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Effect of Supplementation of Palm Kernel Meal with Yeast Culture Enzyme on Growth Performance and Carcass Characteristics of Broiler Chickens

[1]Anyaegbu, B. C., [1]Afam-Ibezim, E. M., [2]Ogbonna, A. C., [1]Isonguyo, I. S. and [1]Onunkwo, D. N.

[1]Department of Animal Nutrition and Forage Science; [2]Department of Animal Production,
Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria
Corresponding Author's email: donunkwo@gmail.com

Abstract
This study was carried out to determine the effect of supplementation of palm kernel meal with yeast culture enzyme additive on the growth performance and carcass characteristics of broiler chickens. The palm kernel meal supplemented with yeast culture enzyme was used to replace soyabean meal at various levels to determine the best replacement that would give optimal performance in broiler chickens diets. The proximate composition of palm kernel meal showed that it contained 91.05% dry matter, 8.9% moisture, 4.2% ash, 20.00% crude protein, 6.50% ether extract, 1.3% crude fibre, 66.07% nitrogen free extract (NFE) and 3481.81 Kcal/Kg metabolizable energy. In the starter feeding trial, the palm kernel meal supplemented yeast culture enzyme was used to replace soyabean meal at levels of 25%, 50%, 75% and 100% each. Each starter diet was fed to a group of 30 broiler chicks for four weeks using completely randomized design. Each treatment was divided into three replicates of 10 broiler chicks each. Parameters determined include; initial body weight, final body weight, body weight gain, feed intake, feed conversion ratio, and cost of production. In the finisher feeding trial, the replacements were 25%, 50%, 75% and 100% PKM to replace soyabean meal in the control diet. Each finisher diet was fed to a group of 30 finisher broiler chickens for another four weeks using completely randomized design. The parameters determined include; initial body weight, final body weight, body weight gain, feed intake, feed conversion ratio, cost of production and carcass characteristics. In the starter feeding trial, the starter broiler chicks fed 25% PKM supplemented with yeast culture enzyme compared favourably with those fed the control diet (P<0.05) in terms of feed intake, body weight gain and feed conversion ratio and hence recorded highest body weight gain. The cost of production of the starter broiler chicks was lowest for Treatment 5 (N361.47) (100% PKM supplemented with yeast culture enzyme) while the costliest was Treatment 1 (Control) N494.89. In the finisher feeding trial, the finisher broiler chickens fed 75% PKM supplemented with yeast culture enzyme compared favourably with those on the control diet in terms of body weight gain, feed intake and feed conversion ratio. It was observed that the finisher broiler chickens could tolerate high palm kernel meal supplemented with yeast culture enzyme up to 75% inclusion in their diets. The cost of production of the finisher broiler chickens was lowest for Treatment 5(100% PKC supplemented with yeast culture enzyme) (N308.90) versus N354.74 for the control which was the costliest. The internal organs expressed as percent of the live-weight were not affected by the treatments. The results of the trials have shown that supplementation of palm kernel meal with yeast culture increased its digestibility and reduced high fibre level of palm kernel meal. Palm kernel meal supplemented with yeast culture enzyme could be used up to 25% in the diets of starter broiler chicks and up to 75% in the diets of finisher broiler chickens without affecting body weight gain, feed intake and feed conversion ratio negatively.

Keywords: ***Supplementation, Palm kernel meal, Yeast culture enzyme, Carcass characteristics, Broiler chickens***

Introduction

A major constraint of livestock industry in Nigeria is inadequate and poor quality feed. Feed alone accounts for over 75 – 80% of the total cost of production (Oluyemi and Roberts, 2000; Agbede and Aletor, 2003). Feed insufficiency is due to stiff competition for feedstuffs between human, industry and livestock; particularly for the fast growing and prolific monogastric species (Esonu, 1999; Iyayi and Davies, 2005). Conventional sources of protein and energy such as groundnut cake, maize and sorghum are directly utilized by man and have become increasingly expensive. The over dependence on conventional protein and energy concentrates for feeding livestock is currently threatening the development of the industry. This has stimulated research efforts directed towards the use of non-conventional feedstuffs that are non-competitive, readily available and cheap (Akinmutimi, 2004). These can partly replace the traditional energy and feedstuffs in animal feed formulation. Non-conventional feedstuffs offer the best alternative in our environment for the reduction of feed cost and therefore reduction in the cost of meat and other animal products (Dafwang *et al*., 2001).

