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Effect of Poultry Hatchery Waste Meal supplemented with Clove basil leaf, *Ocimum gratissimum* as Replacement for Fish Meal on Growth Performance of *Clarias gariepinus* (Burchell, 1822)

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Abstract

This study was carried out to investigate the graded level replacement of fish meal with poultry hatchery waste meal supplemented with *Ocimum gratissimum* leaf on growth performance of *Clarias gariepinus* juvenile. The fish were divided into 7 groups of 15 juvenile (10 ±0.03g) in three replicates. The fish were fed with diets containing 0, 25, 50, 75 and 100% poultry hatchery waste meal as replacement for fish meal, *Ocimum gratissimum* was included at 2% in all the treatment except treatments 6 and 7 with Hatchery waste only which served as control groups with 100% fish meal and hatchery waste with no inclusion of *O. gratissimum* respectively. The highest weight of 0.39gm, protein efficiency ratio 0.01 and feed conversion ratio of 1.75 were found in fish fed with diet containing 75% poultry hatchery waste and 2% *Ocimum gratissimum in* T4, which was significantly ($p<0.05$) higher than those fish fed with other treatments and control diets. The present results suggested that replacement of fish meal with poultry hatchery waste meal and *O. gratissimum* supplementation up to 75% could improve growth and feed utilization of *Clarias gariepinus* fingerling.

Keywords: Hatchery waste meal, *Ocimum gratissimum*, *Clarias gariepinus*, Growth.

Introduction

African walking mud catfish, *Clarias gariepinus*, is the most successful aquaculture species in Nigeria. The fish is widely cultured by both trained and untrained smallholder, medium and large-scale farmers. Attributes that make *C. gariepinus* relished by producers include biological (high food conversion ratio, fast growth rate, readily accepting artificial feeds, ease of artificial propagation, disease resistance), social (good market price, good food quality) and ecological reasons (tolerance to wide range of environmental conditions) (Ayinla and Nwadike, 1988; Nwadike and Ayinla, 2004; Zabbey *et al*., 2007). One problem facing fish culturists is the need to obtain a balance between rapid fish growth and optimum use of the supplied feed (Gokcek, 2008). Since the feed cost accounts approximately 40 - 60% of the operating costs in intensive culture systems (Agung, 2004), the

economic viability of the culture operation depends on the feed and feeding frequency. It means that nutritionally well-balanced diets and their adequate feeding are the main requirements for successful culture operations. Feeding at the optimum frequency can result in tremendous savings in feed cost (Davies *et al*., 2006). Under culture conditions, poorly fed fish becomes runt and do not attract good market price (Olurin *et al.,* 2012). Protein is the main constituent of the fish body thus sufficient dietary supply is needed for optimum growth. It is also the most expensive macronutrient in fish diet (Pillay, 1990).

Consequently, efforts have been geared towards re-cycling of non-conventional feed ingredients in the formulation of fish diets with a view to maximizing profit. Hatchery by-product is a rich protein source and it include:, eggshells, non-fertile eggs, dead embryos and dead or culled chicks (Harthi, e*t al,* 2010).

Feed additives have been used to improve fish growth performance, some of these additives used in feed mill are chemical products especially hormones and antibiotics which may cause unfavorable side effects (Dada, 2012). Several medicinal plants have been used in order to prevent and treat several diseases in fish (Dügenci *et al*., 2003; Jian and Wu, 2004; Vasudeva and Chakrabarti, 2005; Yin *et al*., 2006; Choi *et al*., 2008 and Ardó *et al*., 2008). These natural plant products have various activities like anti stress, appetizer, tonic, anti-microbial and immune-stimulants (Citarasu *et al*., 2002). Clove basil, *Ocimum grattissimum* is a widely used local plant in Nigeria for both nutritional and therapeutic purposes. The whole plant is used as an antibacterial agent throughout West Africa (Iwu, 1993). Oboh (2004) reported the antioxidant and antimicrobial properties of *O.gratissimum*, the extracts of *O. gratissimum* exhibited antibacterial activity (Oforkansi *et al.,* 2003). Use of natural herbs-medicinal and aromatic plants in fish feeding is still limited on the experimental and commercial scales. However, few studies have been conducted to utilize herbs and plants as feed additives to enhance growth and fish feed efficiency (El-Dakar, *et al.,* 2008 and Falaye *et al*., 2018).

