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Growth Response, Feed Conversion Rate and Cost Benefits of (*Clarias gariepinus*) Juveniles Fed on Processed Cassava Leaf Meal in Outdoor Concrete Ponds

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ABSTRACT
The growth response, feed conversion ratio and cost benefits of *Clarias gariepinus* fed in four levels of Cassava leaf inclusion (*Manihot esculenta*) meal based diets were evaluated for 91 days in outdoor concrete ponds. The study was conducted Biological garden, fisheries unites Department of Biology Education, Federal College of Education (Tech) Bichi, Kano State, Nigeria (8-9^{0}E and 12-13^0 N). Twenty juvenile hybrid fish were stocked in twelve outdoor concrete tanks of dimension 1.0 x 0.9 x 1m was coded as diet I, II, III, IV in relation to their diet name. Four diet 0% of Cassava leaf meal inclusion, diet II 10% Cassava leaf meal, diet III-20% Cassava leaf meal, diet IV 30% Cassava leaf meal, were used for the experiment. The higher the proportion of cassava leaf in the meal, the higher the ether extract and crude fibre. No significant difference P>0.05 exist between ash content of the experimental diets. Diet III had the best growth performance and highest MGR with a significant difference P<0.05 exists between the growth parameters for diet I, diet II and diet IV. A positive correlation (r= 1.0) exists (P<0.05, 0.25).between the growth parameters for the different experimental diets. Highest correlation r^2 =0.9581 exists p<0.05 between MGR within the treatments. No significant p>0.05 difference expenditure. But there is significant difference between the profit indices and incidence of cost between the trials. Diet III has the best yield cost and net profit. Without any reservation, inclusion of Cassava leaf meal diet is recommended as feed of *C. gariepinus* catfish to 20% inclusion for growth and profit incidence.
Keywords: *Clarias gariepinus*, Cassava leaf meal fishmeal, proximate composition, growth and Cost Benefits.

INTRODUCTION

The cost of feeding has long been recognized as the major cost in aquaculture (Sogbesan, Ajuonu, Madu, Omojouro and Ugwumba, 2004) to buttress this, Sadiku (2003) documented that this cost claims about 60% of the recurrent cost of fish farming venture that minimized the profit margin of fish farmers and negate the economic viability of the fish industry. Fishmeal, which constitutes about 50-75% by weight in most aqua feeds, is an important ingredient in aquaculture diets. Though it has high protein quality determines the palatability but still remains the most expensive ingredient out of the other ingredients used in fish feed formulation. The cost attached to these ingredients has a lot to do with its rare availability, consumption by man and competition from other livestock industry (Madu, Sogbesan .and Ibiyo, 2008).

Although, cost is not the most important consideration for feeding a diet to fish or in feed formulation (Burka, 2009); it is rather important than alternate diet contains all the essential amino acids, fatty acids, vitamins and minerals required by a fish for rapid growth, sound health and economic profitability (Balogun, Abdullahi, Auta and Ogunlade, 2008). Hence, partial replacement of fishmeal protein with alternate sources of protein could be of considerable economic advantage especially of the ingredients in associated with moderate reduction in feed efficiency.

Cassava leaves have been used in the tropics as a cheap protein source in ruminant feeds and livestock (FAO, 2012*)*. According to Oduro, Ellis, and Owusu, (2008) the leaf meal has a high protein content of between 18 to 33% of protein in various cultivars with high Amino Acid; it has good mineral profile and vitamins such as A, B, C, and E. Moreover, Cassava leaves can be harvested many times throughout the year (Fasuyi, .and Aletor (2005). One of the major factors limiting the use of this leaf meal in fish feed is the presence of anti-nutritional factors. These substances can be inactivated by various processing methods such as oven drying, sun-drying, boiling, over steaming and grinding prior to inclusion in fish feed. This will enable researchers not only to select the plant as a source of high quality protein, but also to expand our future on fish production and fish feed supply will boost food production (Ty, Khieu, Saphararith, Preston & Maung, 2010).

