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Research Article

Utilization of Tropical Feed Stuff by Heteroclarias Hybrid Catfish in the Face of COVID-19 Lockdown

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Abstract

Fish farming is a growing business in the tropics, spreading to localities in Nigeria. High cost of feed discourage new farmers. The COVID-19 lockdown experience made it necessary for people to be involved in one thing or the other in order to survive the pandemic, emphasis and create awareness on aquaculture. Tropical countries are endowed with locally available fish feed ingredient including Fish meal, Blood meal, Maize meal, soybean meal, Moringa leaf, and cassava flour which could be utilized for fast growth of fish. This work evaluate the effects and tolerance of blood meal in the diet of hybrid catfish (Heteroclarias). Six isonitrogenious diets of 40 percent crude protein were produced from these ingredients. There were unboiled blood meal and boiled blood meal with high protein contents of animal source. The SGR of fish fed diet v (3.61 ± 0.19) were significantly higher than those fed control diet I (2.98 ± 0.15) difference. There were high final weight in fishes of fed diet VI (406.77 ± 13.94g) from an initial weight of (63.20 ± 6.26g) to a weight gain of 343.57 ± 19.68g. There are high FCE (46.74 ± 7.26) and PER (26.71 ± 0.77) of fishes fed diet V, the diets were more efficient than others while fish fed diet II and III had better FCR (0.05). Local feed ingredients are nutritious, Blood meal used in fish feed can be prepared in two forms, boiled and un-boiled. The inclusion of blood meal and moringa leaf in the diet of hybrid catfish is recommended for fast growth and appreciable weight for quick economic gain in the face of COVID-19 pandemic.

Keywords: Blood Meal; Moringa Leaf; *Clarias gariepinus*; Feed Utilization

Introduction

There is need for people to be productive all the time, even in the face of COVID-19 pandemic, this can be achieved by making production cheap through utilizing locally available materials in the tropics Fish farming is a growing business in the tropics, spreading to localities in Nigeria. But high cost of feeding discourage farmers in the business. The COVID-19 lockdown experience made it necessary for people to be involved lucrative ventures like aquaculture in order to survive the pandemic, emphasis and create awareness on aquaculture. Tropical countries are endowed with locally available fish feed ingredients including Fish meal, Blood meal, Maize meal, soybean meal, Moringa leaf, and cassava flour which could be utilized for fast growth of fish.

Culturing of fish is an instrument that bridge the gap between fish demand and supply, supplementing captured fisheries is an important source of quality protein and employment oppoturnity for many people [1]. In other to meet up with growth, fish farmers depend highly on the expensive imported fish feed. Locally produced fish feed cost much less than the imported feeds [2]. Locally composed fish feed also depends highly on fish meal for fast grow out size. The cost of fishmeal and other conventional fish feed ingredients makes fish farming a costly venture in the tropics. Fish meal used in supplementary fish feeds amounts to 40-60% of the recurrent cost of most intensive fish farm ventures [3]. The cost of feeding the fish affects the viability of the fish when cheap protein alternatives are not employed [4,5].

Large quantities of blood are discarded as wastes in about 496 abattoirs in Nigeria [6], these blood is a common sustainable sources of protein [7] recommended inclusion of blood meal in the diet of Clarias fingerlings [8] noted that blood meal has relatively high lysine and but low isoleucine. The lysine level of blood meal makes it an excellent protein source in combination with low lysine plant derived feed ingredients. *Moringa oleifera* is highly valued tropical and subtropical tree with high crude protein in the leaves, there were awareness creation campaign on the value of moringa leaf and as edible substance in Nigeria. The length of intestine of omnivorous and herbivorous fish aids digestion and assimilation of plants materials [9,10] noted that African catfish also digest plant protein diet. The increasing cost of importing fish feed has discouraged many people from fish farming which is also a major form of employment for many people [1]. Since fish meal is very expensive and it serves as the major protein source in fish diets, fish farmers have been using cheaper alternative protein sources in place of fish meal [5].