Therefore, this research was conducted to investigate the effect of replacing fish meal with poultry hatchery waste as protein source ingredient and the inclusion of *Ocimum gratissimum* as feed additive for improved growth performance.

Materials and methods

Experimental Fish and experimental design

The experiment was carried out at the Wet Laboratory of the Department of Animal Sciences in the Faculty of Agriculture, Obafemi Awolowo University Ile-Ife, Osun State Nigeria. A total of 340 juvenile *Clarias gariepinus* juvenile were procured from a reputable farm at Ile-Ife.. They were acclimatized for fourteen days after which 15 (10 ±0.03g) were randomly allotted into seven treatments and replicated three (3) times in a completely randomized design (CRD). Each replicate was in a 100L plastic tank. Experimental fish were fed twice daily, between 8.00-9.00am and 16.00-17.00pm at 5% body weight throughout the experiment. Leftover feed and faeces in each tank were siphoned out each week.

Processing of Poultry hatchery waste

Fresh hatchery waste was collected and boiled for 40 minutes, after boiling, the waste was drained using sieve. The whole boiled hatchery product was spread under fan overnight (about 5hrs), after which it was placed in Gallenkamp oven at 75°C until it was well dried and thereafter grinded to powder. The proximate composition of processed poultry hatchery waste was carried out before compounding the fish feed.

Data collection and analysis

Data on fish growth characteristics were recorded every week. The weight of individual fish was determined with an electronic scale (Metler scale), standard length was determined with a measuring board. Fish weight gain, feed conversion ratio, specific growth rate, protein intake and mortality were determined as follows:

(i) Weight gain (g) = Final weight of fish - Initial weight of fish

(ii) Feed conversion ratio (FCR). = $\frac{\text{Total feed consumed by fish (g).}}{\text{Weight gain by fish (g)}}$

(iii) Protein efficiency ratio (PFR) = $\frac{\text{Weight gain (g)}}{\text{Protein intake}}$

(iv) Mortality (M) was calculated as: $M = \frac{(No - N t)}{} \times 100\ \% / No$
Where:

No = Number of fish at the start of the experiment
Nt = Number of fish at the end of the experiment

(v) Protein Intake (PI) = Total feed consumed × percentage protein/100

Processing of *Ocimum gratissimum* leaf
Fresh leaves of O. *gratissimum* were collected from the Obafemi Awolowo University, Nigeria. It was authenticated at the Department of Botany's Herbarium and cleaned after which they were air-dried and grinded into powder for inclusion in the diet.

Table 1: Composition of Experimental Diet

Ingredients	T1	T2	T3	T4	T5	T6	T7
Fishmeal	29.4	22.1	14.7	7.3	0	0	29.4
HWM	0	7.3	14.7	22.1	29.4	29.4	0
Sbm meal	39	39	39	39	39	39	39
Maize	18	18	18	18	18	20	20
Palm oil	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Bone meal	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Premix	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Vit. C	0.04	0.04	0.04	0.04	0.04	0.04	0.04
O. g	2.0	2.0	2.0	2.0	2.0	0	0
Total	100	100	100	100	100	100	100

Key: HWM= Hatchery waste meal, O. g = *Ocimum gratissimum,* FM = Fish meal; SBM: Soybean Meal
T1: 100% FM, T2: 75%FM, T3: 50%FM, T4: 25%FM, T5: 0% FM, T6: 0% FM; T7: 100% FM (control)

Results

The proximate analyses of the feeds fed to the fish are shown in Table 2. Diets with 100% HWM had higher contents of ether extract.

