

## APPARENT DIGESTIBILITY COEFFICIENTS OF DIFFERENT PROCESSED AFRICAN LOCUST BEAN (*Parkia biglobosa*) SEED MEAL BY *Clarias gariepinus* FINGERLINGS

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### Abstract

This study investigates the apparent digestibility coefficient of different processed African locust bean seed meal by *Clarias gariepinus* fingerlings. Diets containing 40% crude protein were formulated with Chromic oxide (Cr203) use as an inert marker at 1% inclusion in the reference and experimental diets. The five experimental diets containing 70% reference diets and 30% of the test diets. All data were subjected to a one-way analysis of variance. The Apparent Digestibility coefficient (ADC) values protein were significantly highest in fish fed diet II and III with  $80.764 \pm 0.012$  and  $81.175 \pm 0.091$  and lower in fish fed diet IV with  $71.613 \pm 0.095$ . ADCs fat was significantly highest in fish fed diet II with  $83.619 \pm 0.026$  and lowest in fish fed diet I with  $75.732 \pm 0.101$ . ADCs gross energy was significantly higher in fish fed diet II with  $76.896 \pm 0.084$  and lower I fish fed diet  $71.138 \pm 0.084$ . ADCs calcium was significantly higher in fish fed diet V with  $87.497 \pm 0.430$  and lower in fish fed diet with  $83.171 \pm 0.402$ . ADCs values for phosphorus were significantly higher in fish fed V with  $90.122 \pm 0.087$  and lowest in fish fed diet I with  $87.154 \pm 0.237$ . In conclusion, the processed *Parkia biglobosa* seed meal was digested, and they can be used as a partial protein source for *Clarias gariepinus* diets

**Keywords:** Feed, Sustainable, Fermented, Aquaculture

### INTRODUCTION

The expansion of the aquaculture industry depends on the availability of cost-effective fish feed, (Chhorn *et al.*, 2008) which account for over 80% of aquaculture operation (Abdullahi *et al.*, 2019a), 60% to 80% variable cost of aquaculture operation (Akanda, *et al.*, 2014), while the most expensive aspect of fish feed is the fish meal, which continues rising in price and uncertain in availability (Deyab, *et al.*, 2009). Soybean meal (SBM) is currently the major plant's protein source used in fish feed and it comprises up to 50 percent of the channel Catfish feed NRC 1993 cited by Chhorn *et al.*, (2008), therefore replacement of SBM with less expensive plant proteins could be beneficial in reducing feed cost for sustainable aquaculture.

*Parkia biglobosa* seed meal are rich in protein (30%Dm), lipids (17-20%) (NRC, 2006) and different processed *P. biglobosa* seed meal have crude protein range from 31-45% and reduced Anti-nutrients (Abdullahi, *et al.*, 2019b). Processing methods help to improve nutrients digestibility, while digestibility study is very important in the selection and evaluating the efficiency of feed ingredients and feedstuff as a basic requirement for feed formulation (Falaye, *et al.*, 2014). Therefore, this study investigates the apparent digestibility coefficients of different processed African locust bean seed meal by *Clarias gariepinus* fingerlings.

### MATERIALS AND METHODS

**Processing of African Locust Beans:** African locust beans (*Parkia biglobosa*) seeds were collected from a retailer store in Mokwa central market. They were hand-picked to remove impurities. The seeds were processed differently into five portions. A portion of it was peeled raw, milled, and designated LPM, another portion was toasted and milled as LTM. The third portion was toasted, peeled, and milled designated LTPM. The fourth part was cook, peel using local mortal and pistol and fermented and was designated LCPF. The fifth part was cooked, peeled, and oven-dried LPCO.

**Diets preparation:** Six iso-nitrogenous and iso-caloric diets containing 40% crude protein were formulated. Reference diets (D0) which served as the control diet, do not contain *P. biglobosa* seed meal and while the five experimental diets which contain different processed methods were also prepared, coded as Diet I, II, III, IV, and V contain LCPO, LCPF, LTPM, LTM, and LPM ingredient respectively. The reference diet (D0) contained clupeid meal (40.6 %), GNC (27.59 %), Soybeans meal (24.13%) of total protein. Chromic oxide (Cr203) was used as an inert marker at 1% inclusion in the reference (D0) and experimental diets each. The five experimental diets contain 70% reference diets (D0) and 30% of the test ingredient on a dry weight basis. (Falaye *et al.*, 2014).