Moringa oleifera is an extremely appreciated plant, spread in several countries of the world (especially in the tropics and subtropics) [11]. It is a non-leguminous tree with a high crude protein in the leaves (251g/kg DM) and insignificant content of tannins and other anti-nutritional factors [12]. It is considered to be of great medicinal and nutritional importance. Majority of the plant parts contain high number of essential minerals, and also a good number of proteins, vitamins, carotene, amino acids and all kinds of phenolics. Every part of moringa plant is said to possess important properties that can serve humanity. Nutritional study indicates that Moringa leaves contain a wealth of crucial, disease preventing nutrients [13,14]. They even contain all of the crucial amino acids, such as methionine, cystine, tryptophan [12], as required by aquatic animals, this is unusual for a plant source. Based on a several reports on the nutritional/medicalvalue of moringa, it has been endorsed as a "healthy" food, used conventionally to combat a number of collective ailments. Since the desiccated leaves are intense, they contain advanced sums of various nutrients, except Vitamin C. Leaves and pods of Moringa therefore, offers an alternative source of protein to fish [15]. This work evaluate the effects and tolerance of blood meal in the diet of hybrid catfish (Heteroclarias).

Materials and Methods

Feed ingredients

The ingredients for these diets formulation were sourced from Lapai, in Niger State Nigeria, they include fish meal, Blood meal, maize, soybeans, moringa leaves and vitamin premix. Moringa leaves were collected from moringa tree in the Ibrahim Badamasi Babangida University, Lapai (IBBUL) staff quarters, air dried in the IBBUL Biology Department practical Laboratory, grinded as feed additive. Dried tilapia and Clarias were bought from Lapai market and grinded together as fishmeal. Soybean was bought from Lapai market toasted and grinded as soybean meal. Maize also purchased from Lapai market and grinded as maize meal. Blood from cattle, sheep and goat were collected from Lapai abattoir very early in the morning, half of the quantity was weighed and mixed with maize flower and dried as unboiled blood meal while the other half was par boiled, sun-dried and kept as boiled blood meal. The vitamin premix was purchased at Gidan-Matasa, Bosso area Minna, in Nigeria.

The ingredients were subjected to proximate analysis before their usage in formulation and the diet were also subjected to proximate analysis according to the standard method described by [16].

Experimental diet

The diets were targeted for the juvenile catfish growth to grow-out size. Blood meal, Fish meal, maize, moringa leaf leaf, soybean and vitamin premix was used in the formulating six isonitrogenious experimental diets of 40% crude protein where blood meal replaces fish meal and moringa leaf replaces vitamin/minerl premix. Pearson's square method of feed formulation was employed. Diet I (the control diet) contained fish meal, vitamin/mineral premix and all other ingredients except blood meal and moringa leaf leaf. In Diet II, boilled blood meal replace 25 percent fish meal and moringa leaf leaf replaced vitamin premix. In Diet III, boilled blood meal replaced 50 percent of fish meal and mornga leaf replaced vitamin/mineral premix. In Diet IV, boilled blood meal replaced 75% fish meal and mornga leaf replaced vitamin/mineral premix. In Diet V, boilled blood meal replaced 100% fish meal and mornga leaf replaced vitamin/mineral premix. In Diet VI, un-boiled blood meal replaced 100% fish meal and mornga leaf replaced vitamin/mineral premix. Proximate analyses of the diets were carried out following the procedure of [16].

Experimental animals

Healthy fingerlings of hybrid catfish of mixed sex and same brood stock with standard length (21.9 ± 3.5cm) and body weight (66.40 ± 15.40g) were purchased from Alhassan fish farm at Minna, Niger State, Nigeria. The fishes were transported in an aerated aquarium into the department of Biology aquarium laboratory.