Palm kernel meal (PKM) is another material of great promise; a by-product of palm kernel oil extraction in many tropical regions in the world, relatively cheap, easily available and virtually has no competition between man and animal (Chin, 2008). PKM is a good dietary option because its average content energy, fibre and protein, contributes to the livestock feed., high in fibre content and this has limited its use in poultry rations. Its amino acid profile is poor (Chin, 2008) and particularly high in non-starch polysaccharides which limits its digestibility and usage. It has been worked on by many researchers and is known to have good nutrient profile. As a result, incorporating it in the diet of egg-type pullets will bring down the cost of feed which presently accounts for 60 – 70% of cost of production. There is therefore, the need for more studies on the possibility of using this cheap and more readily protein source supplemented with yeast enzyme additive on the performance of broiler chickens and their carcass characteristics.

Materials and Methods

The experiment was conducted at the poultry unit of the teaching and research farm of Michael Okpara University of Agriculture, Umudike, Abia State. The area is located at latitude 05º 27` North, Longitude 07º 32` East with an attitude of 123m above sea level. Umudike has an ambient temperature of 22ºC - 37ºC with an annual rainfall of 2,177mm and relative humidity of above 50 – 90% (NRCRI, 2006).

Procurement of Feed Ingredients

The test ingredient, palm kernel meal and other feed ingredients like maize, brewers' dried grains, fishmeal, soyabean meal, bone meal, vitamin/mineral premix, lysine, methionine, salt etc were bought from Jocan Livestock Services, Umuahia, Abia State.

Source of Enzyme

The yeast culture enzyme (Bioyeaster) was procured from mid-century Agro-Allied Ventures Limited, 29 Akanke Estate, Hannat Augusto Close, Opp. Lagos State Abattoir, Agege, Lagos. Crude protein ≥15%, Ash ≤ 6%, Moisture ≤ 10%. Main ingredient: Yeast culture.

Chemical Analysis of Feed Ingredients

The test materials and the processed ingredients were subjected to proximate analysis according to AOAC (2006) to determine their nutrients composition and gross energy. All analyses were based on 100% dry matter. Proximate compositions determined were Dry matter (DM), Crude Protein (CP), Crude Fibre (CF), Ether Extract (EE), Ash, Nitrogen Free Extract (NFE) and Gross Energy (GE).

Experimental starter broiler diets

Five experimental starter broiler chicks diets were formulated, Diet 1 (Control) contain PKM but have enzyme supplementation and 30% soyabean meal as the main source of protein, while diets 2, 3, 4 and 5 contain 25%, 50%, 75% and 100% of PKM supplemented with yeast enzyme completely replacing soyabean meal in the control diet. The enzyme supplementation was 0.15g to 1kg diet. Other dietary ingredients were varied in order to provide the required protein and energy for the broiler chicks. The following diets were produced and tested in the feeding trial (Table 1).

Experimental Finisher Broiler Chicken Diets

For the finisher broiler chickens diets, a control diet (Diet 1) contain PKM, but with enzyme supplementation and with soyabean meal as the main source of protein. Four other diets were formulated such that diets 2, 3, 4 and 5 contain 25%, 50%, 75% and 100% of PKM supplemented with yeast enzyme to completely replace soyabean meal. Other dietary ingredients were varied in order to provide the required protein and energy for the broiler chickens. The enzyme supplementation was 0.15gm to 1kg diet. The following diets were produced and tested in the feeding trial (Table 2).

Experimental design

The design of the study was Completely Randomized Design (CRD). The statistical model is expressed thus;

$$Y_{ij} = \mu + T_i + e_{ji} \ldots. (1)$$

Where, Y_{ij}=Individual observation, μ= Population mean, T_i=Treatment effect and e_{ji}=Random error effect.

