ISSN 2664-4010 (Print) & ISSN 2664-6730 (Online)
South Asian Research Journal of Agriculture and Fisheries
Abbreviated Key Title: South Asian Res J Agri Fish

| Volume-3 | Issue-4 | July-Aug -2021 | **DOI: 10.36346/sarjaf.2021.v03i04.001**

Original Research Article

Effects of Different Cooking Period of Cassava Peels (*Manihot esculenta*) on the Growth of *Clarias gariepinus*

Isiyaku, M. S.[1*], R. Mohammed[2], Laurat, H.T.[3], and A.Y. Lawee[2]

[1]Department of Fisheries and Aquaculture, Bayero University, Kano, Nigeria
[2]Department of Aquaculture and Fisheries Management, Nassarawa State University, Keffi, Nigeria
[3]Department of Zoology, School of Life Sciences, Modibbo Adama University of Technology, Yola, Nigeria

***Corresponding Author**
Isiyaku, M. S.

Article History
Received: 25.05.2021
Accepted: 28.06.2021
Published: 08.07.2021

Abstract: Cassava (*Manihot esculenta*) is available everywhere around the globe and the leaves are left wasted after harvest. Despite its high nutrient profile, incorporation in fish diet is hindered by its high cyanogen content. Processing could help remove the cyanogen and enhance its utilization by fish. Two hundred (200) fingerlings of Catfish (*Clarias gariepinus*) with average weight of 6.52±0.02g were obtained from a fish hatchery in Kano. The fish were acclimatized for seven (7) days in the plastic bowls during which the fish were fed same diet with Coppens. A 56 days feeding trial experiment was conducted on *Clarias gariepinus* fingerlings fed cassava peels, processed at different cooking period. The period variation were uncooked Cassava peel meal (DT1); cooked at 10 minutes (DT2); cooked at 20 minutes (DT3); cooked at 30 minutes (DT4) cooked at 40 minutes (DT5). The five (5) different diets of Cassava peel were used to formulate Iso-nitrogenous of 35% crude protein. Growth parameter monitored showed that the best growth and feed conversion efficiency were obtained with DT5-Cassava peel cooked for 40 minutes. D5 had the highest mean weight gain (MWG) of 6.19g, Specific Growth Rate (SGR) of 1.26, Protein Efficiency Ratio (PER) of 29.94 and conversely the lowest Feed Conversion Ratio (FCR) of 0.10. Similarly, there were statistical difference ($P < 0.05$) for MWG, SGR, PER and FCR. Based on these results, DT5-Cassava cooked for 40 minutes is recommended for *Clarias gariepinus* fingerlings diet to fish farmers.

Keywords: Growth performance, nutrient utilization, *Clarias gariepinu*s, cassava peels.

INTRODUCTION

Fish is highly nutritive and rich source of animal proteins. For the improvement of fisheries and to achieve maximum yields from resources of fresh water, it is necessary to provide artificial feed, by which fish grows rapidly and attains maximum weight in shortest possible time. Among commonly used feed ingredients, fish meal is considered to be the best ingredients, due to its compatibility with the protein requirement of fish (Alam et al. 1996). The soaring cost of feed is observed as one of the problems hampering the development of aquaculture in Nigeria (Gabriel et al., 2007). This is as a result of high crude protein content (35-50%) which is the most critical and/or costly ingredient in catfish feeds where protein sources represent about 60 per cent or most of the cost of fish feeds. The primary source of protein in fish feed is fishmeal which is facing much pressure from both livestock and aquaculture industry. This has motivated the search for local, cheap and available ingredients that are unsuitable for direct human consumption as alternative protein source in practical diets for Clarias gariepinus. Leaf meal proteins are among the unconventional sources of protein that may reduce the high cost of fish feed (Udo and Umoren 2011).

Cassava peels composed of 60-65% moisture, 20-31% carbohydrate, 1-2% crude protein and a comparatively low content of vitamin and minerals. However, the roots are rich in calcium (50mg/100g) and vitamin-c (25mg/100g) and contain a nutritionally significant quantity of thiamine, riboflavin and Nicotinic acid. Cassava starch contains 70% amylopectin and 20% amylase, phosphorus (40mg/100g). However, they are poor in protein and other nutrients. In contrast, cassava leaves are a good source of protein (rich in Lysine) but deficient in the amino acid Methionine and possibly Tryptophan (Ravindran, 1992).