Acclimatization and culture management

The experimental fish were acclimatized in the aquarium laboratory of Biology Department and they were fed Aquamax feed commercial feed at 5 percent body weight. After the period of acclimatization, the fish were shared into eighten transparent plastic aquaria, each aquarium had a total of 20 fish. They were divided into three replicates of the six diets. They were fed diets twice daily the experimental diets at 5% of their body weight. The aquaria water were renewed after every two days, the uneaten feed and waste were siphoned twice daily. The temperature, dissolved oxygen, conductivity and pH of the water in each bowl were monitored twice daily. Distilled water was used to caliberate the pH meter before pH reading. Temperature was measured by dipping a thermometer about 10cm into the water in each bowl and allowed to calibrate for two munities before the reading was taken in degree Celsius (^{o}C). Dissolved oxygen level was determined using the dissolve oxygen meter. Conductivity was measured by dipping the conductivity electrode in the plastic aquarium and reading taken from the conductivity meter.

Growth assessment

After the experimenal set up, weight measurments were taken weekly to assess growth and feed untilization from which the following parameter will be calculated as adopted by (Kirirantinkom, 2012)

Mean initial weight (w1) = w1/N1

Mean final weight (G) = w2/N2

Mean growth rate (MGR) (W2-W1/T2-T1) x 100

Mean weight gain (MWG) = W2-W1/N2

Feed conversion efficiency (FCE) = Wg x 100/feed intake

Protein efficiency ratio (PER) – Weight Gain (G) protein intake (g)

Specific growth rate (SGR) = Ln W2W1/T2-T1) x 100

Feed conversion ratio (FCR) = Total feed intake/weight gain (g)

Where

L = Standard length of fish

T2 = Time In day at the end of experiment

T1 = Time in days at the end of experiment

W2 = Weight (g) of fish at time T2 (final)

W1 = Wight (g) of fish at time T1 (initial)

N1 = Initial number of fish

N2 = Final number of fish

Statistical analysis

Following the confirmation of the normality, the Data obtained from the study were subjected to two-way analyses of variance (ANOVA). The means were compared using Turkry multiple comparison tests at ($P \leq 0.05$) using Graph pad prism 7 and SPSS 23 to assess the effect of varying concentration of blood meal in the diet of Heteroclarias hybrid catfish.

Results

The result of growth assessment of fish fed graded levels of blood meal and moringa diets in the diet of catfish is presented below.

Proximate analysis of composed diets

The composed diets were analyzed for proximate analysis to compare the practical composition with the calculated compositions. Moisture, ash, protein, fiber, lipid and nitrogen free extract were analyzed and exposed to statistical analysis. All diet contents show no significant difference ($P < 0.05$) except for ash content of Diet 5 (14.28 ± 0.25%) and Diet 6 (13.56 ± 1.65%) that were higher than that of Diet1 (5.82 ± 0.97%). Protein content of all the diets were approximately 39% (Table 1). Lipid content was another calculated composition, for all the diets, they were approximately equal to the expected values. For Diet1 12.1 ± 2.27% was observed against the expected 12.27%, Diet2 9.92 ± 1.83% was observed against 9.84% expected, Diet2 10.54 ± 0.38% was observed against 10.23% expected, Diet 4 9.55 ± 1.47% was observed against 9.86% expected for Diet 5 9.64 ± 0.92% was observed against 9.87% expected, while for Diet 6, 10.35 ± 1.16% was observed against expected 10.35%. Moisture was greatly reduced at standing between 7.04 ± 0.96% of Diet 3 to 12.25 ± 0.29% of Diet.