**Experimental procedure:** *Clarias gariepinus* fingerlings were acclimatized under laboratory conditions for 14 days. During these periods they were fed on a commercial diet. Ten fingerlings of *Clarias gariepinus* with an average weight (5.71±0.98) were random distributed into a 36L plastic bowl, each treatment was replicated thrice in a complete randomized design. The fish were fed control diets (D0) and the five experimental diets coded as Diet I, II, III, IV, and V respectively for 21 days. Feeding was done twice daily at 9:00 am and 06:00 pm, while uneaten feeds were clean 30 minutes after feeding to prevent excess feed contaminating the fecal materials, while the fecal materials were gently siphoned from the plastic bowl using 2mm diameter horse pipe after feeding. The fecal materials were pooled for each treatment and dried at room temperature, (Falaye *et al.*, 2014).

**Biochemical analysis:** The feed and fecal materials were analyses for dry matter, crude protein, lipid, and ash content according to the official methods of analysis (AOAC 2015). All analysis was carried out in duplicate.

**Mineral analysis:** The calcium was determined by jenway digital flame photometer (PFP model), phosphorus was determined by spectronic 20 spectrophotometer while magnesium by buck 200, atomic absorption spectrophotometer (AAS) through the suction tube using the AOAC (2015).

**Chromic oxide:** The feed and fecal materials were digested, and chromium was determined using an ultraviolet spectrophotometer at 400m wavelength (Fenton and Fenton, 1979).

**Gross energy:** The energy in feed and fecal materials was determined by Gallenkamp ballistic bomb calorimeter using AOAC (2015) Method

**Analytical methods:**

Apparent Digestibility coefficient

$$= \left[ 1 - \frac{Cr_{2O_4 \text{ in feed}}}{Cr_{2O_4 \text{ in feces}}} X \frac{[nutrient \text{ in feces}]}{[nutrient \text{ in feed}]} \right] X 100$$

Apparent digestibility of dry matter

$$= \left( 1 - \frac{Cr_{2O_4 \text{ in feed}}}{Cr_{2O_4 \text{ in feces}}} \right) X 100$$

**Statistical analysis:** All data were subjected to one-way analysis of variance (ANOVA) and the means were separated using Duncan's multiple range test at a significant level of 5% using SPSS version 23.0

**RESULTS**

The proximate composition of the feed ingredient was shown in Table 2 while the biochemical analysis of the experimental diets was shown in table 3. The ash shows a significant difference (P<0.05) and was highest in diets D0 with

9.43±0.11% and lowest in diets V with 9.050±0.07%. The crude fat was highest in diets D0 and III with 6.805±0.007% and 6.805±0.007% and lower in fish fed diet V with 6.505±0.007%. The dry matter of the experimental diets was highest in diets II with 93.025±0.007 and lower in diets IV with 92.120±0.014. The gross energy also shows a significant difference (p<0.005) and was highest in diets I with 3.707±0.005 and lower in diets IV with 3.525±0.002. The phosphorus was highest in diets D0 and diets III with 0.487±0.001 and 0.490±0.001 lowest in diet V with 0.471±0.001. The potassium was highest in diets II with 0.644±0.002 and lower in Diet V with 0.589±0.002.

The proximate composition, energy, and minerals analysis of the fecal materials were presented in Table 4. The crude protein content of the faces was highest (20.915±0.021%) in fish fed diet II and lower (17.105±.007%) in fish fed diet V. The ash content was higher in fish fed diet D0 with (24.820±0.028) and followed by fish fed diet II with (20.210±0.014). The crude fat of fecal materials of fish fed I, V and III show no significant difference (p>0.05). The gross energy of the fecal materials was highest in Diet IV with 2.302±0.001 followed by Diet III, Diet D0, Diet V, Diet II, and Diet I with 2.283±0.004, 2.210±0.003, 2.188±0.003, 2.148±0.001, and 2.138±0.004 respectively. The dry matter of the fecal materials was higher in fish fed diet D0 with 91.810±0.014 and lowest in fish fed diet I with 90.765±0.007.

The calcium and magnesium of the faeces were both highest in fish fed diets diet IV and III and lower in fish fed diets diet I. The phosphorus of the faeces was highest in fish fed diet IV with 0.139±0.001 and lower in fish fed diet I with 0.105±0.001. The potassium was higher in faeces fed diets IV and diet III with 0.312±0.003 and 0.307±0.002 and lower in fish fed diets I with 0.272±0.002.