African Catfish (C. garepinus) are known to be omnivorous in their food habits (Anyarnwu et al., 2012). Besides, they are hardy and tolerant to a wide range of environmental conditions (Nwani et al., 2015). These attributes have indicated the fish as highly and veraciously disposed to accepting unconventional dietary feeds, such as leaf meals. The quest to intensify the culture of the fish so as to meet its ever increasing demand has made it vital to develop suitable diets either in supplementary forms in ponds or as whole feed in tanks (Olukunle, 2006).Feed is one of the major inputs in aquaculture production and fish feed technology has become one of the least development sectors of aquaculture particularly in Africa and other developing countries of the world (Gabriel et al., 2007). High cost of fish feed ingredients (maize and fish meal) is observed as one of the problems militating against aquaculture development in Nigeria (Gabriel et al., 2007). This leads to malnutrition of fish which subsequently results in decline in reproduction of individual fish. This eventually causes scarcity of fish species in the market which invariably results in high cost of fish. Leaf meals of most tropical plants, for example, cassava leaf meal (Anyanwu, 2009) are available and cheap.

MATERIALS AND METHODS

Experimental site

The experiment was carried out at Fisheries Research Farm, Bayero University Kano, Kano State, Nigeria. The feeding experiment was conducted in 10 hapas of $1x1x1m^3$ sizes in Fisheries Research Farm, Bayero University Kano. The hapas were immersed in already existing pond of $25x25x25m^3$.

Collection and processing of ingredients

The entire feed ingredients except the cassava peel meal were obtained from Yankaba Market Kano. Cassava (Manihot esculenta) peels were obtained from Cassava processing factory and sun-dried for 72hours. The raw cassava peels were cleansed and poured into a boiling water of 100^0c contained in the cooking pot and allowed to cook for an indicated time periods (10, 20, 30, 40 minutes). The cooked Cassava peels were sun-dried on concrete slabs with occasional turnings and allowed to dry. They were milled separately and packed into a polythene bag and kept for diet formulation.

Experimental Set up and Management

Clarias gariepinus fingerlings for this research were purchased from a reputable hatchery in Kano, Kano state, Nigeria. Two hundred (200) Clarias gariepinus fingerlings with mean weight of 1.80g were used for the experiment, they were acclimatized for fourteen 14 days at Fisheries Research Farm, Bayero University Kano. Ten hapas were used for the experiment and the fish were stocked at the rate of 20 fingerlings per hapas. The fish were fed 5% body weight, batch weighed weekly and feed adjusted accordingly. They were fed twice daily at 0900 am and 0400 pm.

Diet Formulation and Compounding

In this experiment, diet of 35% crude protein for Clarias gariepinus fingerlings was formulated using cassava peels and maize meal as carbohydrate supplement in the mixture. Other feed ingredients such as fish meal, groundnut cake, vitamin and mineral premix were added in their required percentages. The mixture of the feed ingredients were pelleted. The gross composition of the experimental diet are shown in Table 1.

Table-1: Gross composition of Cassava Peel Based Diets

Ingredient Time lag	DIET 1 0min	DIET 2 10mins	DIET 3 20mins	DIET 4 30mins	DIET 5 40mins
Maize meal	19.35	19.35	19.35	19.35	19.35
Cassava peel	19.35	19.35	19.35	19.35	19.35
Fish meal	28.16	28.16	28.16	28.16	28.16
SBM	28.16	28.16	28.16	28.16	28.16
Mineral	1.25	1.25	1.25	1.25	1.25
Vitamin	1.25	1.25	1.25	1.25	1.25
Oil	2.0	2.0	2.0	2.0	2.0
Salt	0.5	0.5	0.5	0.5	0.5
% Total	100%	100%	100%	100%	100%

Proximate composition

Proximate composition of the cassava peel used in this study was analyzed. Dry matter (DM), crude protein (CP), crude fibre (CF), ether extract (EE), ash were analyzed according to standard methods of AOAC (2005)

Estimation of growth performance, feed utilization and survival parameters

The overall growth parameter and feed efficiency indexes were computed using the following equations (i) weight gain (%) = (final weight – initial weight) x (final weight) $^{-1}$ x 100; (ii) daily weight gain (DWG) = (final weight –

initial weight) x t^{-1}; (iii) feed conversion ratio (FCR) = (dry food fed) x (wet weight gain) $^{-1}$; (iv) specific growth rate (SGR; % day $^{-1}$) = [Ln (final weight) – Ln (initial weight)] x (number of days)$^{-1}$ x 100 and (v) survival rate (SR; %) = (Total number of fish sampled) x (Total number of fish stocked)$^{-1}$ x 100.