The culture of *C.gariepinus* is rapidly increasing in Nigeria. This is due to the high growth rate and resistance to disease and it can trivet/ survived in poor environments. *C.gariepmus* is an omnivorous fish which is cultivable in both indoor and outdoor tanks (Moses & Olufeagba, 2008 and Ochang, Fabenro and Adebayo, (2007).With the rapid increase in market demand of this species, there is a need to buttress the production so that the aquaculture sector will be able to alleviate the deficit in the supply of this specie. Hence, the major aim of this study is to evaluate the economics and production capacity of *C. gariepinus* fed in cassava meal supplemented diet. The study was conducted Biological garden, fisheries unites Department of Biology Education, Federal College of Education (Tech) Bichi, Kano State, Nigeria (8-9^{0}E and 12-13^0 N).

MATERIAL AND METHOD

Experimental Set up

Twelve Concrete ponds with dimension (1.3 x 0.9 x 1m) were constructed in Biological garden Federal College of Education technical Bichi in department of Biological Sciences pond were fertilized with poultry dump later were thoroughly washed and the Concrete ponds were scrubbed with agricultural lime ($CaCo_3$) which served as disinfectant. The ponds were then rinsed and drained after 24 hours to clear the ponds of the lime. Thereafter each Pond was filled with 150litres of water with a labeled and an assigned experimental diet. The twelve ponds were each stock with twenty juveniles of *C .gariepinus* selected randomly. The water in each pond was changed fortnightly to remove the faeces and left over food.

Plate I Concrete ponds were scrubbed with agricultural lime ($CaCo_3$) which served as disinfectant

Experimental diet

Freshly harvested Cassava leaves from Biological garden of the Department of Biological sciences A.B.U, Zaria Nigeria, Plate I: Rogo (mesoki) Sweet Variety of Cassava (Herbarium No.:2347) was pounded and sun dried for three days and thereafter grounded into fine powder using the hammer mill. All the other feed ingredients were milled using locally fabricated hammer mill and sieved through a 595um sieve to remove stones and dirty as well as ensure homogeneous size profile before being analyzed for proximate composition. Four dry diets were prepared in which fish meal was replaced with Cassava leaf meal at 0%, 10%, 20% and 30% levels of inclusion at 40% crude protein level fortified with vitamin premix. They were thoroughly mixed in a bowl and pelletized in an improvised pelleting machine using 1% starch as binder,

Plate II: Pounded, Sun-drying of Ground Cassava Leaf Meal at Rehoboth Feed PLC. Opposite A.B.U.Zaria.

Plate III Measurement, Mixing, Pasting, Pelleting and Cutting

Stocking and feeding of The Experimental fish

C. gariepinus Juveniles were collected from the Genetic Improvement Laboratory, Funtua hactary units Nigeria. The fish were transported to the Hydrobiology laboratory of the Department of Biological Sciences Federal College of Education (T) Bichi. They were acclimatized for three days before the takeoff of the experiment, this was necessary to enable the juveniles empty their stomach content and to force them to adjust to the new diet**.** The experimental fish were randomly distributed at a stocking density of 20 juveniles per tank in triplicates. Immediately after acclimatization, the fish were sorted, weighed and randomly stocked into the twelve outdoor tanks at the rate of 20 fish per tank. The fish were starved overnight to empty their gut and increase their appetite and reception for the new diets. Compounded feed formulated at 40% crude protein. They were fed twice daily, morning (08.00-09.00) and evening (18.00-19.00h). They were fed at 5% body weight twice daily morning and evening at equal ration. Sampling was done weekly using a sensitive electronic balance (Soehnle - 2000g Model) to determine the average weight of the fish and adjust the feed accordingly.

Plate IV Stocking and measurement of sample fish.