Management of the Experimental Birds

A total of 150 day old unsexed Agrited Anak broiler chicks were used for the study. They were brooded for one week with commercial starter broiler diet (Top broiler starter feed) to stabilize them before they were distributed into five experimental treatment groups. Each treatment group contains 30 broiler chicks. Then each treatment group was sub-divided into three replicates of 10 birds each. Each replicate was kept in a pen and covered with polythene sheet to conserve heat. Heat was supplied with electricity and kerosene lantern during the brooding period. The floor of the pens was covered with wood shavings. Each group was randomly assigned to an experimental starter diet using Completely Randomized Design (DRD) and was fed for four weeks. Feed was supplied in feeding troughs built in such a way as to minimize wasting of feed. Water was supplied *ad-libitum*. Feeding was done once daily around 8am. The birds were weighed at the beginning of the feeding trial and weekly thereafter. Feed intake was recorded daily by weighing the quantity of feed given and the leftover the following morning. The starter phase of the trial lasted for four weeks. The feed was changed from starter broiler diets to finisher broiler chicken diets and were fed for another four weeks using completely randomized design. Health management practice was carried out on the broiler chicks. The chicks were given anti-stress drug on arrival to boost their energy level. They were given Newcastle disease vaccine strain (NDV) by intraocular (I/O). The Gumboro vaccine was administered at the end of the second week through drinking water and Lasota Vaccine against Newcastle disease (Lasota strain) was also administered at the end of the third week and the final Gumboro vaccine was administered at the end of the fourth week against infectious bursal disease (Gumboro). Coccidiostat and other antibiotics were also administered by drinking water when there were signs of infections.

Data Collection

Data collection was done on the starter phase which lasted for 28 days and at finisher phase which also lasted for another 28 days. At the starter phase, the following parameters were determined: daily feed intake, body weight gain, final live weight, weekly body weight gain, feed conversion ratio, cost of production and mortality. At the finisher phase, the parameters that were determined include daily feed intake, body weight gain, feed conversion ratio, mortality, dressed weight, internal organ weight and cost of production. The values obtained were used to compute the following parameters:

Growth performance parameters:

$$\text{Average feed intake/bird/day (g)} = \frac{\text{Qty of feed given} - \text{leftover}}{\text{Number of birds x No of days}} \ldots \quad (2)$$

$$\text{Daily weight gain (g)} = \frac{\text{Final live weight} - \text{initial weight}}{\text{No of birds x No.of days}} \ldots.. \quad (3)$$

$$\text{Feed conversion ratio (FCR)} = \frac{\text{Daily Feed intake (g)}}{\text{No of birds x No.of days}} \ldots.. \quad (4)$$

Carcass Characteristics

At the end of the feeding trial, 3 birds per treatment were randomly selected, starved of feed for 12 hours but were given water. The birds were weighed individually and then slaughtered by severing the jugular veins with sharp knife and blood allowed to drain. The carcasses were de-feathered after scalding in hot water and then eviscerated. The percentage of carcass cut parts and internal organs proportion were determined such as live weight, dressed weight, percentage dressed weight, heart, lungs, kidney, spleen, gizzard, abdominal fat, liver, etc using a sensitivity scale.

Data Analysis

The data collected were subjected to one way Analysis of Variance (ANOVA) according to Snedecor and Cochran (1989) where significant effects were detected from the ANOVA means were separated using Duncan's New Multiple Range Test (Duncan, 1955) at 5% level of significance.

Results and Discussion

Data on the Proximate Composition of PKM is shown in (Table 3). The proximate composition showed that the test material, PKM contains Dry Matter (DM) 91.05%, moisture 8.95%, Ash 4.20%, crude protein 20.00%, Ether extract 6.5%, Crude fibre 13%, Nitrogen Free Extract (NFE) 16.07% and metabolizable energy 3481.81 Kcal/Kg. The dry matter and crude fibre contents were high. The crude fibre content of palm kernel meal was about 13.20% which was responsible for the grittiness and poor digestibility of PKM (Onuorah and King, 1985; Alimon, 2004; Nuzul, 2013). The crude protein content of PKM was low. According to McDonald, (1973), Palm kernel meal has a comparatively low protein content which is however of high quality relative to other oil seeds.

