EFFECTS OF RAW AND DIFFERENTLY PROCESSED *Mucuna pruriens* SEED DIETS ON THE GROWTH PERFORMANCE OF *Cyprinus carpio* FINGERLINGS

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ABSTRACT

The dietary effects of raw and differently processed *Mucuna pruriens* seed diets on growth and haematology of *C. carpio* fingerlings was investigated. The Mucuna seeds were boiled with distilled water (DW), fresh tamarind pulp extract (TP) and maize cob ash solution (MCA) for 60 minutes. The raw (RM) and resulting meals from the differently processed Mucuna seeds were included at 20% substitution of soya bean meal in 4 (four) treatment diets designated RMD, DWD, TPD and MCD respectively, while a reference diet with no mucuna served as the control diet (NMD). The experimental set up consisted of 15 (fifteen) 40 x 30 x 25cm rectangular plastic tanks (15L capacity) in a static and aerated water system in an indoor hatchery. The treatment diets and control were fed in triplicate groups to *C. carpio* fingerlings (average weight, 15.40g) for 56 days in a completely randomized design. Data obtained was subjected to analysis of variance at $\alpha_{0.05}$. Results obtained showed that growth performance and feed utilization indices were lowest for fish fed RMD diet. The MCD diet gave the best growth indices thus considered the most appropriate processing method of *Mucuna pruriens* seeds for dietary inclusion in the feeding of *C. carpio* fingerlings.

Key words: Processed *Mucuna pruriens* Seed, Growth performance, *Cyprinus carpio* fingerlings, Fish and haematology

INTRODUCTION

Mucuna pruriens seeds like other legumes contains a high level of crude protein (28 to 35%), vitamins and minerals (Ukachukwu *et al*., 2002; Bressani *et al*., 2003) which makes it a suitable alternative plant protein source for fish feed. Previous studies have only focused on the improvement of the nutritional status of plant seeds as protein sources such as *Phaseolus lunatus* (Alegbeleye *et al*., 2005); *Mucuna utilis* (Akinmutimi and Okwu, 2006; Vadivel and Pugalethi, 2009); *Ricinus commnis* (Balogun *et al.*, 2008); *Vigna sinesis* (El-Saidy and Saad, 2008); *Vicia faba* (Azaza *et al*., 2009) and *Pisum sativum* (Davies and Gouveia, 2014).

The problem of biochemical components of plant protein sources which limit their utilization as potential alternative in fish diets has drawn much attention considering the fast growth of aquaculture industry (Bressani *et al*., 2003; Tacon and Metian, 2008). To enhance utilization of plant protein in aquaculture production, thermal processing and biochemical evaluation of feedstuff diets for fish are therefore essential (Davies and Gouveia, 2008; Tacon *et al*., 2009).

In this study, the dietary effects of inclusion of raw and differently processed *Mucuna pruriens* seeds by boiling the seed in distilled water, fresh tamarind pulp extract and maize cob ash solution were investigated on the growth response and digestibility indices of *C. carpio* fingerlings.

MATERIALS AND METHODS

The Mucuna seeds were boiled with distilled water (DW), fresh tamarind pulp extract (TP) and maize cob ash solution (MCA) for 60 minutes. The raw (RM) and resulting meals from the differently processed Mucuna seeds were included at 20% substitution of soya bean meal in 4 (four) treatment diets designated RMD, DWD, TPD and MCD respectively, while a reference diet with no mucuna

served as the control diet (NMD). The experimental set up consisted of 15 (fifteen) 40 x 30 x 25cm rectangular plastic tanks (15L capacity) in a static and aerated water system in an indoor hatchery. The treatment diets and control were fed in triplicate groups to *C. carpio* fingerlings (average weight, 15.40g) for 56 days.

EXPERIMENTAL DESIGN

Completely randomized design.

DETERMINATION OF GROWTH AND NUTRIENT UTILIZATION INDICES

At the end of the feeding trials, growth performance and digestibility parameters were calculated as follows: Mean Live Weight Gain (MWG), Food Conversion Ratio (FCR), Specific Growth Rate (SGR % day ¯1), Protein Efficiency Ratio (PER), Protein Productive Value (PPV), Apparent Protein Digestibility Coefficient (APDC).

STATISTICAL ANALYSES.

All experimental data obtained were subjected to One-way Analysis of Variance (ANOVA) and means were compared using Duncan's multiple-range test (DMRT) (Duncan, 1955). The PC software SPSS version 17 was used for the analyses.