Sampling and Monitoring of the Experimental Fish The length and weight of each juvenile in each tank was measured at the commencement of the experiment. Subsequently, ten juveniles were taken randomly from each tank once two week and weighed the growth rate. The sampling exercises were carried out in the morning before feeding the fish. Any dead fish is quickly removed and recorded to survival rate. The experiment lasted for 12 weeks. –

Monitoring of Water Quality: Water temperature record was taken daily before feeding (7.00-8,00) with Hanna instrument and water transparency secchi-disc --- thermometer. Dissolved oxygen and pH were determined using the methods described by Auta (1993)

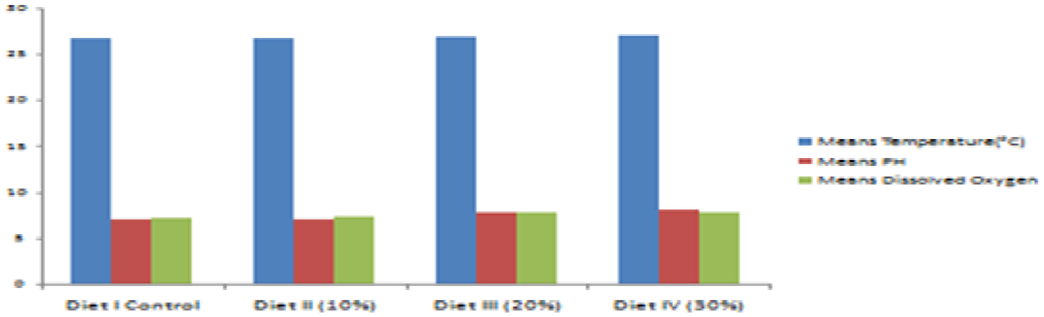
Temperature; Temperatures readings were taken with HANNA Instrument HI 98129 dipping the mercury bulk in water for two minutes and then the value was recorded and reading on the calibrated glass stem, this was carried out weekly.

PH Hydrogen Ion Concentration ; pH determination was done by using HANNA Probe Meter Instrument HI -98129 by lowering the mercury bulk in water for two minutes and the value was recorded and reading on the calibrated glass stem, this was carried out bi-weekly.

Dissolved Oxygen (DO) ;This was determined be-weekly by using "Winkler" test-kit (Aqua Merck) and pH were determined using Digital DO meter and Jenway Automatic pH meter instrument were used to determine the(DO) by lowering the top into the body of water and the reading were taken and Secchi disc were used for measure transparence of water before change it, show in the figure below.

i) Hanna HI 98129 Instrument, ii) Secchi- disc and Winkler test-kit

- **Figure 1: Means of Water Parameter Readings Within the Duration of the Experiment (Twelve's Weeks)**



Economic Evaluation

The economical evaluation of inclusion of cassava leaf meal in the culture of *C.gariepnus*, was determined. The feed ingredient costs were evaluated by using the current market price, the profit index and incidence of cost were evaluated based on the equation:

$$\text{Profit index} = \frac{\text{Number of fish produced}}{\text{Cost of feed}}$$

$$\text{Incidence of cost (R)} = \frac{\text{Cost of feed}}{\text{Mass of fish produced (kg).}}$$

$$\text{Net Profit} = \text{Sales - Expenditure.}$$

$$\text{Benefit: Cost ratio (BCR)} = \frac{\text{Total Sales}}{\text{Total Expenditure}}$$

(Madu, et. al., 2003)

Table I. Formulation and Proximate Composition of Experimental Diets

Diet ingredient	Diet I	Diet II	Diet III	Diet IV
Soya bean meal	17.73	17.73	17.73	17.73
G.Nut Cake	21.33	21.33	21.33	21.33
Fish Meal	38.94	32.92	26.90	20.88
Cassava Leaves	0.00	6.02	12.04	18.06
Maize	25.00	25.00	25.00	25.00
Salt	0.50	0.50	0.50	0.50
Fish Premix	1.00	1.00	1.00	1.00
Binder	1.00	1.00	1.00	1.00
oil	0.50	0.50	0.50	0.50
Total	100%	100%	100%	100%

Table 2 Proximate Composition of Experimental Diets

	Percentage dietary protein levels (%)			
Composition	Diet I control (0%)	Diet II (10%)	Diet III (20%)	Diet IV (30%)
Moisture	13.13^{d}	14.63^{c}	14.65^{b}	15.13^{a}
Dry Matter	86.85^{a}	85.37^{a}	85.37^{a}	84.87^{a}
Organic Matter	81.72^{a}	78.66^{ab}	78.29^{ab}	76.81^{b}
Carbohydrate/Fibre	16.25^{b}	18.07^{a}	18.31^{a}	19.66^{a}
Crude Protein	39.93^{a}	41.38^{a}	41.44^{a}	42.29^{a}
Crude Fat	0.43^{b}	0.61^{ab}	0.68^{a}	0.73^{a}
NitrogenFree Extract	11.85^{a}	4.59^{b}	4.50^{b}	0.80^{c}
Ash	18.28^{b}	21.34^{ab}	21.71^{ab}	22.19^{a}