Performance of Experimental Starter Broiler Chicks:

The growth performance of the starter broiler chicks fed palm kernel meal supplemented with yeast culture enzyme is presented in (Table 4). Significant differences ($P<0.05$) were observed in final body weight, daily feed intake, daily weight gain, body weight gain and feed conversion ratio. No significant differences ($P>0.05$) was observed in their initial body weight gain, daily body weight gain. Daily feed intake, decreased as the level of palm kernel meal supplemented yeast culture enzyme increased in their diets. There were significant differences ($P<0.05$) in their feed intake. The starter broiler chicks on 25% PKM supplemented with yeast culture enzyme recorded highest feed intake which was significantly different ($P<0.05$) from those on the control diet. The lowest feed intake was those starter broiler chicks on 100% PKM supplemented with yeast culture enzyme. The use of enzyme in poultry diets improved apparent metabolization of energy of the diet and increased feed intake, weight gain and feed conversion ratio (Amnison and Choct, 1991; Bedford *et al*., 1996). Generally, the feed intake of the starter broiler chicks fed with diets containing PKM supplemented with yeast culture enzymes was good. The yeast culture enzyme must have digested or reduced the poor digestibility and high fibre level of PKM in their diets. According to Bedford (2000), enzymes reduce the variation in nutrient quality of feed ingredients and with response to the use of enzyme greatest on the poorest quality feed raw materials Bedford (1996). The lowest feed intake of the starter broiler chicks on 100% PKM supplemented with yeast culture enzyme could possibly be as the result of high crude fibre, and poor digestibility of PKM by starter broiler chicks due to high PKM level in the diet. Significant differences ($P<0.05$) exists among the treatment groups in their body weight gain. The body weight gain of the starter broiler chicks on 25% PKM supplemented with yeast culture enzyme compared favourably with those on the control diet and recorded the highest body weight gain. The body weight gain of those on 50% PKM and 100% PKM supplemented with yeast enzyme were similar and significantly ($P<0.05$) higher than those on diet 4 (75% PKM) supplemented with yeast culture enzyme. Significant differences ($P<0.05$) exists among the various group in their feed conversion ratio. The feed conversion ratio of the starter broiler chicks on the control (Diet 1) and Diet 2 (25% PKM) supplemented with yeast culture enzyme were similar and significantly (P<0.05) better than other groups. The feed conversion ratio of the starter groups on 50% PKM and 100% PKM were similar and significantly (P<0.05) better than those on 75% PKM supplemented with enzyme. The use of enzyme in poultry diets improved apparent metabolization of the energy of the diet and increased feed intake, weight gain and feed conversion ratio (Amnison and Choct, 1996; Bedford *et al*., 1996).

There were significant differences (P <0.05) in the feed intake of the finisher broiler chickens (Table 5). The feed intake of the finisher broiler chicken on 25% PKM supplemented with yeast culture enzyme compared favourably with the control group and recorded significantly (P<0.05) higher feed intake possibly because of the inclusion of the enzyme in the diet. According to (Bedford, 2000) enzymes reduce the variation in the nutrient quality of ingredients with response to the use of enzyme greatest on the poorest quality feed raw materials (Bedford, 1996). In terms of body weight gain, significant differences (P<0.05) exists in their body weight gain. The body weight gain of the finisher broiler chickens on the control diet recorded a higher body weight gain which compared favourably with those on diet 4 (75% PKM) supplemented with yeast culture enzyme). The body weight gain of the group on 25% PKM, 50% PKM and 75% PKM supplemented with yeast culture enzyme were similar and significantly (P<0.05) higher than those on (100% PKM) supplemented with yeast culture enzyme. The low weight gain of the finisher broiler chickens on 100% PKM supplemented with yeast culture enzyme was as a result of the high palm kernel meal in their diets which contain high crude fibre.