The ADC Protein were significant (p<0.05) higher in diet III and IV with 80.764±0.012% and 81.175±0.091% and lower in diet II with 71.613±0.095%. ADCs fibre and ADCs dry matter show the same trend. ADCs fat was significantly higher in diet IV with 83.619±0.026% followed by diets III, diet D0, I, II, and V with 81.946±0.850%, 80.504±0.104%, 77.648±0.49%, 76.692±0.645%, and 75.732±0.101% respectively. ADCs gross energy was significantly (P<0.05) higher in diet IV with 76.896±0.036% and significantly lower in diet II with 71.138±0.084%.

ADCs Calcium was significantly higher in fish fed diet I with 87.497% and lower in fish fed diet V with 81.180%. The ADCs for magnesium were significantly higher in fish fed diets IV and III with 85.182% and 84.275% and lower in fish fed diets V and II with 80.107% and 80.811%. ADCs values for phosphorus were significantly higher in both fish fed diet I, IV, and III with 90.122±0.087, 89.714±0.071, and 89.796±0.024, which showed no

significant difference ( $P > 0.05$ ) and lowest in fish fed diet V with  $87.154 \pm 0.237$ . ADCs values for potassium were significantly higher in fish fed diet IV with 82.411% and lower in fish fed V with 76.917%. The ADC values of nutrients and energy were significantly affected by the test ingredients ( $P < 0.05$ ).

## DISCUSSION

The difference in ADCs of nutrients from this study is a result of the difference in the chemical composition of the processed feed ingredients and this is in line with Koprucu and Ozdemir (2005), which said that the difference is to explain in terms of chemical composition, origin, and processing feed ingredient (methods).

The ADCs for protein of different processed *P. biglobosa* seed meal from this study range from 71.61-81.18% and these values are in agreement with 71-90.5% reported by Koprucu and Ozdemir (2005) when fed Nile Tilapia *Oreochromis niloticus* with selected feed ingredients, and lower than 85.71-91.26% reported by Fagbenro *et al.*, (2013) when fed *Clarias gariepinus* fingerlings with sesame and sunflower seed meal and 81-86% reported by Lupatsch, *et al.*, (1997). Diet IV which contains LCPF (40.98 C.P) ingredient has the highest ADCs of 80.76%, these have ascertained that not all feed ingredients with higher chemical composition are an excellent source of nutrients.

The ADCs fat of different processed *P. biglobosa* seed meal from this study ranged from 75.73-83.62% and these correspond with 72—97.5% report by Koprucu and Ozdemir (2005), Sklan *et al.*, (2004) and lower than 93.84-95.12 reported by Zhiluo *et al.*, (2009). The ADC for fat is higher in fish fed diet IV with 83.62%, fat promotes fat-soluble vitamins absorption, (Abdullahi, *et al.*, 2019b). The digestibility of fibre from this study ranged from 38.620-52.379% and these are lower than 44.83-52.15% reported by Fagbenro *et al.*, (2013). The highest digestibility of fiber was recorded in fish-fed diets IV with 52.379% followed by fish-fed diet III with 51.344%. Dietary fiber helps in digestion, prevents constipation, and maintains bowel health (Mayo, 2021).

ADCs dry matter of different processed *P. biglobosa* seed meal, range from 53.64-64.63% and these is lower than 62.3-73.8% reported by Nangthu *et al.*, (2009) when fed rainbow trout with sesame oil cake and 68.36-77.55% reported by Fagbenro *et al.*, (2013).

The ADCs values for gross energy of 80.55-87.52 Kcal/g reported by Hossaini *et al.*, (2000) is higher than 71.425-76.896 Kcal/g from this study, and these were similar with Jimoh *et al.*, (2010) when fed *Oreochromis niloticus* with different process jack meal.

