GROWTH RESPONSE OF HETEROBANCHUS LONGIFILIS (VALENCIENNES, 1840) FINGERLINGS FED RAW AND BOILED MUCUNA COCHINCHINENSIS SEED MEAL.

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ABSTRACT

Feeding trial was conducted in static water to assess the growth of H. longifilis fingerlings fed different inclusion levels of mucuna seed meal (MSM). Raw and boiled MSM were used in the diets at 10%, 20%, 30% and 40% inclusion levels and the performance of fish fed these diets was compared with fish fed a fishmeal-based diet which contained 40% protein. All diets were prepared to be isonitrogenous and isocaloric. A two by five factorial experiment with three replicates using ten fish of average initial weight 1.46g was carried out. Daily fish ration of five percent body weight was administered two times for eight weeks. The specific growth rate in diets 1 (control) and 6 (10% boiled MSM) were similar and significantly (P<0.05) higher than the other dietary groups. The significantly lower growth performance of fish fed diets containing higher inclusion levels of both raw and boiled MSM might be due to incomplete elimination of the antinutritional factors present in MSM by boiling. Other methods of processing MSM to improve its nutritive value should be investigated.

INTRODUCTION

Nigerian aquaculture produced over 30,000 tonnes of various fish species in the year 2000 (Fagbenro and Adeparusi, 2003) which involved the input of supplementary and complete feeds that accounted for between 40-60% of production costs. Since diets generally represent the largest single cost item of most fish farm operations, it follows that the selection of feed ingredients for use within diets will play a major role in dictating the ultimate nutritional and economic success for farmed fish.

Fishmeal, which serves as the main protein source for fish feed because of its high quality protein content, is not only very expensive but also usually unavailable (Tacon and Barg, 1998) particularly in developing countries. Efforts to replace fishmeal with vegetable protein from more sustainable sources have been embarked upon by various workers (Fagbenro, 1999; Fagbenro and Davies, 2001; Ogunji and Wirth, 2001, Osuigwe et al., 2002; Fagbenro and Davies 2003; Ogunji et al, 2003).

Mucuna a tropical legume is widely cultivated as a cover crop and the seeds, which have relatively high protein content, is hardly consumed by man. This work is an effort to evaluate the nutritional potential of Mucuna cochinchinensis seed meal as an alternative to fishmeal in diets for H. longifilis a commonly cultured catfish.

MATERIALS AND METHODS

Dry mature seeds of M. cochinchinensis obtained from Michael Okpara University of Agriculture Research Farm were hammer milled and divided into two lots. One lot was subjected to wet boiling
for 60 minutes by introducing the moistened meal wrapped in polythene sheets into water brought to boil (100°C - 105°C) in plastic buckets using electric boilers. The boiled meal was thereafter dried in an oven at 60°C. Both raw and boiled MSM were used to formulate isonitrogenous (CP 40%) and isocaloric (Kcal/g 2.8) diets at various inclusion levels. Prior to diet formulation, the proximate composition of *M. cochinchinensis* was performed (Table 1).

Raw MSM was included in the diets at 10%, 20%, 30% and 40% levels and designated diets 2,3,4 and 5 respectively while similar proportions of boiled MSM were included in diets 6,7,8 and 9. Diet 1 represented the fishmeal based diet and served as the control diet (Table 2).

Proximate composition of MSM was analyzed by using standard methods of A.O.A.C. (1990). The gross energy was determined by bomb calorimeter. The mineral content was determined by atomic absorption spectrometry after wet digestion with perchloric and nitric acids by the Johnson and Ulrich (1959) method. Phosphorus content was determined following the development of colour which was determined following the development of colour with ammonium molybdate on spectronic 20 spectrophotometer.

The alkaline titration method of A.O.A.C. (1990) was used to determine the hydrocyanic acid in MSM. Haemagglutinin extract was prepared by a modified Liener (1955) method. The method of Hoff and Singleton (1977) was employed to determine tannin content of MSM. The chemical method described by Kakade *et al.* (1974) was used for assessment of trypsin inhibitor.

Fingerlings of *H. longifilis* of average weight 1.46g were collected from Green Lake Farm near Owerri and transported to Michael Okpara University of Agriculture, Umudike. The fish were acclimated for seven days before starting the feed trial.

A total of 270 fish were divided into nine groups and each group had three replicates. Ten fish per replicate were used in ten litre plastic aquaria with water replaced every three days. At the commencement of the trial, fish were bulk weighed with ACCULAB 33 to the nearest gram and subsequently every two weeks, until the end of the 8 weeks study period. Fish ration was five percent of fish biomass administered twice daily.