According to McDonald (1973), PKM is not used in poultry and pig diets partly to its unpalatability and partly to its high fibre content. According to Oyenuga, (1968), palm kernel meal reduces the digestibility of nutrients, especially amino acids. The result of the carcass yield of the experimental finisher broiler chickens were shown in (Table 6). The result of the live weight and dressed weight showed that there had the same trend of significance differences (P<0.05) across the treatment groups. The finisher broiler chickens fed 75% PKM supplemented with yeast culture enzyme compared favourably with those fed the control diet in dressed weight, while % breast muscles, thigh, % backcut, % drumstick and %wing showed that there were no significant differences (P>0.05) across the treatment groups. The result of the dressing percentage showed that the inclusion of palm kernel meal supplemented with yeast culture enzyme up to 100% did not have any adverse effect as the dressing percentage of the control diet, diet 2, 3, 4 and 5 were 73.44, 68.06, 69.64, 71.43 and 64.44 respectively which were in agreement with recommendation of Oluyemi and Roberts (2000). Organ proportions of finisher broiler chicken fed PKM supplemented with yeast culture enzyme: the weight of the organs (liver, gizzard, heart, kidney, spleen, large intestine, small intestine, lungs, crops, proventriculus etc) of the birds were not affected by the treatment (P<0.05). The finisher broiler chicks on 100% PKM supplemented with yeast culture enzyme recorded significantly (P<0.05) more abdominal fat than others indicating higher efficiency of the birds in converting the carbohydrate of the diets into fat (Table 7).

The result of the cost benefit of starter broiler chicks fed palm kernel meal supplemented with yeast culture enzyme is shown in (Table 8). In the starter broiler chicks feeding trial, the cost/Kg of feed was cheapest for (Diet 5) 100% PKM supplemented with yeast culture enzyme while the costliest was the control diet. The cost of production per kg starter broiler chick was cheapest for those on diet 5 (100% PKM supplemented) with yeast enzyme while the costliest was those on the control diet. The starter broiler chicks on diet 2 (25% PKM supplemented with yeast) yielded the highest revenue and gross margin which were significantly (P<0.05) better than others. The result of cost benefit of finisher broiler chickens fed PKM supplemented with yeast culture enzyme was shown in (Table 9). The cost/Kg of the experimental diet was high for those on the control diet while the cheapest was diet 5 (100% PKM supplemented with enzyme). The cost of production of the finisher broiler chickens was lowest for diet 4 (75% PKM supplemented) with yeast enzyme versus N403.21 for diet 2 (25% PKM supplemented) with yeast which was the costliest.

Conclusion

Results show that Palm Kernel Meal supplemented with yeast culture enzyme could be used up to 25% in the diet of starter broiler chicks without affecting the body weight gain, feed intake and feed conversion ratio negatively. Palm kernel meal supplemented with yeast culture enzyme could be used up to 75% in the diet of finisher broiler chickens without affecting the body weight gain, feed intake and feed conversion ratio adversely.

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Table 1: Ingredient and Nutrient composition of the experimental starter broiler chicks diets supplemented with yeast enzyme

Ingredients (%)	Diet 1 Control	Diet 2 25% PKM	Diet 3 50% PKM	Diet 4 75% PKM	Diet 5 100% PKM
Maize	50.00	50.00	50.00	50.00	50.00
Soyabean Meal	30.00	22.50	15.00	7.50	0.00
Palm Kernel Cake	0.00	7.50	15.00	22.50	30.00
Groundnut Cake	8.20	8.20	8.20	8.20	8.20
Bone meal	3.00	3.00	3.00	3.00	3.00
Wheat offal	5.00	5.00	5.00	5.00	5.00
Fish meal	3.00	3.00	3.00	3.00	3.00
Common salt	0.25	0.25	0.25	0.25	0.25
Vit/Min Premix**	0.25	0.25	0.25	0.25	0.25
Lysine	0.20	0.20	0.20	0.20	0.20
Methionine	0.10	0.10	0.10	0.10	0.10
Total (%)	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