Values with the same superscript on the same row are non-significantly different (P>0.05) Duncan's test. Superscript ^{a} stand for the highest value

Analytical Determination

The experimental diets were analyzed separately for proximate composition using the standard A.O.A.0 methods (A.O.A C., 1995). Growth response and survival data collected were subjected to analysis of variance (ANOVA) test and the mean treatments were compared with each other for significance differences ($p<0.05$). All statistical analyses were done using statistical package for social scientists (SPSS 6.0) for windows on an IBM-Compatible PC,

Table 3. Growth parameters, Feed Conversion rate and Cost benefits of *C. gariepinus* fed Cassava leaf meal inclusion based diets for 91 days.

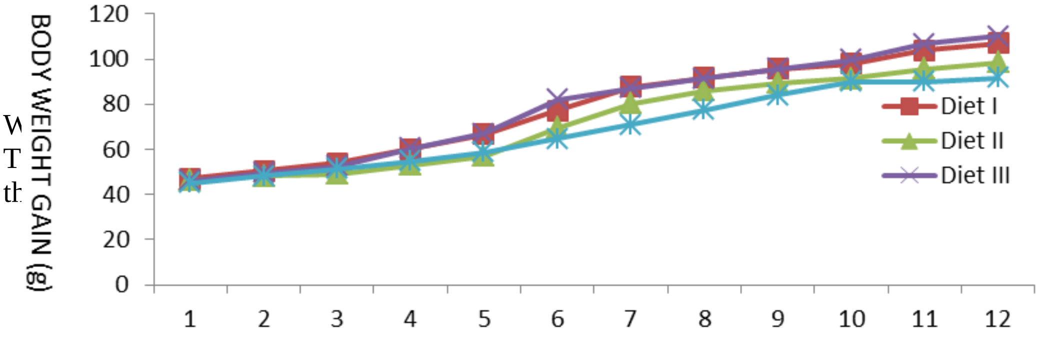
PARAMETER	DIET I	DIET II	DIET III	DIET IV
Initial Weight (g)	46.72	46.02	46.26	26.12
Final Weight (g)	107.17^{ab}	93.11^{cb}	109^{a}	88.23^{c}
Relative Weight gain %	127.96	103.43	135.57	95.55
Mean Weight gain (g/day)	0.66^{ab}	0.51^{cb}	0.68^{a}	0.47^{c}
Mean body Weight gain (g)	60.17^{ab}	47.11^{cb}	62.74^{a}	43.11^{c}
MGR	60.17^{ab}	47.11^{ab}	62.74^{a}	43.11^{c}
SGR	0.44^{ab}	0.32^{ab}	0.47^{a}	0.29^{b}
FCR	0.40^{a}	0.31^{a}	0.41^{a}	0.28^{a}
Survival %	94.83	93.17	95.66	81.66
Profit Indices	0.92	1.27	0.88	1.22
Incidence of Cost	0.37	0-41	0.33	0.39
Expenditure	7,711.04	7,574.07	7,421.60	7,271.06
Sales	9,630.00	8,375.90	9,810.80	7,940.70
Net Profit	2,390.80	1,125.20	2,566.95	676.70

Means with the same superscripts across the rows are non-significantly different (p>0.05)

RESULT AND DISCUSSION

Table 1 presented the formulation and proximate composition of the experimental diets. The crude lipid of the diets increase insignificantly as the cassava leaf inclusion level increases. This is as a result of the high lipid in cassava leaf meal which has earlier been reported (Adikwu, 2003, Sogbesan. *et al* 2004) The crude fibre increase with significant difference P<0.05 as shown by a single ANOVA. Figure I show the mean water parameter of weekly temperature, dissolve oxygen, and water P^{H}. Figure II show the growth pattern of *C.gariepinus* fed cassava leaf meal supplemented diets for 91 days. From the line graph, diet III has the best growth pattern week10, 11, 12 but at the end of the experimental period; the highest weekly weight gain was recorded from diet III.

