine and methionine, from the 10% PKC (T1), which disagrees with (20) who stated that P.K.C cannot be used in the ration of chicks and broilers. Poor performance in the control (T4) indicates that the quality of energy from sole utilisation of the maize at that % inclusion is poor in comparison with the mixture of Palmkernel cake and maize supplement for the development of the birds. There existed a similar dramatic pattern ($P < 0.05$) for the Cumulative Gain in Weights and the Average Daily Weight Gain (ADGW), with the peak (162.2 g/day at

T1). The Feed Conversion Ratio (FCR) varied significantly ($P < 0.05$) among the groups. The least (best) FCR (3.21) and therefore the most effective utilization of the feed for body mass gain was that of the birds that were maintained on the T1 ration. The control (T4) generated the lowest (worst) FCR (6.08). This evidence suggests that the test rations, particularly T1, not only promoted higher body weight but were also more efficiently converted into growth.

3.2 Economic Analysis

The economic indicator of feed cost per kilogram gain was significantly influenced by the dietary treatment ($P < 0.05$). Even though the cost per kilogram of the diet changed, the economic viability is defined by the production cost per kilogram of the birds. The control (T4) had the least economical character with the highest cost per kg gain of the birds (#705.33), owing to the poorest efficiency of the FCR encountered in the experiment. While T3 (30% PKC) displayed the lowest numerical value in the production cost per kg gain of the birds (#471.70), it, however, proved statistically not different ($P > 0.05$) from T1, and T2. All the test dietary levels were therefore found to be more economical compared to the control, with the best combination of high growth performance alongside economical returns being offered by T1.

3.3 Carcass Characteristics

There were no considerable variations ($P > 0.05$) in live weight, dressed weight, or dressing percentage between the various treatment groups. This highlights that while the different dietary levels significantly influenced weight gain and efficiency, they did not affect the post-slaughter final carcass yield and composition. The consistently high dressing percentages (1216-1300%) across all the groups are acceptable and confirm that the birds were healthy and well-fed across the entire study period. The absence of mortality/morbidity also demonstrates that all the experimental rations were well-tolerated and harmless to the birds.

Table 3: performance characteristics of experimental broiler finisher birds

| Parameters | T1 | T2 | T3 | T4 | SEM |
|---|---|---|---|---|---|
| Average Initial weight(g) | 1680.0 | 1673.0 | 1693.3 | 1673.3 | 19.14 |
| Average Final weight(g) | 2973.3 | 2848.3 | 2560.0 | 2566.6 | 154.6 |
| Mean weight gain | 293.0 | 1175.0 | 866.6 | 893.3 | 157.0 |
| Average Daily Feed intake(g) | $162.2^{a}$ | $152.6^{b}$ | $156.8^{a}$ | $138.0^{a}$ | 1.29 |
| FCR Feed Conversion ration | $3.21^{b}$ | $3.82^{ab}$ | $5.25^{a}$ | $5.08^{a}$ | 0.51 |
| Feed Cost/kg (N) | $146.95^{a}$ | $140.65^{ab}$ | $134.35^{bc}$ | $128.05^{c}$ | 2.45 |
| Feed cost/kg WG | $537.28^{c}$ | $650.49^{b}$ | $471.70^{d}$ | $705.33^{a}$ | 6.38 |
| Mortality | 0 | 0 | 0 | 0 | 0.00 |

SEM: Standard Error of the Mean. ADWG: Average Daily Weight Gain. FCR: Feed Conversion Ratio (Feed Intake/Weight Gain)

Means within the same row with different superscript letters are significantly different ($P < 0.05$).

Table 4: Weight of Animal organs in broiler finisher

Parameter Treatment

| | T1 | T2 | T3 | T4 | SEM |
|---|---|---|---|---|---|
| Standard | 2266 | 2100 | 2133 | 2100 | 169.9 |
| Dressed wt | 1300 | 1300 | 1233 | 1216 | 34.35 |
| Heart(g) | $20^{a}$ | $18.3^{ab}$ | $13.6^{b}$ | $17.6^{ab}$ | 1.87 |
| Liver | $50^{a}$ | $50^{a}$ | $18.3^{c}$ | $25^{b}$ | 1.87 |
| Gizzard (g) | 50 | 50 | 50 | 50 | 0.00 |
| Intestine (It) | $263^{a}$ | $184^{b}$ | $227^{ab}$ | $207.6^{ab}$ | 20.39 |

## IV. CONCLUSION

From the results of this study, conducted for a period of 28 days, it is concluded that partial substitution of maize with Palmkernel cake greatly improves the weight gain and economic efficiency of growing marshell breed broiler finisher birds. Among the ingredients tested, the inclusion of Palmkernel cake

at 10% of the diet (T1) produced the best results, with the heaviest final body weight, the most significant weight gain, and the most efficient feed conversion ratio. Consequently, for farmers seeking to maximize productivity and returns on investment, a ration containing 10% Palmkernel cake incorporation is highly recommended for the intensive rearing of broiler finisher birds.

