Nutritive Values of The Carcass Of African Catfish (Clarias Gariepinus) Fingerlings Fed Raw And Steam-Heated Moringa Oleifera Diets

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Abstract—The use of Moringa oleifera leaf meal as a substitute to fish meal in fish feed for the production of fish was studied. M. oleifera leave meal, raw and steam and steam-heated was substituted for fish meal at 30% level while the 0% served as control. The proximate composition of the various diets and the fish carcass were determined using standard methods. Fish were fed at 7% of their body weight three times daily (8:00, 12:00 and 16:00 hrs) until apparent satiation for 84 days. Results from proximate analyses showed that replacement of fish carcass showed an increase in crude protein, crude lipids, crude fibre and ash in 0%, 30% raw and 30% steam-heated, respectively. However, a decrease in moisture and carbohydrates were recorded for the treatments compared with the control. The sensory analyses showed that replacement of fish meal with M. oleifera leaf meals at 30% of substitution level produced acceptable fish flesh which was comparable with the control in terms of the colour, texture, taste and overall acceptability of the dried fish. The experiment demonstrated that the use of steam heated M. oleifera leaf meal as a substitute for fish for fish meal up to 30% level increased the nutritive value of C. gariepinus.

Keywords—Nutritive values, African catfish, Moringa oleifera, sensory analyses, proximate composition.

I. INTRODUCTION

Fish is a relatively cheap source of animal protein and other essential nutrient required in human diet [1], [2], [3], it may be the sole accessible and/or affordable source of animal protein for poor households in urban areas. Previous studies by nutritionist have shown and recommend that the human beings should consume fish everyday [4] because regular consumption of fish can promote the defense mechanism for protection against the invasion of human pathogens because fish has antimicrobial peptide.

The nutritional value of fish flesh comprises of moisture, dry matter, protein, lipids, vitamins, minerals and caloric value of the fish [5] and this is the major reason why fish is a favourite food for the entire society [6]. [7] reported that fish is acceptable because of its high palatability, low cholesterol and tender flesh. Fish flesh contains significantly low lipids and higher water than beef or chicken and is favoured over other white or red meat.

Marine fish are source of high quality protein, vitamins and essentials minerals and a rich source of omega-3 long chain poly unsaturated fatty acid [8]. These fats are important for maintaining the integrity of members of all living cells, for making prostaglandins which regulate many body processes such as inflammation and body clotting [9]. Fish meat is generally a good source of vitamin B and, in the case of fatty species of A and D vitamins. As for minerals, fish is a particularly valuable source of calcium and phosphorus as well as iron, copper and selenium. In fish processing, the knowledge of proximate composition i.e. the analysis of moisture, ash, protein and fat content of fish is very important as the information on lipid, proteins, ash, moisture content is needed for effective utilization. Proximate composition of food is of growing interest to consumers because of the effect of the various levels of protein, lipids, water and ash have on the storage and texture of fish. Besides being used as food, fish is also in increasing demand for use as livestock feed. However, information on the chemical composition of fishes is valuable to nutritionists that are concerned with the available sources of low fat, high protein foods such as marine fishes [1], [10] and to the food scientist who is interested in developing them into high protein foods while ensuring the finest sensory quality (flavor, colour, odour, texture and the acceptability) and safety obtainable with maximum nutritive value. Fish also contains significant amount of essential amino acids, particularly lysine in high concentration which is low in cereal. Fish protein can therefore be used to complement the amino acid pattern and the overall protein quality of a mixed diet [11].

It is of biological importance to study the distribution of mineral element present in living organism since many of these elements take part in some metabolic processes and are to be indispensable to all living things [12]. [13] reported that a reduction in lipid content of fish could be seen as beneficial from a processor’s point of view because of the associated reduction in the development of rancid flavours. Smoked or dried fish is a traditional part of the diet of a large section of the world’s population. Studies on proximate composition are essential for fish and fish products to be utilized efficiently.

Moringa oleifera is a small, shrub or tree that can reach 12.0 m in height at maturity and can live for up to twenty years. M. oleifera in countries like India and many African countries, has long been treasured as a source of nutrition and medicine. It is revered as an excellent source of vitamins, minerals, protein and phytonutrients. Its leaves are good sources of protein and needs to be examined on its suitability for human consumption.
for feed for African catfish *Clarias gariepinus*. The objective of this study is to determine the proximate composition of the flesh of *C. gariepinus* fed raw and steam heated *M. oleifera* leaves and to evaluate the acceptability of the flesh of *C. gariepinus* fed raw and steam heated *M. oleifera* leaves to consumers.