The ADCs values for calcium were 81.18-87.50% from this study and these are higher than the

values reported by Koprucu and Ozdemir (2005) while the ADCs values for magnesium were 80.107-85.182%. The ADCs values for phosphorus were 87.15-90.12% and these were higher than 52.33-63.97% reported by Zhiluo *et al.*, (2009) and Koprucu and Ozdemir (2005). The fish fed diets IV had the highest ADC for magnesium (85.18%), phosphorus (89.71%), and potassium (82.41%). According to Abdullahi, *et al.*, (2019b), magnesium and phosphorus in conjunction with calcium are good for bone formation. The phosphorus of the fecal materials from this study range from  $0.105 \pm 0.001$  -  $0.139 \pm 0.001$  and these are within the fertility range (0.05-0.2ppm) of phosphate that supports eutrophication in the aquatic environment (Mohun *et al.*, 2019)

## CONCLUSION

In conclusion, the nutrient in different processed *Parkia biglobosa* seed meal were well digested in this study, and Diet IV (LCPF) processed method, has the highest digestibility in terms of protein, fat, fibre, gross energy, magnesium, and phosphorus. Indicating it can be efficiently used as a partial protein source for *Clarias gariepinus* diets and these values determined can be used for estimating nutrient digestibility in formulated compound diets.

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## REFERENCES

- Abdullahi U.U., Ipinjolu, J.K., Lawal, A.F., Hauwau, J and Mairo, A. (2019a). Economic Viability of Catfish Farming in Mokwa, Mokwa Local Government Area, Niger State, Nigeria. *Nigeria Journal of Fisheries*. 16, No.1;1693-1696
- Abdullahi U.U., Garba, B., Mairo, A., Nadako, A.M and Abraham, O.V (2019b). Effect of Processing Methods on the Nutritional Profile of African Locust Bean (*Parkia biglobosa*) Seed Meal pp197-201. In: Fagbenro, O.A, Ipinjolu, J.K., Ajani, E.K., Magawata, I., Shinkafi, B.A., Ayoola, S.O., Abubakar, M.Y., and Orisasona, O., (Eds). Proceedings of the 2<sup>nd</sup> Association of Nigeria Fisheries Scientist. Sokoto State, Nigeria. 257p
- Akanda, G.R., Oresgun A., Osibona, A.O., Bernard, E and Ayo-olalusi C.I. (2014). Utilization of stunted tilapia as a replacement for imported fish meal in the diets of *Clarias gariepinus* fingerlings. *American Journal of Food*

- Science and Technology*. 2014 (3); 38-42
- AOAC (Association of Official Analytical Chemists), (2015). *Official Method of Analysis. 17th Edition* Washington, D.C., USA
- Chhom L., Menghe, H.L., Edwin, R and Mediha, Y (2008). Cottonseed meal in fish diets. In: Chhorn, L., Carl, D.W and Cheng S.L (Eds). *Alternative protein sources in Aquaculture Diets*
- Deyab, D.M.S.E, Samy, H. M, M8ostafa, A.E and Hayam, D.T (2009). Nutrition evaluation of sesame seed meal, *Sesamum indicum* (L) as alternative protein source in diets of juvenile mono-sex Nile tilapia (*Oreochromis niloticus*). *Egypt Journal of Aquatic Biology and Fish*, 13(1) 93-106pp
- Fagbenro, O.A., Adaparusi, E.O and Jimoh, W.A. (2013). Apparent digestibility coefficients of Sunflower and sesame seed meal in *Clarias gariepinus* (Burchell, 1822) fingerlings. *Journal of Fisheries and Aquatic Science* 8(1): 43-50
- Falaye, A.E, Omoike, A and Orisasona G. (2014). Apparent digestibility coefficients of differently processed Lima bean (*Phaseolus lunatus* L.) for *Clarias gariepinus* juveniles. *Journal of Fisheries and Aquatic Science* 9(2) 84-95
- Fenton, T.W and Fenton, M (1979). An improved procedure for the determination of dietary chromic oxide in feed and feces. *Journal of Animal Science*. 159. 631-634
- Hossain, M.A, Jahan, P and Kikuchi, K. (2000). Nutrient digestibility coefficients of diets with varying energy to protein for Japanese flounder, *Paralichthys olivaceus*. *Bangladesh Journal of fish Research* 4(2): 105-112
- Jimoh, W.A, Fagbenro, O. A and Adeparusi, E.O (2010). Digestibility coefficients of processed jackbean meal *Canavalia ensiformis* L. DC for Nile tilapia *Oreochromis niloticus* Linnaeus, 1758 diets: *International Journal of Fisheries and Aquaculture*. 2(4):102-107
- Koprucu, K and Ozdemir, Y. (2005). Apparent digestibility of selected feed ingredients for Nile tilapia (*Oreochromis niloticus*). *Aquaculture* 250:- 308-316.
- Lupatsch, I and Kissil, G. W.M (1997). Apparent digestibility coefficients of feed ingredients and their predictability in compound diets for gilthead seabream, *Sparus aurata* L. *Aquaculture Nutrition* 3:- 81-89
- Mayo, (2021). *Nutrition and healthy eating*. Mayoclinic.org
- Nang-Thu, T.T., Bodin, N., De Saeger, S., Larondelle, Y and Rollin (2011). Substitution of fish meal by sesame oil cake (*Sesamum indicum* L.) in the diets of rainbow trout (*Oncorhynchus mykiss* W.). *Aquaculture Nutrition*. 17:80-89
- Sklan, D., Prag, T., and Lupatsch, I., (2004). Apparent digestibility coefficients of feed ingredients and their prediction in the diets for tilapia, *Oreochromis niloticus* x *Oreochromis aureus* (Teleostei, Cichlidae). *Aquaculture Research* 5:- 358-364
- Zhiluo, Xiao-dong li, Shi-yuan gong, and wen-qui xi (2009). Apparent digestibility coefficients of four feed ingredients for *Synechogobius hasta*. *Aquaculture Research*, 40; 558-565