RESULTS

Growth responses and nutrient utilization of *C. carpio* fingerlings fed the four experimental (RMD, DWD, TPD, MCD) and control (NMD) diets are as shown in Table 5 and Figure 1. The fish were observed to feed voraciously on all the diets at onset of feeding regime. Growth responses showed the mean live weight gain (MLWG) was highest (10.28g) for the NMD diet followed by the MCD diet (MLWG, 8.87g). Diets DWD and TPD gave MLWG of 6.93 and 5.66g respectively, while the RMD diet had the poorest MLWG of 3.34g. The differences were statistically significant ($P<0.05$). Similarly, there was significant difference ($p<0.05$) in the food conversion ratio (FCR) of the different diets which was least (1.61) in the NMD diet followed by MCD (2.18). Other processed diets (DWD and TPD) had FCR of 3.66 and 3.79 respectively, while the RMD diet had the highest (3.84) FCR. The protein utilization parameters such as protein efficiency ratio (PER), apparent net protein utilization (ANPU) and protein productive value (PPV) appeared to follow the same trend as the growth parameters which were significantly different ($p<0.05$) among all the experimental diets (Table 1).

Table 1: Effect of Differently Processed *M. pruriens* Diets on Growth and Nutrient Utilization of *C. carpio* Fingerlings Fed for 8 Weeks

	Treatments					
Parameters	**RMD**	**DWD**	**TPD**	**MCD**	**NMD**	**SEM**
Initial mean weight (g)	15.10^{a}	15.10^{a}	15.10^{a}	15.10^{a}	15.10^{a}	0.26
Final mean weight (g)	18.44^{e}	22.03^{c}	20.76^{d}	23.97^{b}	25.28^{a}	0.26
Mean live weight gain (g)	3.34^{e}	6.93^{c}	5.66^{d}	8.87^{b}	10.28^{a}	0.28
Mean live weight gain (%)	22.12^{e}	45.89^{c}	37.36^{d}	58.74^{b}	67.63^{a}	0.26
Feed intake (g/day)	1.52^{e}	2.01^{c}	1.84^{d}	3.32^{b}	3.86^{a}	0.21
Food Conversion Ratio	3.84^{a}	3.66^{c}	3.79^{b}	2.18^{d}	1.61^{e}	0.26
Specific Growth Rate (%)	1.08^{e}	1.24^{c}	1.16^{d}	1.88^{b}	2.25^{a}	0.26
Protein Efficiency Ratio	0.72^{c}	0.76^{b}	0.72^{c}	0.89^{a}	0.92^{a}	0.12
PPV	22.56^{e}	24.00^{c}	23.46^{d}	27.97^{b}	29.73^{a}	0.18
ANPU (%)	25.60^{e}	28.78^{c}	26.66^{d}	38.76^{b}	46.36^{a}	0.18
APDC (%)	65.58^{d}	67.34^{c}	65.75^{d}	78.28^{b}	84.52^{a}	0.26
Survival Rate (%)	60^{d}	80^{c}	85^{b}	98^{a}	98^{a}	1.00

Values on the same horizontal row followed by the same superscript are not significantly different from each other at * ($p<0.05$)

TREATMENT DIETS

RMD = Raw Mucuna Diet,
DWD = Diet from *M. pruriens* seed boiled with distilled water
TPD = Diet from *M. pruriens* seed boiled with tamarind pulp extract
MCD = Diet from *M. pruriens* seed boiled with maize cob ash solution
NMD = Control diet
ANPU= Apparent net protein utilization
PPV = Protein productive value

DISCUSSION

From the results of this study, the differently processed mucuna diets (DWD, TPD and MCD) showed improved performance in the specific growth rate (SGR), food conversion ratio (FCR) and protein efficiency ratio (PER) of the *C. carpio* fingerlings as compared to the raw diet (RMD) suggesting an improvement in the nutritive values of the processed seeds which encouraged better utilization of the mucuna diets. In similar studies (Fagbenro *et al*., 2003; Siddhuraju and Becker, 2003) the authors reported that the improvement in the nutritive value of the processed seeds can be due to the detoxification and reduction on the quality and quantity of ANF in the raw seeds by various hydrothermal treatments. This study has shown that the lower level of residual anti-nutritional factors in the MCD diet made the Common carp fingerlings to better efficiently utilize the protein of MCD diet than protein of DWD and TPD diets. This is evident in the higher protein productive value (PPV), apparent net protein utilization (ANPU) and apparent protein digestibiblity coefficient (APDC) for *C.*

carpio fingerlings fed the treatment diets which showed higher values for MCD diet. Davies and Gouveia (2014) reported on the reduction of anti-nutrients in pea seed meals (*Pisum sativum*) with thermal processing, which subsequently made it more palatable and increased consumption resulting to higher growth performance of *Cyprinus carpio* fish. Similar observations were also reported by Alegbeleye *et al*. (2005) and Tiamiyu *et al*. (2006) in which anti-nutrients in lima bean and soybean respectively reduced significantly ($p<0.05$) with boiling, thus making the seed meals more palatable and acceptable when fed to fish.

CONCLUSION

The MCD diet gave the best growth indices thus considered the most appropriate processing method of *Mucuna pruriens* seeds for dietary inclusion in the feeding of *C. carpio* fingerlings.