Table 3 shows the growth Performance, Survival and Cost benefits of *C. gariepinus* fed cassava meal based diets for 91 days. The juveniles fed diet III recorded a better growth performance that varies significantly at P<0.05 with those fed diet IV. Mean weight gain for the study fall within 0.66-0.68g/day with juveniles fed diet having the best MWG was diet III recorded the worst MWG is diet IV The same is applicable to. SGR and RWG. There is a lower positive correlation r = 0.2438 at P<0.05 between the SGR recorded at different experimental feed treatments. This correlation shows a prediction equation of Weekly Increase Y = 68.03 - 48.65X.



diet III has a net profit of value of N2566.95k, followed by N 3390.80k for diet I while diet IV recorded the lowest net profit value of N 676.70k. The value of fish was ₦500.00 per kilogramme, (₦ 9,630.00,8375.50, 9,810.80 and 7,940.00). The cost of Diet I per kilogramme was (₦238.19kg), Diet II (₦229.62kg), Diet III (₦220.10kg) and Diet IV (₦210.68kg), and during the Twelve weeks period, the cost of feed used was ₦3572.85 for Diet 1, ₦3,3444.45 for diet II, ₦3,301.50 for Diet III, ₦3,160.20 for diet IV. While the cost per juveniles at N60 per fish was (3,600.00) per each diets. The total cost of production for Diet I, II, III, and IV was (7711.04, 7574.07, 7421.60 and 7271.06) respectively. Gross profit analysis showed that Diet III had the highest profit. Diet III gave the best economic weight gain (EWG) of 0.88 followed by Diet I had (0.92). The most uneconomical feed was Diet II with (EWG) of 1.27, which mean the lower the economic gains the higher the profit accrued.

The optimum aim of every agricultural investor is to make profit at the end of the cultural season. This same phenomenon is as well applicable to fisheries. Since cost of feed has been one of the major constrain to the Development of aquaculture sector; provision of an alternative ingredient that will be able to reduce certain percentage incurred by feeding overhead cost should be embraced. *C. gareipinus* fed on combined protein feed did better in weight gain, mean weight gain, relative weight gain and specific growth rate than those fed on single protein source feed as in diet I and diet IV. The higher growth performance observed in combined feeding can explain by the synergetic effect of combining two biological compounds to have a single and superior effect than when individually applied.

This observation is in agreement with suggestions by (Abdulahi, 2009).that combined protein source is better than single protein source for fish diets. Moreover, when alternative sources of feedstuff such as plant protein are used in fish diets, one of the common problems is the acceptability by fish and this has to do with the palatability of the diet (Adewolu, 2008, Abdulahi, 2009). In the present investigation, all the experimental diets were accepted by *C.gariepinus* juveniles, indicating that the levels of incorporation of Cassava leaf meals did not affect the palatability of the diets. This might be due to the processing technique employed in this study. Palatability of diets has been found to affect total utilization of diets especially its protein might have been metabolized for body structure. This portrays higher acceptability and utilization of the diets with additional advantage of being cheaper sources. This observation was supported by the work of Madu & Aliko, (2001) and Anyanwu, Udebibie, Esonu & Ojuigwe, (2008). These workers reported that reduction in anti-nutritional by different processing techniques resulted in better palatability and acceptability with growth and cheaper in fish feeds production.

C.gareipinus fed diet I would have been expected to show the best growth performance since its contains fish which is a high level of protein that has been known as 'the best feed for fish, but this was not so. However, Anyanwu, *et, al* (2008), reported that the biological value of protein source does not only depend on its amino acid profile but also on its digestibility. Fibre content of feed has been documented to enhance growth performance in fish (Garduno-Lugo & Olvera-Novoa, 2008), the low fibre content of diet I might has been one of the factors for a low growth performance. The results on the survival rate indicated that the feeding of *C.gareipinus* juvenile diets can result into high survival rate. This cannot be connecting to the high acceptability of this meal, which was observed during the study.