**Table 1. Composition of the reference and test diets (%)**

Ingredient	Reference diet	Experimental diet
Maize meal	24.34	11.80
GNC	23.45	17.63
Soya bean meal	23.45	17.63
Clupeid meal	23.45	17.63
Lysine	0.5	0.5
Methionine	0.5	0.5
Premix	3.0	3.0
Salt	0.3	0.3
Chromic oxide	1.0	1.0
African locust bean	-	30
Total	100	100

**Table 2. Proximate Composition of Feed ingredients**

Ingredient	Crude Protein	ASH	Crude fat	Crude fibre	Moisture	NFE
LCPF	40.984±2.238	8.149±0.846	11.035±0.788	8.814±0.257	5.798±0.970	25.222±3.522
LTPM	46.975±0.779	4.458±0.408	8.090±0.564	2.993±0.147	6.346±0.129	31.139±2.027
LPCO	46.303±1.010	5.103±0.172	6.513±0.281	4.943±0.179	4.943±0.179	32.863±0.174
LPM	44.338±1.758	5.397±0.820	6.882±0.248	4.472±0.155	4.412±0.419	34.706±2.612
LTM	30.518±2.238	4.567±0.311	6.116±0.164	8.629±1.039	3.347±0.535	46.825±3.218

GNC	44.560±1.836	7.065±0.437	12.151±0.690	4.648±0.402	9.224±0.577	22.350±2.790
Maize meal	11.931±0.473	2.369±0.066	3.389±0.321	1.307±0.257	8.605±1.017	72.401±2.134
Soybean meal	38.989±1.248	7.139±1.466	7.403±1.140	5.674±0.372	4.837±0.898	35.959±2.584
Clupeid meal	65.575±0.723	12.538±0.334	12.494±0.478	0.685±0.071	7.184±0.718	1.525±0.220