Parameter (%)	DIET					
	I	II	III	IV	V	VI
Moisture	8.51 ± 0.96^{a}	8.22 ± 0.19^{a}	7.04 ± 0.96^{a}	12.25 ± 0.29^{a}	9.25 ± 0.35^{a}	7.55 ± 2.47^{a}
Ash content	5.82 ± 0.97^{a}	9.27 ± 0.94^{a}	6.99 ± 0.37^{a}	6.50 ± 0.44^{a}	14.28 ± 0.25^{c}	13.56 ± 1.65^{b}
Crude Protein	39.05 ± 2.87^{a}	38.71 ± 3.37^{a}	39.15 ± 3.79^{a}	37.68 ± 3.93^{a}	38.45 ± 1.68^{a}	39.87 ± 1.37^{a}
Crude Fiber	14.75 ± 2.29^{a}	13.32 ± 2.35^{a}	16.15 ± 0.73^{a}	9.93 ± 1.15^{a}	10.14 ± 2.10^{a}	8.46 ± 0.30^{a}
Crude lipid	12.10 ± 2.27^{a}	9.92 ± 1.83^{a}	10.54 ± 0.38^{a}	9.55 ± 1.47^{a}	9.64 ± 0.92^{a}	10.35 ± 1.16^{a}
NFE	19.77 ± 2.43^{a}	20.56 ± 0.37^{a}	20.13 ± 2.49^{a}	24.09 ± 0.73^{a}	18.24 ± 1.10^{a}	20.21 ± 0.79^{a}

Table 1: Proximate Analyses of Composed Diets.

NFE: Nitrogen Free Extract.

Physicochemical parameters

Physicochemical parameters of the aquaria monitored twice daily throughout the duration of experiment and were at favourable levels for the growth and survival of the fish. Table 2 below shows the mean and standard error of the tested parameters (temperature, pH, conductivity and dissolved oxygen) for each treatment group:

	Temperature (°C)	Dissolved Oxygen (mg/l)	pH	Conductivity (µS/cm)
Diet 1	27.43 ± 0.64[a]	2.21 ± 02[a]	6.93 ± 0.30[a]	4.30 ± 1.07[a]
Diet 2	27.00 ± 0.89[a]	2.33 ± 0.34[a]	6.55 ± 0.51[a]	2.47 ± 2.05[b]
Diet 3	27.33 ± 0.81[a]	2.23 ± 0.03[a]	7.02 ± 0.63[a]	3.41 ± 1.28[a]
Diet 4	27.33 ± 0.82[a]	2.26 ± 0.05[a]	7.22 ± 0.32[a]	3.55 ± 0.99[a]
Diet 5	27.33 ± 0.83[a]	2.31 ± 0.04[a]	7.13 ± 0.23[a]	3.97 ± 0.84[a]
Diet 6	27.33 ± 0.82[a]	2.34 ± 0.11[a]	7.22 ± 0.32[a]	4.35 ± 0.33[a]
Total	27.29 ± 0.76	2.28 ± 0.15	7.01 ± 0.45	3.34 ± 1.52

Table 2: Water Quality Parameters.

Growth assessment and nutrient utilization of heteroclaria hybrid fed formulated fish diet from locally available feed stuff for eight weeks

The growth of the fish were assessed based on Mean initial weight, Mean final weight (g), Mean Weight Gain (MWG), Mean growth rate (MGR), Specific growth rate (SGR), Feed conversion ratio (FCR), Feed conversion efficiency (FCE) and Protien efficiency ratio (PER).

The initial weight of the experimental fish show no significant difference ($P < 0.05$) ranging from 52.47 ± 9.10g of fish fed diet V to 80.60 ± 8.85g for fish fed diet II. The highest final weight was observed in fish fed diet VI (406.77 ± 13.94g) while the least was observed in fish fed diet II (342.53 ± 25.94g). Mean weight gain and Mean growth rate were higher in fish fed diet VI (343.57 ± 19.68g and 613.51 ± 35.14 respectively) and least Mean weight gain and Mean growth rate were observed in fish fed diet II (261.93 ± 18.99g and 467.74 ± 33.92 respectively). The SGR range from 2.60 ± 0.12 for fish fed diet II to 3.61 ± 0.19 for fish fed diet V which were significantly higher ($P < 0.05$) than SGR of fish fed control diet I (2.98 ± 0.15), the fish fed diets III and IV had the least FCR of 0.05 ± 0.00 while those fed diet V had the highest FCR of 0.08 ± 0.01. significant difference ($P < 0.05$) were not observed among the FCE and PER of the fihes ranging from 27.66 ± 3.89 for fish fed diet II to 46.74 ± 7.26 for fish fed diet V and from 21.83 ± 0.52 for fish fed diet II to 26.71 ± 0.77 for fish fed diet V respectively.