Table 2: Calculated nutrient composition of the starter broiler chicks diets

Crude protein (CP%)	23.00	23.43	23.30	23.25	23.20
ME Kcal/Kg	2849.71	2849.71	2857.86	2870.99	2867.71

PKM = Palm Kernel Meal

*****To provide per kg of diet: Vit. A, 2,000000 iu; Vit D3: 4,000iu; Vit E, 80g; Vit. K, 0.49g; Choline, 48.00g; BHT, 32.00g; Manganese, 16.00g; Iron, 8.00mg; Zinc, 72gm; Copper, 0.32g; Iodine, 0.25g; Cobalt, 36.00g; Selenium, 16.00g***

Table 3: Proximate composition of Palm Kernel Meal (PKM)

Parameter	Palm Kernel Meal (PKM), Test Ingredient
Dry Matter (%)	91.05
Moisture (%)	8.95
Ash (%)	4.20
Crude protein (%)	20.00
Ether extract (%)	6.50
Crude fibre (%)	13.00
NFE (%)	66.07
Metabolizable Energy (Kcal/Kg)	3481.81

Table 4: Performance of Starter Broiler Chicks fed Palm Kernel Meal Supplemented with Yeast Culture Enzyme

Parameter	Tmt 1 Control	Tmt 2 25% PKM	Tmt 3 50% PKM	Tmt 4 75% PKM	Tmt 5 100% PKM	SEM
Initial body weight (g)	100.00	103.33	100.00	103.33	100.00	8.86
Final body weight (g)	903.00[a]	956.67[a]	820.00[ab]	690.33[b]	731.67[ab]	29.74
Body weight gain (g)	803.33[ab]	853.34[a]	720.00[ab]	587.00[c]	631.67[b]	13.31
Daily body weight gain (g)	28.69	30.84	25.71	20.96	22.56	0.96
Daily feed intake (g)	82.15[a]	83.48[a]	77.03[b]	70.42[ab]	67.20[c]	0.45
Feed conversion ratio	2.86[a]	2.74[a]	3.00[ab]	3.36[b]	2.98[ab]	0.08

[abc]Means within the same row with different superscripts are significantly different (P<0.05)
SEM: Standard Error of Mean

Table 5: Performance of finisher broiler chicken fed palm kernel meal supplemented with yeast culture enzyme

Parameter	Tmt 1 Control	Tmt 2 25% PKM	Tmt 3 50% PKM	Tmt 4 75% PKM	Tmt 5 100% PKM	SEM
Initial body weight (g)	903.33	956.67	820.00	690.33	731.67	29.12
Final body weight (g)	2565.00	2334.33	2210.66	2091.66	1765.56	29.05
Body weight gain (g)	1661.67[a]	1377.66[ab]	1390.66[ab]	1401.33[a]	1033.89[b]	26.0
Daily body weight gain (g)	59.35[a]	49.20[ab]	49.20[ab]	50.05[a]	36.92[b]	0.54
Daily feed intake (g)	125.66[ab]	129.29[a]	121.79[ab]	111.01[b]	98.07[c]	8.02
Feed conversion ratio	2.12[a]	2.63[a]	2.45[ab]	2.22[a]	2.68[ab]	0.08

[abc]Means within the same row with different superscripts are significantly different (P<0.05)

Table 6: Carcass yield/cut parts weight of experimental finisher broiler chickens

Parameter	Diet 1 Control	Diet 2 25% PKM	Diet 3 50% PKM	Diet 4 75% PKM	Diet 5 100% PKM	SEM
Live weight (Kg)	3.20	3.60	2.80	2.45	2.25	0.155
Dressed weight (Kg)	2.35[a]	2.45[a]	1.95[ab]	1.75[ab]	1.45[b]	0.086
% dressed weight	73.44	68.66[ab]	69.64[ab]	71.43[a]	64.44[b]	0.873
% Thigh	15.71	15.71	18.26	16.94	18.10	0.299
% Drumstick	15.19	15.19	22.89	15.80	15.07	0.356
% Shank	6.12	4.33	6.89	4.37	4.52	0.106
% Breast muscle	34.08[a]	31.65[ab]	33.56[a]	30.20[c]	31.24[ab]	2.05
% Head	3.09	3.06	3.87	3.40	3.48	0.160
% Wing	11.43	11.06	13.31	10.80	11.89	0.177
% Backcut	21.34	21.73	23.85	22.54	23.72	1.28
% Neck	5.98	5.98	7.79	7.43	7.17	0.162