Values are average mean± standard deviation

Keys: LPM as peel raw and milled *P. biglobosa* seed meal

LTM: Toasted and milled *P. biglobosa* seed meal

LTPM: Toasted, peeled and milled *P. biglobosa* seed meal

LCPF: Cook, peel and fermented *P. biglobosa* seed meal

LCPO: Cooked, peeled and oven dried *P. biglobosa* seed meal

GNC: Groundnut cake meal

**Table 3. Biochemical analysis of the experimental diets**

Parameters	D0	V	IV	III	II	I
Crude Protein (% DM)	36.325±0.106	36.65±01.41	36.025±0.035	37.055±0.078	36.625±0.035	35.525±0.035
Ash (% DM)	9.425±0.106 <sup>a</sup>	9.005±0.007 <sup>d</sup>	9.210±0.014 <sup>bc</sup>	9.325±0.035 <sup>ab</sup>	9.105±0.007 <sup>cd</sup>	9.050±0.071 <sup>d</sup>
Crude fat (% DM)	6.805±0.007 <sup>a</sup>	6.505±0.007 <sup>c</sup>	6.705±0.007 <sup>b</sup>	6.805±0.007 <sup>a</sup>	6.505±0.007 <sup>c</sup>	6.725±0.035 <sup>b</sup>
Crude fibre (% DM)	3.805±0.007 <sup>a</sup>	3.705±0.007 <sup>b</sup>	3.495±0.007 <sup>c</sup>	3.675±0.035 <sup>b</sup>	3.495±0.007 <sup>c</sup>	3.705±0.007 <sup>b</sup>
Dry matter (% DM)	92.165±0.021 <sup>e</sup>	92.265±0.021 <sup>c</sup>	92.120±0.014 <sup>f</sup>	92.210±0.014 <sup>d</sup>	93.025±0.007 <sup>a</sup>	92.555±0.007 <sup>b</sup>
Gross Energy(Kcal/g DM)	3.535±0.003 <sup>e</sup>	3.550±0.001 <sup>d</sup>	3.525±0.002 <sup>f</sup>	3.569±0.001 <sup>c</sup>	3.700±0.001 <sup>b</sup>	3.707±0.005 <sup>a</sup>
Calcium (% DM)	0.267±0.002 <sup>b</sup>	0.253±0.001 <sup>e</sup>	0.261±0.001 <sup>cd</sup>	0.272±0.002 <sup>a</sup>	0.257±0.003 <sup>de</sup>	0.263±0.001 <sup>bc</sup>
Magnesium (% DM)	0.289±0.001 <sup>c</sup>	0.282±0.003 <sup>d</sup>	0.302±0.001 <sup>a</sup>	0.296±0.001 <sup>b</sup>	0.279±0.002 <sup>d</sup>	0.283±0.001 <sup>d</sup>
Phosphorus (% DM)	0.487±0.001 <sup>a</sup>	0.471±0.001 <sup>c</sup>	0.478±0.001 <sup>b</sup>	0.490±0.001 <sup>a</sup>	0.479±0.001 <sup>b</sup>	0.476±0.002 <sup>b</sup>
Potassium (% DM)	0.602±0.001 <sup>d</sup>	0.589±0.002 <sup>e</sup>	0.628±0.004 <sup>b</sup>	0.618±0.002 <sup>c</sup>	0.644±0.002 <sup>a</sup>	0.631±0.001 <sup>b</sup>
Chromic oxide (%)	1.754±0.009 <sup>c</sup>	1.807±0.007 <sup>b</sup>	1.661±0.003 <sup>e</sup>	1.696±0.008 <sup>d</sup>	1.881±0.005 <sup>a</sup>	1.793±0.003 <sup>b</sup>

Mean on the same row with same letter are not significantly different (P<0.05)

Values are average mean± standard deviation

Key: DM= Dry matter

**Table 4. Biochemical and Energy analysis of the fecal materials**

Parameters	D0	V	IV	III	II	I
Crude Protein(% DM)	17.505±0.000 <sup>e</sup>	17.105±0.007 <sup>f</sup>	19.590±0.014 <sup>c</sup>	18.765±0.021 <sup>d</sup>	20.915±0.021 <sup>a</sup>	20.150±0.212 <sup>b</sup>
Ash (% DM)	24.820±0.028 <sup>a</sup>	23.105±0.007 <sup>b</sup>	21.615±0.021 <sup>e</sup>	22.015±0.021 <sup>d</sup>	20.210±0.014 <sup>f</sup>	22.100±0.000 <sup>c</sup>
Crude fat (% DM)	3.055±0.064 <sup>b</sup>	3.405±0.007 <sup>a</sup>	3.105±0.007 <sup>b</sup>	3.305±0.007 <sup>a</sup>	3.050±0.007 <sup>b</sup>	3.360±0.057 <sup>a</sup>
Crude fibre (% DM)	4.675±0.035 <sup>c</sup>	4.905±0.007 <sup>a</sup>	4.705±0.007 <sup>c</sup>	4.810±0.014 <sup>b</sup>	4.505±0.007 <sup>d</sup>	4.705±0.007 <sup>c</sup>
Dry matter (% DM)	91.810±0.014 <sup>a</sup>	91.455±0.007 <sup>c</sup>	90.960±0.014 <sup>d</sup>	91.310±0.014 <sup>c</sup>	91.710±0.014 <sup>b</sup>	90.765±0.007 <sup>e</sup>
Gross Energy(Kcal/g DM)	2.210±0.003 <sup>c</sup>	2.188±0.003 <sup>d</sup>	2.302±0.001 <sup>a</sup>	2.283±0.004 <sup>b</sup>	2.148±0.001 <sup>e</sup>	2.138±0.004 <sup>f</sup>
Calcium (% DM)	0.090±0.001 <sup>c</sup>	0.103±0.002 <sup>b</sup>	0.110±0.001 <sup>a</sup>	0.107±0.001 <sup>a</sup>	0.087±0.001 <sup>c</sup>	0.074±0.002 <sup>d</sup>
Magnesium (% DM)	0.112±0.003 <sup>c</sup>	0.121±0.001 <sup>b</sup>	0.127±0.002 <sup>a</sup>	0.125±0.001 <sup>ab</sup>	0.108±0.001 <sup>d</sup>	0.105±0.001 <sup>d</sup>
Phosphorus (% DM)	0.121±0.001 <sup>d</sup>	0.131±0.002 <sup>c</sup>	0.139±0.001 <sup>a</sup>	0.135±0.001 <sup>b</sup>	0.110±0.002 <sup>e</sup>	0.105±0.001 <sup>f</sup>
Potassium (% DM)	0.286±0.002 <sup>c</sup>	0.293±0.003 <sup>b</sup>	0.312±0.003 <sup>a</sup>	0.307±0.002 <sup>a</sup>	0.279±0.002 <sup>d</sup>	0.272±0.002 <sup>e</sup>
Chromic oxide (%)	4.039±0.086 <sup>c</sup>	3.8975±0.005 <sup>d</sup>	4.696±0.006 <sup>a</sup>	4.561±0.006 <sup>b</sup>	3.783±0.003 <sup>e</sup>	4.008±0.006 <sup>c</sup>