Weight gain are known to be the most important indices for measuring fish responses to experimental diets and very liable indicators of growth (Dongmeza, Steinbronn, Francis, Focken &Becker, 2008).The general increase in body weight and length of the experimental fish confirms that the fish responded positively to the diets, with mean body weight gains in Diet III which suggests greater protein utilization in the diets which may be associated with the reduction of anti-nutrients as a result of processing (Ikeckwumere, Ndubuisi, Amasi & Ekwere, (2007*)*. Similar findings were reported by Balogun *et al., (2008*) where higher growth values were attained for fish fed with processed Castor oil Seeds.

The economic evaluation of feeding *C.gareipinus* juvenile on experimental diets shows that diet II recorded the highest net gain and Benefit: Cost ratio. The positive net gain and Benefit: Cost ratio recorded in all the diets indicate that *C.gareipinus* can be economically reared on all diets. However, the result further indicated that inclusion of fishmeal with cassava leaf meal to 20% in the diet of *C.gareipinus* can result into a better Benefit: Cost ratio than when fed with either fishmeal or cassava leaf diet alone.

CONCLUSION AND RECOMMENDATION

This study has shown the possibility of inclusion of cassava leaf meal in the formulation of fish feed and that this meal can be used to supplement fishmeal to about 30% inclusion levels which gave the best growth performance from this study.

The economic analysis also justifies the growth performance findings. Based on -these results, the use of cassava leaf to supplement for the costly fishmeal to about 30% inclusion levels is recommended to fish farmers and feed industry.

REFERENCES

Abdullahi, S.A (2009). Determination of Protein Qualities of Three Species of Fresh Water Fishes ,*Gynarchus niloticus, Heterotis niloticus and Latis niloticus* Using Chemical indices. *International Journal of Applied Biological Research*, 1: *34-39.*

Adewolu, M. F. (2008). Potential of Sweet Potato (*Ipomoea batatas*) Leaf Meal as Dietary Ingredient for *Tilapia zilia* Fingerlings, *Pakistan Journal of Nutrition,* 7 (3): 444-449 Asian Network for Scientific Information.

Adikwu, I.A. (2003). Review of Aquaculture Nutrition in Aquaculture Development in Nigeria. In: Eyo, A.A (Ed), .National Workshop On Fish Feed Development and Feeding Practices in Aquaculture, FISON, NIFER, and FAO-NSPFS 32-40.

Anyanwu D.C., Udebibie A.B.I., Esonu B.O and Ojuigwe D.I (2008).Growth and Nutrient Utilization of *Heteroclarias* (*Heterobrachus bidorsalis)* and *Clarias gariepinus* Feed Dietary Level of (*Microdesmis puberula)* Leaf Meal. *Pakistan Journal of Nutrition,* (73: 482 – 489, Asian Network for Scientific Information

AOAC (2001). Official Methods of Analysis of the Association of official analytical chemist. Vol.11.,Washington, USA, 1234pp \

Auta, J. (1993).Water Quality Management in Fish Fond, In; Oniye, S. J, Bolurunduro, P.I and Auta J. *(Ed) Proceedings of National Workshop on Fisheries Extension Delivery.* NAERLS, A.B.U Zaria. .l-20.

Balogun, J.K., A.S Abdullahi., J.Auta and O.P. Ogunlade, (2008).Feed Conversion, Protein Efficiency, Digestibility and Growth Performance of *Oreochromis niloticus fed Delonix regia* Seed Meal. 2008 In: *Proceedings of the National Conference of Fishers Society of Nigeria* (FISON). FISON, Lagos, Nigeria. 823-829 .

Burke, R.L (2009). *An Economics Analysis of Producing Pond Raised Catfish for Food on Mississippi* Bull. No 870 Mississippi Agriculture and Forestry Experimentation Station, Mississippi State Ms. 25p.