Table 2: Proximate Composition (%) of the Experimental Diets

		Parameter				
Sample	%DM	%Ash	%Fiber	%EE	%CP	NFE
HWM	95.20	6.40	0.00	9.34	34.6	44.86
T1	90.00	8.40	2.53	9.22	28.9	40.95
T2	90.00	9.30	2.73	9.50	29.7	38.77
T3	89.20	8.20	2.60	9.50	28.8	39.20
T4	90.40	7.20	2.40	10.5	28.4	42.06
T5	90.90	9.10	2.23	10.1	28.9	40.57
T6	89.00	8.00	2.00	10.0	29.8	36.20
T7	86.40	6.90	1.67	11.00	29.0	38.73

DM = Dry Matter, CF = Crude Fiber, EE = Ether Extract, NFE = Nitrogen Free Extract, HWM= Hatchery Waste Meal. T1: 100% FM; T2: 75% FM; T3: 50% FM; T4: 25% FM; T5: 0% FM; T6: 0% FM: T7: 100% FM (control)
The results of the growth response and feed utilization of *C. gariepinus* is shown in Table 3.

Table 3: Growth Responses and Feed Utilization of Catfish, (*Clarias gariepinus*) Feed Hatchery Waste Meal Based Diet

	Treatments							
Parameters	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**±SEM**
IW(g)	10.44	10.17	10.39	10.28	10.29	10.28	10.11	0.03
FW (g)	17.80^{c}	18.57^{c}	24.80^{b}	32.56a	28.50^{ab}	20.42^{bc}	16.90^{c}	1.15
AWG	0.13^{c}	0.15^{c}	0.25^{b}	0.39^{a}	0.33^{ab}	0.180^{bc}	0.15^{c}	0.02
ADFI	0.60^{a}	0.53^{ab}	0.60^{a}	0.55^{a}	0.57^{a}	0.500^{ab}	0.46^{b}	0.13
FCR	5.10^{a}	4.88^{a}	2.83^{bc}	1.75^{c}	1.87^{c}	3.590^{b}	4.02^{ab}	0.20
IL	8.48	10.96	9.86	8.00	9.29	9.290	8.77	0.18
FL	11.30^{a}	12.29^{a}	12.68^{a}	12.61^{a}	12.71^{a}	12.170^{a}	10.50^{a}	0.31
PER	0.005^{bc}	0.01^{a}	0.01^{a}	0.01^{a}	0.01^{a}	0.006^{c}	0.004^{c}	0.57
PI	28.90^{c}	29.70^{b}	28.80^{c}	28.40^{c}	28.90^{c}	29.80^{a}	29.00^{ab}	0.01

KEY: IW=Initial Weight, FW = Final Weight, AWG = Average Weight Gain, ADFI= Average Daily Feed Intake, FCR=Feed Conversion Ratio, IL= Initial Length, FL = Final Length, PI= Protein Intake, PER=Protein Efficiency Ratio. T1: 100% FM with O.g, T2: 75%FM with O.g, T3: 50%FM with O.g, T4: 25%FM with O.g, T5: 0% FM with O.g, T6: 100% FM, T7: 0%FM

Fish in treatment 4 had the highest value of 0.390 g/d while treatment 1 fish had the least value of 0.130 g/d. The fish in treatment 4 had the lowest feed conversion ratio of 1.75 while the fish on 100% fish meal with O. *gratissimum* had the highest (5.1).

The proximate composition of the experimental fish is shown in Table 4, the ether extract of the fish reduced with decrease in fish meal and increase in hatchery waste meal.

Table 4: Proximate Composition (%) of the Experimental Fish

Sample	%DM	%Ash	%CF	%EE	%CP	%NFE
T1	88.90	6.55	0.00	10.40	63.90	18.55
T2	89.30	6.40	0.00	22.30	46.38	14.22
T3	89.00	6.38	0.00	21.70	56.88	4.04
T4	88.00	6.31	0.00	14.20	61.63	4.93
T5	89.10	6.28	0.00	20.00	57.75	5.07
T6	88.70	6.40	0.00	20.50	62.13	3.67
T7	89.10	6.50	0.00	10.10	66.93	5.57

T1: 100% FM with O.g, T2: 75%FM with O.g, T3: 50%FM with O.g, T4: 25%FM with O.g, T5: 0% FM with O.g, T6: 100% FM, T7: 0%FM

Discussion

The higher ether extract content of PHWM could be associated with higher egg yolk content of infertile eggs in the processed samples. However, crude protein (CP) content of PHWM was 34.6%. Presence of high eggshell in hatching waste reduces the CP content (Ristic and Kormanjos, 1988).