Disclosures. The authors declare no conflicts of interest.
Data availability. All data that support the findings of this study are included within the article

REFERENCES

[1] Smith, A.J., 1990. Poultry. Tropical Agriculturist Series MacMillan. Ibadan. Nigeria, pp: 138-147.

[2] Oluyemi, J.A. and F.A. Robert, 2000. Poultry production in warm wet climate. Spectrum Books Ltd. Ibadan. Nigeria, pp: 143-146.

[3] A.H. Hakim, I. Zulkifli, A.S. Farjam, E.A. Awad, S.K. Ramiah, Impact of Feeding Fermented Palm Kernel Cake and High Dietary Fat on Nutrient Digestibility, Enzyme Activity, Intestinal Morphology and Intestinal Nutrient Transporters mRNA Expression in Broiler Chickens under Hot and Humid Condition. *Animals* 12 (2022) 882.

[4] A.A. El-Deek, A.A.A. Abdal-Warath, M. Osman, Alternative feed ingredients in the finisher diets for sustainable broiler production. *Scientific Reports* 10 (2020) 17743.

[5] P. Maharjan, D.A. Martinez, J. Weil, N. Suesuttajit, C. Umberson, G. Mullenix, K.M. Hilton, A. Beitia, C.N. Coon, Physiological growth trend of current meat broilers and dietary protein and energy management approaches for sustainable broiler production. *Animal* 15 (2021) 100284.

[6] M. Abougabal, M. Taboosha, Productive performance, carcass characteristics and meat quality of broiler chickens at different marketing ages. *Egyptian Poultry Science Journal* 40 (2020) 275–289.

[7] O.O. Tewe, M. Bokanga, Post harvest technologies in Nigeria's livestock industry: status challenges and capacities. Paper presented at the *GFAR-GIPhT Conference*, (2001).

[8] K.U. Amaefule, C.C. Nwaokoro, F.C. Uheukumore, The effect of feeding graded levels of raw pigeon pea (Cajanus cajan) seed meal on the performance, nutrient retention and carcass characteristics of weaned rabbits. *Nigerian Journal of Animal Production* 31 (2004) 194–199.

[9] Negesse T, Makkar HPS, Becker K.. Nutritive value of some non-conventional feed resources of Ethiopia determined by chemical analyses and an in vitro gas method. Anim Feed Sci Technol. 2009;154(3–4):204–217

[10] Azizi MN, Loh TC, Foo HL, et al. Is palm kernel cake a suitable alternative feed ingredient for poultry? Animals. 2021;11(2):338. [DOI] [PMC free article] [PubMed]

[11] Kum W,H, Zahari MW. Utilisation of oil palm by-products as ruminant feed in Malaysia. J Oil Palm Res. 2011;23:1029–1035.

[12] Kperegbeyi JI, Ikperite SE. The effectiveness of replacing maize with palm kernel cake in broilers' starter diets. J Environ Issues Agric Dev Ctries. 2011;3(1):145–149.

[13] Nuzul Amri I. Characteristics of Malaysian palm kernel and its products. J Oil Palm Res. 2013;25(2):245–252.

[14] Sharmila, A.; Alimon, A.R.; Azhar, K.; Noor, H.M.; Samsudin, A.A. Improving nutritional values of palm kernel cake (PKC) as poultry feeds: A review. Malays. J. Anim. Sci. 2014, 17, 1–18.

[15] Abdollahi, M.R.; Hosking, B.; Ravindran, V. Nutrient analysis, metabolisable energy and ileal amino acid digestibility of palm kernel meal for broilers. Anim. Feed Sci. Technol. 2015, 206, 119–125.

[16] Alshelmani, M.; Kaka, U.; Abdalla, E.; Humam, A.; Zamani, H. Effect of feeding fermented and non-fermented palm kernel cake on the performance of broiler chickens: A review. World's Poult. Sci. J. 2021, 77, 377–388.

[17] Ministry of Land and Survey (MLS), Imo State cartographic unit. (2004).

[18] A.O.K. Adesehinwa, Utilization of Palm kernel cake as a replacement for maize in diets of growing pigs: Effects on performance, serum metabolism, nutrient digestibility and cost of feed conversion. *Bulgarian Journal of Agricultural Science* 13 (2007) 593–600.

[19] M.A. Soltan, Growth Performance, immune response and carcass traits of broiler chicks fed on graded levels of Palm kernel cake without or with enzyme supplementation. *Livestock Research for Rural Development* 21 (2009).

[20] O. Oyediji, Feed Mill management in Nigeria. *Jimmy Virgo press LTD*, Lagos, Nigeria, (2006) 50–78.