II. MATERIALS AND METHODS

A. Study Area

The study was conducted in the Aquaculture Research and Training Laboratory of the Department of Environmental Biology and Fisheries, Faculty of Science, Adekunle Asajin University, Akungba Akoko, Ondo State, Nigeria between July and October, 2012.

B. Sources of ingredients and diets preparation

*M. oleifera* leaves were freshly harvested from the University environment. The leaves were spread on a slab for air drying under a shed for three days during which it was regularly turned to ensure homogenous drying. Fishmeal, yellow maize grains and cassava flour were obtained locally from the market. All ingredients were ground into a fine powder with milling machine. The milled Moringa leaves were sieved with a mosquito net into a fine powder and stored in a dried container. Fish meal, yellow maize and cassava were the main dietary protein sources while mineral/vitamin was added to further enhance the nutritional quality of the diets. Three diets containing different levels of moringa leaf meal (0, 15, and 30%) were prepared as shown in (Table 1). The experimental diets were formulated to contain 35% crude protein. The ingredients were then thoroughly mixed together by hand, warm water added and homogenized to a dough-like paste. The diets were then pelleted using a 1-mm pellet press. The diets were sun-dried for four days and stored in airtight plastic containers throughout the period of the experiment. The proximate chemical compositions of feed ingredients were estimated by the methods described by the Association of Analytical Chemists [14].

C. Experimental Procedure

A total of 180 African catfish, *C. gariepinus* fingerlings of average weight 9.27 ± 0.07 were randomly allotted at the rate of 20 fingerlings per tank into each of the nine experimental plastic tanks, each trial in triplicates. The nine tanks of 1000L capacity were filled with water 700L maximum level. The fish were acclimatized for 14 days and were fed with control diet, after which the fish were starved for 24 hours in order to empty their stomach and prepared their appetite for the new feed. Water was regularly supplied at a flow of approximately 2 L minimum continuously for 12 weeks. Temperature of water was taken three times a week using a multi-parameter probe meter. Dissolved oxygen, pH, nitrate, conductivity and salinity were also monitored with the probe meter. During the study period, fish were fed at 7% of their body weight three times daily (8:00, 12:00 and 16.00 hrs) until apparent satiation. The ration was adjusted every week when new mean weights of fish for the various experimental units were determined. Left-over feeds and faeces were siphoned out from each tank daily before feeding.

Proximate chemical composition: The proximate chemical composition of the fish flesh (carcass) were estimated by the methods described by the [14].

Sensory Evaluation of the dried fish carcass: The oven dried fish flesh samples were subjected to sensory evaluation using ten panelists. Their preference of the samples was evaluated using the 9-point hedonic scale for 1- extremely dis-like, 9- like extremely [15]. The dried fish flesh samples were evaluated for muscle colour, texture, taste and overall acceptability. During sensory evaluation, panelists were instructed to drink water or rinse their mouths to clear the palate after each evaluation. Sensory evaluation was done on the same day the dried fish were prepared.

D. Data collection and analysis

Data obtained from the experiment were expressed in mean ±SD and it was subjected to one way analysis of variance (ANOVA) using SPSS 20.0 version. Where the ANOVA reveals significant (P<0.05) difference, Duncan multiple range test was used to compare differences among means.

III. RESULTS

Table 1 showed the proximate composition of African catfish, Clarias gariepinus, fed differently with raw and steam-heated Moringa oleifera leaf meal incorporated into feed over an 84 day period. There were significant differences (p<0.05) among the treatments. Lowest % crude protein and lipid was recorded in fish fed raw leaf meal feed. Results of sensory evaluation revealed that fish carcass from the various treatments was acceptable to consumers but fish fed raw *M. oleifera* had the least rate as shown in (Table 2).