There was significant difference ($p < 0.05$) among all the treatments with average daily weight gain ranging from 0.130 – 0.390 g/d. There was significant difference in the daily feed intake among the fish in groups with hatchery waste treatment while treatment 7 had the lowest feed intake (0.47g). Fish fed *Ocimum gratissimum* fortified diets had improved feed intake as compared to those that were not fed *Ocimum gratissimum* fortified diets. Weight gain is known to be the most important criterion for measuring fish responses to experimental diets and a very reliable indicator of growth (Lovell, 1989). This result is in agreement to the trend reported by Aliu, *et al.,* (2014) who replaced fishmeal with poultry hatchery waste meal on the growth response of clariid catfish (*Clarias gariepinus).* The feed conversion ratio was significantly different among the groups with treatment 1 (100% FM with 2% O. gratissimum) fish having the highest value (5.10) and treatment 4 had the least value (1.75). Various extracts from herbs and spices are reported to improve animal performance by stimulating action on gut secretions or by having a direct bactericidal effect on gut microflora and furthermore the herbals active principles in the diets induce the secretion of the digestive enzyme and the growth promoter in herbs induced high protein synthesis (Citarasu, 2010). Mehrin, (2009) also reported positive effects in fish growth performance which may be related with supplementation of commercial and natural probiotic Biogen®, which can enhance the metabolism and energy of fish body cells, raise the efficiency of feed utilization, increase the palatability of feed, also promotes the secretion of digestive fluids and acts as appetite stimulant. As confirmed by Pares-Sierra *et al.* (2012), the feed conversion ratio (FCR) decreased as the level of poultry hatchery waste increased, since the lower the FCR value the better the utilization of the feed. In contrast, Morenike *et al*. (2010) reported an overall increase in FCR among the diets as the levels of PHWM increased. The decrease in FCR among the diets could be explained with processing methods of PHWM, quality of the ingredients, digestibility, the rearing conditions or a combination of all those cases (Gumus and Aydin, 2013). It could also be due to the inclusion of *O. gratissimum* because of the difference between 100% PHWM with *Ocimum gratissimum* and 100% without it.

Protein Efficiency ratio has been defined as the ratio of grams of body weight gain (in specified time) to the grams of protein consumed. Protein efficiency ratio (PER) and feed efficiency are utilized as quality indicator for fish diet and its amino acid balance. Therefore, these factors are used to evaluate protein utilization and turnover (Shalaby *et al.*, 2006). Fish in group fed 100% PHWM without inclusion of *O. gratissimum* (Treatment 7) had the least value (0.004) of PER while treatment 4 (75% PHWM and 2% *O. gratissimum*) had the highest value (0.01). The protein intake ranged between 28.40 – 29.80g with treatment 6 having the highest value (29.80g). This shows that diet 4 has the best PER among the treatments, though this is not significantly different from diet 5. This study indicates that fat content in the body composition may be manipulated by changing the diet and the experimental conditions.

In conclusion, results from this experiment shows that poultry hatchery waste meal with 2% *Ocimum gratissimum* can totally replace fish meal in the diet of *Clarias gariepinus* juvenile.

References

Agung, S. (2004). Comparism of Lupin meal based diets cost efficiency for juvenile *Penaeus monodon* tested under pond conditions. *J. Coastal Dev*., 8(1): 47–51.

Al –Harthi, M. A., El-Deek, A. A., El-Din, M.S. and Alabdeen, A. A. (2010). A nutritional evaluation of hatchery by -product in the diets for laying hens. *Egypt. Poult. Sci*. Vol 30 (I): 339-351.