Dongmeza, E.B., Steinbronn, S., Francis, G., Focken U. and Becker K.(2008). Investigations on the Nutrient and Anti-nutrients Content of Typical Plants Used as Fish Feed in Small Scale

Aquaculture in the Mountainous Regions of Northern Vietnam, *Animal Feed Science and Technology, (49): 162 – 178.*

FAO, (2012*). Analysis of Feeds and Fertilizers for Sustainable Aquaculture Development* in Vietnam in Hassan, M.R. Hecht, T.; De silver Tacon A.G.J (Ed) study and technical paper no 497 Rome FAO2007. 331 – 357

Fasuyi, A.O .and V.A. Aletor (2005).Protein Replacement Value of Cassava (*Manihot esculenta* Crantz leaves Protein concentrate (CLPC) in broiler Starter; Effect on performance, muscle Growth, Haematology and Serum Metabolites. *International Journal of Poultry Sciences*, 4; 287-295.

Garduno-Lugo, M. and Olvera-Novoa, M.A. (2008). Potential of the Use of Pea nut (*Arachis hypogaea*) Leaf Meal as a partial Replacement for Diets for Nile Tilapia (*Oreochromis niloticus* L.). *Aquaculture Research* 39 (12):129 -132.

Ikeckwumere, F .C., E.C. Ndubuisi, E., Amasi M.U And Ekwere (2007). Growth Blood Chemistry and Carcass Yield of Broilers Feed Cassava Leaf Meal (*Manihot esculenta) International Journal Poultry Science* 6. (8):555-557

Madu C.T and Akilo K.T (2001). The Use of Live Maggot and Live Tilapia Fry as Unconventional Diet for Juveniles of Catfish in;Eyo A.A (Ed) *Fish Nutrition and Fish Feed Technology,* FISON, 72-75.

Madu, C.T., Sogbesan, O.A and Ibiyo , L.M.O . (2003). Some Non Conventional Fish Feed Resource in Nigeria. In*; Proceeding of the Joint Fishery Society of Nigeria/National Institution for Freshwater Fisheries Research*/Specials Programme on Food Security National Workshop on Fish Feed and Feeding Practices in Aquaculture (Eyo A.A Ed.) *Held at National for Freshwater Fisherie Research New BUSSA* 15th-19th, September 2003 73-83.

Moses, T. and Olufeugba S.O (2004). An Exposition on Field Identification of *Clarias* Catfish. As An Important Tool in Fish Breeding and Genetic National Institute for Freshwater Fisheries Research*. In: Proceeding of the 19th Annual Conference of FISON, .185-192—*

Ochang, S.N., Fabenro O.A and Adebayo O.T. (2007). Growth Performance, Body Composition, Hematology and Product Quality of the African Catfish (*Clarias gariepinus*) Fed Diets with Palm Oil. *Pakistan Journal of Nutrition,* 6 (5) 452 – 459.

Oduro, I., Ellis, W.O and Owusu, D, (2008). Nutritional Potential of Two Leafy Vegetable (*Moringa olefera*) and (*Ipomea batatas*) Leaves. *Scientific Research and Essay,* 3(2) 57 – 60.

Sadiku, S.O.E. (2003). Least cost Feed Formulation, p55-59 in A.A.Eyo (Ed) *National work Shop in Fish Feed development and Feed Practices in Aquaculture National Institude For Fresh water Fisheries Research (NIFFR)* New Bussa. P114.

Sogbesan, A.O., Ajuonu, N.D., Madu, C.T., Omojouro, F.S, and Ugwumba A.A.(2004).Growth Response, Feed Conversion Rate and Cost Benefits of Hybrid Catfish fed Maggot Meal Based Diets in Outdoor Concrete Tank. In: *Proceeding of the 19th annual conference,* FISON Lagos,. 231 – 237.

Ty, C., Khieu ,B., Saphararith, N., Preston T.R and Maung, A. (2010). Dietary Effect of Rice bran cassava leaves and root meal on growth of tilapia (*Oreochromis niloticus*) fish fed basal diets of rice bran or rice brand mixed with cassava root meal to publish by LRRD newsletter, *International Center for Tropical. Agriculture* (CIAT) *Bangkok Livestock Research for Rural Development,* 22 (3)2010.