Statistical analysis

Data were analysed as a design using the IBM SPSS statistics 22. Mean and one-way analysis of variance was performed to compare means. Duncan multiple range test was used to identify significant differences among different treatment means; P<0.05 was considered to be statistically significant.

RESULTS

The proximate composition of the experimental diets is presented in Table 2. Nutrients for the formulated diets were all within the requirements by African catfish according to NRC (2011). The results obtained for the proximate composition of Cassava Peel Based Diets revealed ranges for moisture as 4.66% in diet DT1 to 5.24 % in the control diet DT1 Crude protein was relatively higher (34.77%) in diet DT5 and lowest (34.66%) in diet DT1. Results for fat revealed relatively higher values in the experimental diets while the least value was recorded in the control diet DT1. The highest value (7.15%) recorded for ash was in diet DT1, while the lowest value (6.77%) was recorded in diet DT5. Crude fibre was highest in experimental diet DT3 (9.12%), followed by diet DT4 and DT5, with percentage values of 8.77% and 8.64% respectively. The least value was recorded in diet DT1 with a percentage value of 6.84%.

Table-2: Proximate composition of Cassava Peel Based Diets

Parameters	Treatments				
	DT1	**DT2**	**DT3**	**DT4**	**DT5**
Protein	34.66±0.13^{a}	34.77±0.01^{a}	35.08±0.02^{a}	35.77±0.01^{a}	34.77±0.10^{a}
Ash	7.15±0.00^{a}	7.12±0.01^{a}	7.03±0.03^{b}	6.88±0.01^{c}	6.77±0.01^{d}
Lipids	5.76±0.01^{d}	5.82±0.01^{d}	6.11±0.02^{b}	6.19±0.02^{a}	5.89±0.03^{c}
Fibre	6.84±0.06^{d}	8.55±0.01^{c}	9.12±0.01^{a}	8.77±0.02^{b}	8.64±0.01^{c}
Moisture	4.66±0.01^{c}	4.31±0.01^{e}	4.47±0.01^{d}	5.13±0.01^{b}	5.24±0.02^{a}
NFE	40.93±0.07^{a}	39.43±0.04^{a}	38.19±0.03^{a}	37.26±0.02^{a}	38.69±0.09^{a}

The proximate composition of the five DTs formulated are shown in Table 3. The results obtained for the proximate composition of Cassava formulated Diets revealed ranges for moisture as from 4.31% (DT2) to 5.24% (DT4), Crude protein content ranging from 34.66% (DT1) to 35.78% (DT4). Ash varied significantly (P<0.05) ranging from 6.77% (DT5) to 7.15% (DT1). Crude fibre varied significantly (P<0.05) ranging from 6.84% (DT1) to 9.12% (DT4). Nitrogen free extract range from 37.26 (DT4) to 40.93 (DT1). Ether extract (DT1) 5.76% had the least value while (DT4) 6.19% recorded the highest value.

Table-3: Proximate Composition of Clarias gariepinus Carcass Fed Cassava Peels Boiled for Different Periods.

Parameters	Treatments					
	Initial	**DT1**	**DT2**	**DT3**	**DT4**	**DT5**
Protein	11.18±0.01^{e}	13.36±0.11^{d}	13.79±0.04^{b}	13.39±0.02^{cd}	13.52±0.00^{c}	14.08±0.01^{a}
Ash	1.22±0.01^{f}	1.66±0.01^{a}	1.56±0.01^{c}	1.61±0.01^{b}	1.49±0.01^{d}	1.33±0.01^{e}
Lipids	0.81±0.07^{d}	1.67±0.01^{b}	1.63±0.03^{b}	1.88±0.01^{a}	1.48±0.01^{c}	1.59±0.00^{b}
Fibre	0.92±0.03^{d}	1.07±0.05^{c}	1.22±0.00^{b}	1.33±0.01^{a}	1.05±0.04^{c}	1.09±0.01^{c}
Moisture	62.04±0.09^{f}	77.29±0.19^{c}	77.85±0.02^{b}	79.14±0.09^{a}	76.71±0.12^{d}	76.13±0.12^{e}
NFE	23.84±0.16^{a}	4.25±0.25^{d}	3.97±0.04^{d}	2.67±0.11^{e}	5.76±0.18^{c}	6.52±0.02^{b}

Means on the same row with different superscript are statistically significant (p<0.05)

Table-4: Growth Response of Clarias gariepinus Fed Cassava peels Boiled for Different Periods.