REFERENCES

Akinmutimi, A.H. and Okwu, N.D. (2006). Effect of quantitative substitution of cooked *Mucuna utilis* seed meal for soyabean meal in broiler finisher diet. *International Journal of Poultry Science*, 5(5): 447-481.

Alegbeleye, W.O., Odulate, D.O., Obasa, S.O. and George, F.A.O. (2005). Potential of toasted Lima bean (*Phaseolus lunatus*) as a substitute for full fat soya bean meal in the diets for *Oreochromis niloticus* fingerlings. *Moor Journal of Agricultural Research*, 6(2): 92-98.

Azaza, M.S., Wassim, K., Mensi, F., Abdemouleh, A., Brini, B. and Kraiem, M.M. (2009). Evaluation of Faba beans (*Vicia faba*) as a replacement for soybean meal in practical diets of juvenile Nile tilapia *Oreochromis niloticus*. *Aquaculture*, 287 (1-2): 174 -179.

Balogun, J.K., Auta, J., Abdullali, S.A. and Agboola, E.O. (2008). Potentials of Castor seed meal (*Ricinus commnis*) as feed ingredients of *Oreochromis niloticus*. *Proceedings of the 19th Annual Conference of Fisheries Society of Nigeria* (FISON), Araoye P.A. (Ed). pp 838-843.

Bressani, R., Lau, M. and Silvia-Vargas, M. (2003). Protein cooking quality and residual content of dehydroxyphenylalanine and trypsin inhibitors of processed Mucuna beans (*Mucuna* spp). *In*: M.Eilita, J.Mureithi, R.Muinga, C.Sandoval, and N.Szabo (Eds), *Increasing Mucuna's Potential as a Food and Feed Crop. Proceedings of an International Workshop*. 23-26 September, 2002. Mombasa, Kenya. *Tropical and Sub- tropical Agro-Ecosystems*, 1(2-3):197-212.

Davies, S.J. and Gouveia, A.(2008). Enhancing the nutritional value of pea seed meals (*Pisum sativum*) by thermal treatment or specific isogenic selection with comparison to soyabean meal for African catfish, *Clarias gariepinus*. *Aquaculture*, 283(1-4): 116-122.

Davies, S.J. and Gouveia, A. (2014). Response of common carp fry fed diets containing pea seed meals (*Pisum sativum*) subjected to different thermal processing method. *Aquaculture*, 305(1): 117-123.

Duncan D.B. (1955).Multiple Range and Multiple F-Tests.*Biometrics*,11:1-42.

El-Saidy, D.M.S.D. and Saad, A.S. (2008). Evaluation of cow pea seed meal, Vigna sinesis, as a dietary protein replacer for Nile tilapia, *Oreochromis niloticus* (L.), fingerlings. *Journal of the World Aquaculture Society*, 39(5): 636-645.

Fagbenro, O.A., Adeparusi , O.E. and Fapohunda , O.O. (2003). Feedstuffs and dietary substitution for farmed fish in Nigeria.*In* A.A.Eyo (Ed) *Proceedings of the National Workshop on Fish Feed Development and Feeding Practices in Aquaculture*, 15th – 19th September, 2003 National Institute for Fresh water Fisheries Research, New Bussa, Nigeria. pp 60-72.

Siddhuraju, P. and Becker, K. (2003). Comparative nutitional evaluation of differently processed mucuna seeds (*Mucuna pruriens* (L.) on growth performance, feed utilization and body composition of Nile tilapia (*Oreochromis niloticus*). *Aquaculture Research*, 34(6): 256.

Tacon, A.G.J., Metian, M. and Hasan, M.R (2009). Feed ingredient and fertilizers for farmed aquatic animals; sources and composition. FAO (Food and Aquaculture Organization) *Fisheries and Aquaculture Technical Paper*, No. 540. 209 pp

Tiamiyu, L. O., Solomon, S. G. and Oketa, E. J. (2006). Effects of different boiling time of soybean (*Glycine max*) on growth performance of tilapia (*Oreochromis niloticus*) fingerlings. *Journal of Aquatic Sciences*, 21(1): 15-18.

Ukachukwu, S.N., Ezeagu, I.E., Tarawali, G. and Ikeorgu, J.E.G. (2002). Utilization of Mucuna as food and feed in West Africa pp. 189-217.*In*: *Food and Feed from Mucuna: Current uses and the way forward, Proceedings of an International Workshop, Tegucigalpa, Honduras*, April 26-29, 2000. Flores, M.B., Eilitta, M. Myhrman, R. Carew. L.B. and Carsky, R.J. (Eds.). CIDICCO.CIEPCA. Judson College.217pp

Vadivel, V. and Pugalethi, M. (2009). Effect of soaking in sodium bicarbonate solution followed by autoclaving on nutritional and antinutritional properties of Velvet bean (*Mucuna pruriens*) seeds. *Journal of Food Processing and Preservation*, 33:60-73.