IV. DISCUSSION

At 30% inclusion level of steam heated *Moringa oleifera*, there was no significant difference between the control (0%) and the treatments, which implied that the level of crude protein derived from fish fed with 100% fish meals can also be derived from fish fed with steam heated *M. oleifera* leaves at 30% inclusion, this confirmed the report of [16] that the leaves of *M. oleifera* is a good source of protein. Dietary fat function to increase food palatability by absorbing and retaining flavours [17] and these was seen in the palatability test of the fish carcass fed 30% raw and steam-heated inclusion levels of *M. oleifera* leaves. However, excess fat consumption by human beings can result into certain cardiovascular disorders such as *Atherosclerosis*, cancer and aging[15]. [18] also reported that fat can promote rancidity in foods, leading to development of unpleasant and odorous compounds. The low moisture in the carcass of fish fed 30% *M. oleifera* leave meal diets was an improvement to the nutrient value of the dried fish because this makes the flesh readily digestible without compromising the shelf life from the effect of mould growth [19]. This is in agreement with the work of [20] who reported that high moisture content fish are prone to spoilage. The ash content in the treatments were higher than the control but with no significant difference (P<
0.05) this is a reflection of the preserved mineral content in the food materials, suggesting a high deposit of mineral elements in *M. oleifera* leaves. The crude fibre was highest at 30% steam-heated *M. oleifera* fed fish and significantly different (P<0.05) from others, high fibre content of food help in digestion and prevention of colon cancer. [21] this makes this fish flesh acceptable as the control. This research has shown that substitution of fish meal with steam-heated *M. oleifera* leave meal diet at 30% inclusion level can increase the nutritive value of African catfish, *C. gariepinus*.

V. RECOMMENDATION

It is therefore recommended that steam-heated *M. oleifera* leaves at 30% level be incorporated into fish feed as a substitute for fish meal for human consumption. Fish flesh is of high protein value and also rich in vitamins and minerals, fish supplement can significantly raise the nutritional value of cereal based diets therefore, mothers should be encouraged to feed their infants and children with fish fortified diets.

### TABLE I

PROXIMATE COMPOSITION OF THE CARCASS OF CLARIAS GARIEPINUS FED DIFFERENT INCLUSION LEVELS OF MORAINGA OLEIFERA LEAF MEAL DIETS

<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>INCLUSION LEVELS OF <em>M. oleifera</em></th>
<th>0% (CONTROL)</th>
<th>30% RWC</th>
<th>30% SHC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude protein</td>
<td></td>
<td>60.34±0.02*</td>
<td>58.81±0.01*</td>
<td>60.38±0.02*</td>
</tr>
<tr>
<td>Crude fibre</td>
<td></td>
<td>1.87±0.01*</td>
<td>1.32±0.03*</td>
<td>2.21±0.01*</td>
</tr>
<tr>
<td>Crude lipid</td>
<td></td>
<td>18.40±0.07b</td>
<td>12.87±0.01*</td>
<td>18.65±0.01*</td>
</tr>
<tr>
<td>Ash</td>
<td></td>
<td>2.50±0.03a</td>
<td>2.53±0.02a</td>
<td>3.19±0.01a</td>
</tr>
<tr>
<td>Moisture</td>
<td></td>
<td>3.97±0.01a</td>
<td>2.37±0.01a</td>
<td>2.53±0.01a</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td></td>
<td>15.92±0.03a</td>
<td>22.09±0.07</td>
<td>13.04±0.03a</td>
</tr>
</tbody>
</table>

a. Values on the same row with different superscripts are significantly different at (P<0.05)

0% (control): carcass of *C. gariepinus* fed 0% *M. oleifera* leaf meal diet
30% RWC: carcass of *C. gariepinus* fed 30% raw *M. oleifera* leaf meal diet
30% SHC: carcass of *C. gariepinus* fed 30% steam heated *M. oleifera* leaf meal diet.

### TABLE II

SENSORY EVALUATION OF FISH CARCASS FED DIFFERENT INCLUSION LEVELS OF MORAINGA OLEIFERA LEAF MEAL DIETS

<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>INCLUSION LEVELS OF <em>M. oleifera</em></th>
<th>0% (CONTROL)</th>
<th>30% RWC</th>
<th>30% SHC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muscle colour</td>
<td></td>
<td>6.30±0.02a</td>
<td>5.85±0.01a</td>
<td>6.25±0.01a</td>
</tr>
<tr>
<td>Muscle texture</td>
<td></td>
<td>6.20±0.01a</td>
<td>5.95±0.02a</td>
<td>6.10±0.02a</td>
</tr>
<tr>
<td>Taste</td>
<td></td>
<td>6.89±0.02a</td>
<td>6.75±0.01a</td>
<td>6.85±0.02a</td>
</tr>
<tr>
<td>Overall</td>
<td>acceptability</td>
<td>6.46±0.02a</td>
<td>6.18±0.02</td>
<td>6.40±0.01a</td>
</tr>
</tbody>
</table>

b. Values on the same column with different superscripts are significantly different at (P<0.05)

### REFERENCES


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