Aliu,B. S., Okeke, I. D. and Okonji,V.A. (2014). Effects of total replacement of fishmeal with poultry hatchery waste meal on the growth response of clariid catfish (*Clarias gariepinus*) fingerlings. *Nigerian Journal of Agriculture,*

Food and Environment. 10(3):28-33.

Ardó, L., Yin, G., Xu, P., Váradi, L., Szigeti, G. and Jeney, Z. (2008). Chinese herbs (*Astragalus membranaceus* and *Lonicera japonica*) and boron enhance the non-specific immune response of Nile tilapia (*Oreochromis niloticus*) and resistance against *Aeromonas hydrophila*. *Aquaculture* 2008; 275: 26-33. http://dx.doi.org/10.1016/j.aquaculture.2007.12.022.

Ayinla O.A, Nwadukwe F.O. (1988). Preliminary studies on the early rearing of *Clarias gariepinus.* N.I.O.M.R. Technical paper, N0.30:15.7.

Baruah K. Norouzitallab P., Debnath D., Pal A .K. and Sahu N.P. (2008). Organic acids as non-antibiotic nutraceuticals in fish and prawn feed. *Journal of Animal science*. 12:4-6.

Choi, S.H., Park, K.H., Yoon, T.J, Kim, J.B., Jang, Y.S. and Choe, C.H. (2008). Dietary Korean mistletoe enhances cellular non-specific immune responses and survival of Japanese eel (*Anguilla japonica*) *Fish Shellfish Immunol* 2008; 24: 67-73. DOI: 10.1016/j.fsi.2007.08.007.

Citarasu, T., Babu, M.M., Sekar, R.R.J. and Marian, M.P. (2002). Developing Artemia enriched Herbal diet for producing quality larvae in *Penaeus monodon*, Fabracius. *Asian Fisheries Sci* 2002; 15: 21-32.

Dada, A.A. (2012). Effects of herbal growth promoter feed additive in fish meal on the performance of Nile tilapia (*Oreochromis niloticus* (L.)), Egypt. *Acad. J. biol. Sci*., **4:** 111-117.

Davies, O. A., Inko- Tariah, M. B. and Amachree, D. (2006). Growth response and survival of *Heterobranchus longifilis* fingerlings fed at different feeding frequencies. *African Journal of Biotechnology* Vol. 5 (9), pp. 778-780, 2 May 2006.
Available online at
http://www.academicjournals.org/AJB

Dügenci, S.K., Arda, N. and Candan, A. (2003). Some medicinal plants as immunostimulant for fish. *J Ethnopharmacol* 2003; 88: 99-106. http://dx.doi.org/10.1016/S0378-8741(03)00182-X

El-Dakar, A. Y.; Hassanien, G. D.; Gad, S. S. and Sakri,S. E. (2008). Use of Dried Basil Leaves as a Feeding Attractant for Hybrid Tilapia, *Oreochromis niloticus* X *Oreochromis aureus*, Fingerlings. *Mediterranean Aquaculture Journal*, 1(1): 35- 44.

Falaye, A. E., Omoike, A. and Awhefeada K. O. (2018). The Haematological parameters of Catfish (*Clarias gariepinus*) fed Fish Feeds with replaced Premix using Moringa Leaf Meal (MLM) *Madridge Journal of Aquaculture Research & Development (MJARD)* 2(1): 35–39.

Gokcek, C.K., Mazlum, Y. and Akyurt, I. (2008). Effect of Feeding Frequency on the Growth and Survival of Himri Barbel Barbus luteus (Heckel, 1843), Fry under Laboratory Conditions. *Pakistan Journal of Nutrition* 7 (1): 66-69.

Gumus, E. and Aydin, B. (2013). Replacement of Fish Meal by Poultry By-product Meal with Lysine, Methionine and Threonine Supplementation to Practical diets for Nile Tilapia Fry (Oreochromis niloticus). *The Israeli Journal of Aquaculture – Bamidgeh*. 65: 1-8.