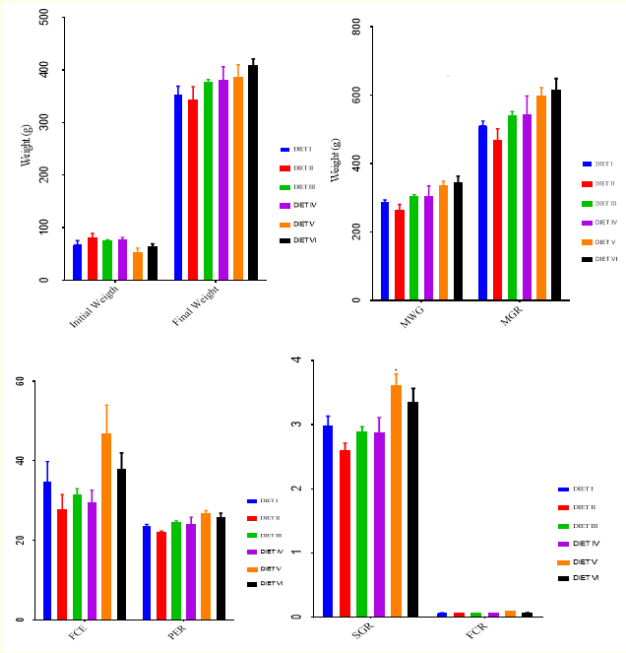

Figure 1: Growth assessment and nutrient utilization of heteroclarias hybrid catfish fed diets made from locally available feed stuff for eight weeks. MWG (Mean weight gain), MGR (mean growth rate), SGR (specific growth rate), FCR (Feed conversion ratio), FCE Feed (conversion efficiency), PER (protein efficiency ratio).

Discussions

This study revealed the possibility of utilizing blood meal and moringa leaf to replace fish meal and vitamin mineral premix respectively in the diet of hybrid catfish. The nutritional value of the moringa leaf used was of high value with very low moisture level of 6.7 ± 0.86% as against 75% as observed by [17], high protein content of 31.5 ± 2.01% where [17] recorded 6.7%. the utilization of blood meal in high moisture content 8.31 ± 1.40 as against 9.50% as observed by [18] high protein content 69.12 ± 1.90% as against 34.35% where for crude fiber 3.14 ± 1.22 as against 9.85% the high ash content 6.05 ± 1.89 as against 9% where [18] for nitrogen free extract 12.71 ± 1.36 as against 35.85%the nutritional value of diet was of high value the very low moisture level of 3.43 ± 0.54 as against 9.75% by [19] low protein content 3.42 ± 55 0.55 where [19] where for crude fat 12.20 ± 0.57 where [19] 10.45 , the ultimate source of waste in any fish culture unit is feed and feeding.

The initial weight gave a very good background for comparison of the fish growth and nutrient utilization while the final weight were higher than those obtained by [20,21] and similar to those observed by [22]. The mean weight gai observed in this study is higher than those observed by [23] who treated clarias with fish offal and those observed by [24] who used Albizia leaf diets to feed clarias. In a similar observation and comparison with the work of [25] who fed hybrid catfish with all plant protein diets, has lower SGR, less efficient FCR and PER indicating that there is synergy between blood meal and moringer leaf that inhance growth of juvenile hybrid catfish.

Conclusion

Local feed ingredients are also nutritious and can compete favourably with other stuff of the world, Blood meal used in fish feed can be prepared in two forms, boiled and un-boiled, person square method can accommodate more than two ingredients and multiple specification. The synergy between blood meal and moringa leaf in the diet of hybrid catfish result to fast growth with better nutrient utilization.

Recommendation

The inclusion of blood meal and moringa leaf in the diet of hybrid catfish is recommended for fast growth and appreciable weight for quick economic gain in the face of COVID-19 pandemic.

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