[abc]Means within the same row with different superscripts are significantly different (P<0.05)

Table 7: Organ proportion/Internal Organ weight of experimental finisher broiler chicken

Parameter	Diet 1 Control	Diet 2 25% PKM	Diet 3 50% PKM	Diet 4 75% PKM	Diet 5 100% PKM	SEM
Live weight (Kg)	3.20	3.60	2.80	2.45	2.25	0.155
Dressed weight (Kg)	2.35^{a}	2.45^{a}	1.95^{ab}	1.75^{ab}	1.45^{b}	0.086
% Dressed weight	73.44	68.06^{ab}	69.64^{ab}	71.43	64.44^{b}	0.873
% Liver	1.59	1.36	1.84	2.00	1.80	0.009
% Gizzard	1.28	1.43	1.89	1.67	2.89	0.094
% Heart	0.41	0.43	0.52	0.47	0.49	0.043
% Spleen	0.06	0.10	0.09	0.12	0.09	0.004
% Abdominal fat	0.11^{c}	0.97^{b}	0.75^{b}	0.51^{ab}	2.24^{a}	0.091
% Large intestine	0.38	0.42	0.39	0.71	0.69	0.038
% Small intestine	1.89	1.89	1.82	2.31	2.40	0.097
% Proventriculus	0.33	0.32	0.38	0.35	0.42	0.032
% Kidney	0.55	0.46	0.48	0.55	0.51	0.040
% Lungs	0.75	0.49	0.46	0.53	0.64	0.036
% Crop	0.33	0.28	0.38	0.33	0.33	0.033
% Pancreas	0.17	0.19	0.23	0.27	0.38	0.012

[abc]Means within the same row with different superscripts are significantly different (P<0.05)

Table 8: Cost benefit of starter broiler chicks fed palm kernel meal supplemented with yeast culture enzyme

Parameter	Diet 1 (Control)	Diet 2 25% PKM	Diet 3 50% PKM	Diet 4 75% PKM	Diet 5 100% PKM	SEM
Cost/Kg feed (₦)	173.04^{a}	160.35^{b}	147.34^{c}	134.99^{d}	121.30^{c}	4.89
Weight gain (g)	803.33^{b}	853.11^{a}	721.00^{c}	587.67^{c}	631.22^{d}	26.73
Cost of production (₦)	494.89	439.36	442.02	453.57	361.47	1.59
Revenue (₦)	802.33^{b}	851.67^{a}	719.00^{c}	586.67^{c}	631.33^{d}	26.66
Gross Margin (₦)	624.67^{b}	690.70^{a}	571.00^{c}	450.67^{c}	504.67^{d}	22.70

Table 9: Cost benefit of finisher broiler chickens fed PKM supplemented with yeast enzyme

Parameter	Diet 1 (Control)	Diet 2 25% PKM	Diet 3 50% PKM	Diet 4 75% PKM	Diet 5 100% PKM	SEM
Cost/Kg feed (₦)	167.33^{a}	153.31^{b}	141.96^{c}	128.28^{d}	115.26^{c}	4.90
Weight gain (g)	1661.22^{a}	1377.55^{d}	1390.55^{c}	1401.11^{b}	1033.63^{c}	53.37
Cost of production (₦)	354.74	403.21	347.80	284.78	308.90	1.50
Revenue (₦)	1661.00^{a}	1376.00^{a}	1391.00^{c}	1401.33^{b}	1032.67^{e}	53.44
Gross Margin (₦)	1491.33^{a}	1221.00^{e}	1245.61	1271.00^{b}	916.00^{e}	49.12