Data generated at the end of the study from weight measurements were subjected to analysis of variance and the significance of the difference between means determined by Duncans Multiple Range Test (P<0.05).
Table 1: Proximate composition and antinutritional factors of raw and 60 min. boiled mucuna seed meal (% on dry matter basis)

<table>
<thead>
<tr>
<th>Component</th>
<th>Raw Mucuna</th>
<th>Boiled Mucuna</th>
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<tbody>
<tr>
<td>Dry matter</td>
<td>89.44</td>
<td>86.96</td>
</tr>
<tr>
<td>Crude Protein</td>
<td>30.19</td>
<td>32.18</td>
</tr>
<tr>
<td>Crude Fibre</td>
<td>9.33</td>
<td>7.48</td>
</tr>
<tr>
<td>Crude Lipid</td>
<td>4.28</td>
<td>4.03</td>
</tr>
<tr>
<td>Ash</td>
<td>3.58</td>
<td>2.97</td>
</tr>
<tr>
<td>Nitrogen-free Extractive</td>
<td>52.62</td>
<td>53.34</td>
</tr>
<tr>
<td>Gross Energy (Kcal/g)</td>
<td>4.63</td>
<td>4.65</td>
</tr>
<tr>
<td>Calcium</td>
<td>0.08</td>
<td>0.07</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>1.06</td>
<td>0.89</td>
</tr>
<tr>
<td>Magnesium</td>
<td>0.16</td>
<td>0.15</td>
</tr>
<tr>
<td>Sodium</td>
<td>0.94</td>
<td>0.75</td>
</tr>
<tr>
<td>Trypsin inhibitors (mg/g)</td>
<td>8.03</td>
<td>4.39</td>
</tr>
<tr>
<td>Tannin (mg/g)</td>
<td>5.52</td>
<td>4.25</td>
</tr>
<tr>
<td>Haemagglutinin (Hu/g)</td>
<td>4264</td>
<td>2130</td>
</tr>
<tr>
<td>Cyanide (mg/kg)</td>
<td>40.0</td>
<td>25.00</td>
</tr>
</tbody>
</table>

RESULTS AND DISCUSSION

The crude protein and nitrogen free extractives of the boiled MSM were higher than those of the raw MSM while its ash and crude fibre content were lower than that of raw MSM (Table 1). Boiling also reduced the concentration of heat labile antinutritional factors such as trypsin inhibitor activity, haemagglutinin and cyanide more than tannins.

The influence of raw and boiled MSM on growth is shown in Table 3. Increasing level of MSM in diet led to reduced growth. Diet 5 with the highest raw MSM inclusion gave the poorest performance in SGR values that is significantly lower than the other diets. Diet 2 with the least raw MSM also gave a poor SGR value that is significantly different from the control diet value. For fish fed boiled MSM, the poorest SGR was observed in fish fed diet 9 which had the highest inclusion of boiled MSM while diet 6 with 10% boiled MSM had similar SGR as that of the control diet (Table 3).
The results of this study show the sensitivity of *H. longifilis* fingerlings to antinutritional factors contained in the MSM which led to poor growth performance. Substantial amounts of antinutritional factors such as tannins, protease inhibitors, lectins, cyanides etc have been detected in Mucuna seed meal (Table 1). Significant growth reduction in fish was observed by Al-Owafeir (1999) when fish were fed diets with levels of tannic acid. Becker and Makka (1999) also reported that 2% tannic acid produced reduced growth in carp. Mukhopadhyay and Roy (1996) equally reported reduced growth in fingerlings of Indian major carp fed high levels of tannins. Although boiling reduced the tannins content of MSM, it did not lead to total elimination of tannin in MSM hence the negative growth effect in fish fed diets 7,8 and 9.

Protease inhibitors and phytohaemagglutinins are considered potential antinutrients and are known to decrease the growth performance of animals (Liener, 1994). Many fish species have been reported to be sensitive to trypsin inhibitors (Wilson and Poe, 1985; Shu, 1992). Abel et al. (1984) found that carp are sensitive to protease inhibitors. In this study, although trypsin inhibitor and haemagglutinin were reduced by about 45% and 50% respectively by boiling MSM, the significantly reduced growth performance in *H. longifilis* fingerlings fed diets 7,8 and 9 implies that residual trypsin inhibitor and haemagglutinin in boiled MSM may have led to the poor performance. Related studies by some workers also reported the presence of other antinutritional factors in mucuna such as non-protein amino acid, 3,4-dihydroxyphenylalanine (L-DOPA), phytates, saponins, non-starch polysaccharides (NSP) etc (Robania et al., 1995; Bureau et al., 1998; Siddhuraju et al., 2000; Siddhuraju and Becker, 2001). These antinutritional factors which are mostly thermostable may have equally contributed to the poor growth performance experienced in fish fed diets containing high inclusion levels of MSM.

The better performance of fish fed diet 6 relative to other MSM containing diets might be due to the well balanced amino acid derived from the proportion of fishmeal contained therein and relatively low levels of antinutritional factors arising from boiling MSM. The present study shows that up to 10% dietary inclusion of boiled MSM did not negatively affect growth performance of fingerling *H. longifilis*. Boiled MSM can therefore be used up to ten percent of the ingredients for the formulation of fish feed. In order to include more mucuna in fish diets, other methods of processing the seed meal that is more effective in detoxifying the antinutritional factors would have to be developed.
REFERENCES