Parameters	Treatments					P-Value
	DT1(Control)	**DT2 (10 Mins)**	**DT3 (20 Mins)**	**DT4 (30 Mins)**	**DT5 (40 Mins)**	
MIW (g)	6.09±0.0	6.06±0.00	6.06±0.00	6.07±0.00	6.05±0.00	-
MFW (g)	8.83±0.57^{b}	9.21±0.15^{b}	10.09±0.55^{ab}	10.39±1.04^{ab}	12.24±0.01^{a}	0.049
MWG (g)	2.75±0.57^{b}	3.15±0.15^{b}	4.03±0.55^{b}	4.32±1.04^{ab}	6.19±0.01^{a}	0.048
%WG	45.11±9.37^{b}	51.98±2.48^{b}	66.50±9.08^{b}	71.20±17.10^{ab}	102.23±0.08^{a}	0.032
SGR (g.day^{-1})	0.67±0.12^{b}	0.75±0.03^{b}	0.91±0.09^{ab}	0.95±0.18^{ab}	1.26±0.00^{a}	0.050
FCR	0.17±0.02^{a}	0.15±0.00^{ab}	0.13±0.01^{ab}	0.13±0.02^{ab}	0.10±0.00^{b}	0.038
FCE	6.16±0.89^{b}	6.84±0.21^{b}	7.95±0.66^{ab}	8.20±1.18^{ab}	10.11±0.00^{a}	0.017
PER	17.87±2.53^{b}	19.66±0.62^{b}	22.29±1.83^{b}	22.93±3.30^{ab}	29.94±0.10^{a}	0.042
ANPU	0.41±0.00^{a}	0.39±0.00^{b}	0.38±0.00^{c}	0.38±0.00^{c}	0.39±0.00^{b}	0.00
% Survival	75.00±10.00	67.50±07.50	75.00±5.00	62.50±7.50	82.50±2.50	0.41^{ns}

Means on the same row with different superscript are statistically significant (p<0.05)

Figure 1, reveals the growth pattern of fish from initial week 1 to week 8. The fish fed different diet separated clearly at the eight (8) weeks with diet 5 having a better growth pattern than any of the diets, this trend was followed by diets 3, 4, 1 and DT2 was the lowest.

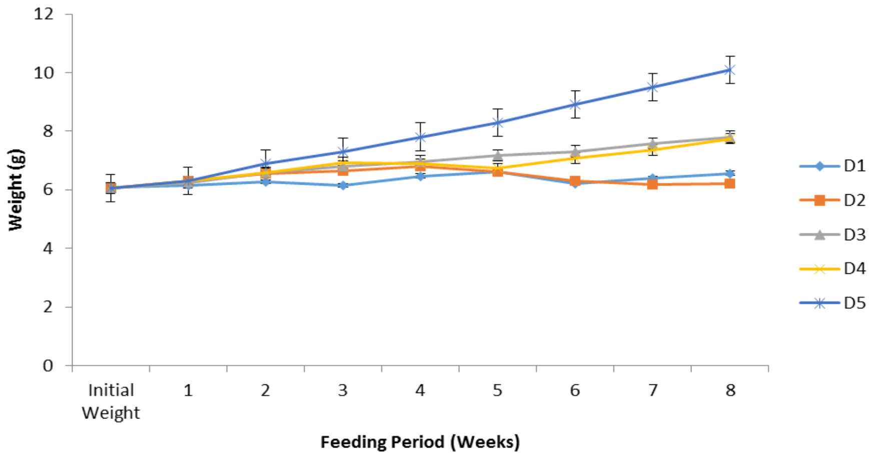

Fig-1: Weekly Growth of Clarias gariepinus Fed Cassava Based Diets.