Mean on the same row with same letter are not significantly different P<0.05

Values are average mean± standard deviation

**Table 5. Apparent Digestibility Coefficient (ADC) of the Nutrient and Minerals of Different Processed African Locust Bean (*Parkia biglobosa*) Seed Meal by *Clarias gariepinus* Fingerlings**

Parameters	D0	V	IV	III	II	I
ADC Protein (%)	79.068±0.415 <sup>b</sup>	78.362±0.020 <sup>c</sup>	80.764±0.012 <sup>a</sup>	81.175±0.091 <sup>a</sup>	71.613±0.095 <sup>e</sup>	74.626±0.288 <sup>d</sup>
ADC Fat (%)	80.504±0.104 <sup>c</sup>	75.732±0.101 <sup>f</sup>	83.619±0.026 <sup>a</sup>	81.946±0.085 <sup>b</sup>	76.692±0.645 <sup>e</sup>	77.648±0.490 <sup>d</sup>
ADC Fibre (%)	46.638±0.379 <sup>c</sup>	38.620±0.347 <sup>e</sup>	52.379±0.185 <sup>a</sup>	51.344±0.328 <sup>b</sup>	35.926±0.014 <sup>f</sup>	43.190±0.014 <sup>d</sup>
ADC Dry matter (%)	56.566±0.718 <sup>c</sup>	53.637±0.240 <sup>e</sup>	64.626±0.122 <sup>a</sup>	62.826±0.217 <sup>b</sup>	50.291±0.168 <sup>f</sup>	55.265±0.007 <sup>d</sup>
ADC Gross Energy(Kcal/g)	72.846±0.436 <sup>d</sup>	71.425±0.196 <sup>e</sup>	76.896±0.036 <sup>a</sup>	76.226±0.166 <sup>b</sup>	71.138±0.084 <sup>f</sup>	74.196±0.021 <sup>c</sup>
ADC Calcium (%)	85.247±0.476 <sup>b</sup>	81.180±0.345 <sup>d</sup>	85.159±0.021 <sup>b</sup>	85.349±0.223 <sup>b</sup>	83.171±0.402 <sup>c</sup>	87.497±0.430 <sup>a</sup>
ADC Magnesium (%)	83.162±0.786 <sup>c</sup>	80.107±0.136 <sup>d</sup>	85.182±0.312 <sup>a</sup>	84.275±0.124 <sup>ab</sup>	80.811±0.337 <sup>d</sup>	83.481±0.032 <sup>c</sup>
ADC Phosphorus (%)	89.208±0.273 <sup>b</sup>	87.154±0.237 <sup>d</sup>	89.714±0.071 <sup>a</sup>	89.796±0.024 <sup>a</sup>	88.636±0.225 <sup>c</sup>	90.122±0.087 <sup>a</sup>
ADC Potassium (%)	79.403±0.139 <sup>d</sup>	76.917±0.259 <sup>f</sup>	82.411±0.252 <sup>a</sup>	81.548±0.172 <sup>b</sup>	78.486±0.166 <sup>e</sup>	80.752±0.104 <sup>c</sup>

Mean on the same row with same letter are not significantly different P>0.05

Values are average mean± standard deviation