Iwu, M.M. (1993). Handbook of African Medicinal Plants. CRC Press, London, pp: 183-184.

Jian, J. and Wu, Z. (2004). Influences of traditional chinese medicine on non specific immunity of Jian carp (Cyprinus carpio var. Jian) *Fish Shellfish Immunol* 2004; 16: 185-91. DOI:10.1016/S1050-4648(03)00062-7.

Lovell, R. T. (1989). Nutrition and Feeding of Fish Van. Nostrand Reinhold: CO. Inc. New York, 318bp.

Mehrim, A.I. (2009). Effect of Dietary Supplementation of Biogen® (Commercial Probiotic) on Mono-Sex Nile tilapia *Oreochromis niloticus* under Different Stocking Densities. *Journal of Fisheries and Aquatic Science*, 4: 261-273.

Morenike, A., Nasfisat, A., Ikenweiwe, B., Sunday, M.M. 2010. Evaluation of an Animal Protein Mixture as a replacement for Fishemeal in Practical Diets for Fingerlings of *Clarias Gariepinus*, (Burchell, 1822). *Israeli Journal of Aquaculture - Bamidgeh* 62(4):23 –244.

Nwadukwe F.O., Ayinla O.A. (2004). Growth and survival of hybrid catfish fingerlings under three dietary treatments in concrete tanks. *Azazeb* 6: 102- 106.

Oforkansi, K.C., Adikwu, M.U., Esimone, C.O. and Nwodo, K.M. (2003). Antibacterial activity of the leaf extract of *Ocimum gratissimum* (Fam. Labiatae). *J. Bio. Res. Biotech*., 1(1): 35-42.

Olurin, K.B., Iwuchukwu, P.O. and Oladapo, O. (2012). Larval rearing of African catfish, *Clarias gariepinus* fed decapsulated Artemia, wild copepods or commercial starter diet.

African Journal of Food Science and Technology Vol. 3(8) pp. 182-185.

Osifo, N.G. (1992): A System of Traditional Health Care. VoL2. Pp. 56.

Pares-Sierra, G., Eduardo, D., Marco, A.P., Daniel, B., Gabriel, C. and Maria, T.V. (2012). Partial to total replacement of fishmeal by poultry by-product meal in diets for juvenile rainbow trout (*Oncorhynchus mykiss*) and their effect on fatty acids from muscle tissue and the time required to restrive the effect. *Aquaculture Research*, 37: 1 – 11.

Pillay T.V.R. (1990). Aquaculture: Principles and practices. Fishing News Book. Blackwell Scientific Publications, Ltd., Oxford, UK. pp. 575.

Ristic, M. and Kormanjos, S. 1988. Characteristics of egg incubation wastes and their processing to feed. Nutr Abst & Review , 60 (1990): 2860.

Shalaby, A.M., Khattab, Y.M. and Abdel rahman, A.M. (2006). Effects of garlic (*Allium sativum*) and chloramphenicol on growth performance, physiological parameters and survival of Nile Tilapia (*Oreochromis niloticus*) *J Venom Anim Toxins Incl Trop Dis*. 2006;12:172–201.

Vasudeva, R. Y. and Chakrabarti R. (2005). Stimulation of immunity in Indian major carp *Catla catla* with herbal feed ingredients. *Fish Shellfish Immunol* 2005; 18: 327-34. http://dx.doi.org/10.1016/j.fsi.2004.08.005.

Yin, G., Jeney, G., Racz, T., Xu, P., Jun, X. and Jeney, Z. (2006). Effect of two Chinese herbs (*Astragalus radix* and *Scutellaria radix*) on non-specific immune response of tilapia, *Oreochromis niloticus*. *Aquaculture* 2006; 253: 39-47.http://dx.doi.org/10.1016/j.aquaculture. 2005.06.038.

Zabbey N, Nwadukwe FO, Deekae SN (2007) Effect of crude petroleum oil (Bonny light) on the survival of the fry of African catfish, *Clarias gariepinus*, Fry . *Azazeb* 9:20-25.8.

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