DISCUSSION

The results obtained for proximate composition of cassava fed diets in this study was higher than the reports posited by Bichi and Ahmad (2010) on proximate composition of cassava leaves. The difference may be attributable to the parts studied as well as processing methods. However, the proximate composition of the experimental diets fall within the range expected to support healthy growth of fish species (Liu et al., 2004).

The trend of growth shows that growth performance increased with increasing period of cooking of Cassava peels which is evidenced by an increase in final weight when compared with the initial weight of the fish. Even though all the five diets were accepted and utilized for growth by the fish, DT5 (40 minute) recorded the highest growth performance parameters. This is could be attributed to the fact that increased period of cooking of Cassava peels improved the growth performance of the experimental fish, it also help to improve the quality and palatability of the diet by reducing the anti-growth factor as observed by (Salami et al., 2003; Adegbola et al., 1985).

DT5 that was boiled for a period of 40 minutes proved to have the best growth performance and nutrient utilization. The lower feed conversion value observed in DT5 was influenced by the length of cooking time and these indicated better rate of utilization and feed efficiency. This is consistent with the observation of Balogun et al (2000) who reported that adequate cooking of feedstuffs improves their nutritive value. Gomez and Valdivieso (1988) reported that Sun-drying alone eliminates almost 86% of the initial HCN content in cassava. DT4 Cassava peels cooked at 30 minutes shows a good growth performance but a decrease in mean weight gain when compared with DT5 and this could be attributable to the fact that a less than 40 minutes cooking time may indicates the presence of limiting factor for diet utilization as this diet may still contain certain amount of Cyanogenic glucosides, which produce the cyanide (HCN) toxin; this toxin inhibit both the rate of efficiency and weight gain as reported by Hill (1973) that feeding of untreated cassava products could result in low survival or death of animals, particularly non-ruminants. DT2 Cassava peels cooked at 10 minutes shows to be better off when compared with DT1 in mean weight gain and feed conversion value. This might be in connection with the fact that a 10 minutes cooking of cassava proved to have a beneficial effect as reported by (Aro et al., 2010). The presence of Cynogenic acid have been reported in cassava peels by Tewe, (2004) who reported that Cassava peels contain high amounts of cyanogenic glycosides which adversely affect the utilization efficiency of diet.

The food conversion ratio obtained in this study corroborates with the reports of Sogiuraet al. (2000) on rainbow trout that replacement of maize with cassava does not affects growth and feed utilization in fish. The high survival rates recorded in this study also indicates that feeding Clarias gariepinus with different cooking period of cassava peel does not lead to mortality of the fish. This may probably be due to the substantial reduction in the cyanide content by boiling and drying of the cassava by product. This agrees with the assertion of Cardoso et al. (2005), that good processing of cassava enhance survival and healthy state of fish at all stages of their life. The increased rate of feed input observed in this study reveals that all the experimental feed were accepted and utilized which led to increase in weight and in feed intake throughout the 8 weeks. This may be because of the nutritive composition, palatability, acceptability and nutrient utilization of the experimental feed.

Conclusion

Growth performance increased with increasing boiling period of Cassava peels and Diets of Cassava peels cooked for 40 minutes DT5 showed the most favorable growth performance when fed to the fish, and recorded the highest Crude protein in Carcass. The use of Cassava peels in fish feed production will not only help in utilization of waste resources but also in reduction in cost of fish feed production.

References

- Adegbola, A. A.; Asaolu, O. (1985). Preparation or cassava peels for use in small ruminant production in western Nigeria. In: ILRI, towards optimal feeding of agricultural by products to livestock in Africa.
- Alam, M.S., S. Teshima, M. Ishikawa, S. Koshio, D. Yaniharto. (2001). Methionine requirement of Juvenile Japanese flounder Paralichthys olivaceus estimated by the oxidation of radioactive methionine. Aquac. Nutr., 7, pp. 201-209.
- Anyanwu DC, Umeh OI,Maduka BC,Mbchu MU. (2012).Nutrient utilization and growth of catfish (Clarias gariepinus) fed dietary levels of cassava leaf meal. Pak. J. Nutr., 11(11):1037-1040.
- Anyanwu, D.C., Udedibie, A.B.I., Esonu, B.O., Osuigwe, D.I. (2009). Growth and nutrient utilization of heteroclarias (Heterobranchus bidorsalis xClarias gariepinus fed dietary levels of Microdesmis puberurla leaf meal. Int. J. Agric. Rural Dev. 11:10-13.
- AOAC (2005). Official Methods of Analysis. 15th Edn. Association of Official Analytical Chemists, Washington, D.C., USA. pp: 200-210.
- Aro, S. O. ; Aletor, V. A. ; Tewe, O. O. ; Agbede, J. O. (2010). Nutritional potentials of cassava tuber wastes: A case study of a cassava starch processing factory in south-western Nigeria. Livest. Res. Rural Dev., 22 (11)
- Balogun, A.M and Ologhobo A.D. (1989). Growth performance and Nutrient Utilization of Fingerlings of Clarias gariepinus Fed Raw and Cooked Soybean Diets Aqua., 79: 119-129.
- Bichi, A. H. & Ahmad, M. K. (2010). Growth performance and nutrient utilization of African catfish (Clarias gariepinus) fed varying dietary levels of processed cassava leaves. Bayero Journal of Pure and Applied Sciences. 3(1), 118- 122.
- Cardoso, A.P., Mirione, E., Ernesto, M., Massazer, F., Cliff, J., Haque, R.M., Bradbun, H.H. (2005). Processing of Cassava Roots to remove cyanides. J. Food Compost. Anal., 18:451-460.
- Gabriel, U.O., Akinrotimi. O.A., Ananwu, P.E., Bekibele, D.O., Onunkwo, D.N. (2007). Locally produced fish feed potential for aquaculture development in sub-Saharan Africa. J. Agric. Res., 2:287-295.
- Gomez, G.; Valdivieso, M.; Santos, J. (1988). Cassava whole root chips silage for growing finishing pigs. Nutr. Rep. Int., 37 (5): 1081-1092. Centro Internacional de Agricultura Tropical (CIAT), Cali, Colombia.
- Hill, D. C. (1973). Chronic Cyanide Toxicity in Domestic Animals. p. 105-111. In Chronic cassava toxicity: Proceeding of an interdisciplinary workshop, London, England, 29-30 January 1973. International Development Research Centre Monography. IDRC-010e.
- Liu, K. K. M. F. T., Barrows, R.W. and Dong, F.M. (2004). Body composition, growth performance and product quality of rainbow trout (Oncorhynchusmykiss) fed diets containing poultry fat, soyabean/corn lecithin, and menhaden oil. Journal of Aquaculture, 238: 309-328.
- National Research Council. (2011). Nutrient requirement of fish and shrimps. Committee on the Nutrient Requirements of Fish and Shrimp; National Research Council. National Academic Press Wasington DC USA 392 pp.
- Nwani, C.D., Ifo, C.T, Nwamba, H.O., Ejere, V.C., Onyishi, G., Ikwuagwu, E.O., Odo, G.E. (2015). Oxidative stress and biochemical responses in the tissues of African catfish Clarias gariepinus juvenile following exposure to primextra herbicide. Drug Chem. Toxicol. 38(3):278-285.
- Olukunle, O. (2006). Nutritive potential sweet potato peel meal and root replacement value for maize in diets of African catfish (Clarias gariepinus) advanced Fry. J. Food Technol. 4:289-293.
- Ravindran, V. (1992). Preparation of cassava leaf products and their use as animal feeds Proceedings of Roots, tubers, plantains and bananas in animal feeding, FAO, Rome.
- Salim, B. D., Booth, M. and Allan, G. L. (2003). A feed is only as good as its ingredients: a review of ingredient evaluation strategies for aquaculture feeds. Aquaculture Nutrition 13: 17-34.
- Sugiura, S. H. and Hardy, R. W. (. 2000). Environmentally friendly feeds. In: Stickney, R.R. (Ed). Encyclopedia of Aquaculture, New York; John Wiley and sons.
- Tewe, O. O., 2004. The global cassava development strategy: cassava for livestock feed in Sub-Saharan Africa. IFAD and FAO.
- Udo, I. U. and Umoren, U. E. (2011). Nutritional evaluation of some locally available ingredients used for least-cost ration formulation for African catfish (Clarias gariepinus) in Nigeria Asian Journal Agricultural Research 5(3):164-175.

Citation: Isiyaku, M. S *et al* (2021). Effects of Different Cooking Period of Cassava Peels (*Manihot esculenta*) on the Growth of *Clarias gariepinus*. *South Asian Res J Agri Fish, 3*(4), 52-56.