

WATER QUALITY IN THE CULTURE OF *CYPRINUS CARPIO* FINGERLINGS FED RAW AND CORN COB ASH PROCESSED *MUCUNA PRURIENS* DIETS

Kakwi, D.G.¹, Audu, B.S.², Awolumate, S.³, Oyedapo F.A.⁴, Ositimehin K.M.¹, and Oshibanjo D. O.¹

¹Animal Production Department, University of Jos, Jos, Plateau State Nigeria

²Department of Zoology, University of Jos, Jos State Nigeria

³Department of Animal Science and Fisheries, Faculty of Agricultural Sciences, National Open University of Nigeria, Abuja, Nigeria

⁴Department of Fisheries, Lagos State University, Lagos State Nigeria.

olusegunoshibanjo@gmail.com

08055438564

ABSTRACT

Water quality in fish ponds can have extreme effects on pond productivity and fish health. This study was carried out to evaluate the water quality in the culture of *Cyprinus carpio* fingerlings fed raw and Maize Corn (MC) cob ash processed *mucuna pruriens*. The raw and the corn cob ash processed *Mucuna* seed meals in two replacement levels of 20% and 50% as substitution of soya bean meal in treatment diets were labelled Raw, MCD1 (20%) and MCD2 (50%) respectively, while a reference diet with no *mucuna* served as the control diet (CD). The diets were fed to *C. carpio* fingerlings for 56 days. Water quality parameters were measured for the period of evaluation. The water temperature varied between 22.90 to 22.96°C similar to the room temperature. The pH ranged between 7.02 and 7.07 while dissolved oxygen ranged between 6.24 to 6.34 ppm. The results obtained for this study is within the acceptable range and has no adverse effect on fish.

Key words: *Mucuna pruriens* Seed, water quality, *cyprinus carpio* fingerlings, corn cob ash

INTRODUCTION

Mucuna pruriens, (also known as velvet bean) is herbaceous legume belonging to the Family *Fabaceae* and sub family *Papilionaceae* (Kay, 1979). *Mucuna*'s potential as a food and feed is affected, on the positive side, by its relatively good seed and forage yield and beneficial composition of nutrients and minerals (Bressani *et al.*, 2003). *Mucuna* also contains anti-nutritional factors (ANFs) such as tannin, haemagglutinin, cyanide and trypsin inhibitors (Francis *et al.*, 2001), anticoagulants, anti-inflammatory factors and L-dopa, a potentially neurotoxic agent (Aguiyi *et al.*, 2003). These anti-nutrients are endogenous toxic substances that are part of the normal feedstuff and affect its nutritional quality (Ukachukwu, 2000; Bressani 2003) as well affect the quality of water. *Mucuna* grain has great potentials in animal feed. According to Kay (1979) and Buckles (1995), an important use of *mucuna* grain in the USA in the early part of this century was as animal feeds.

The successful aquaculture depends on the quality of different water parameters (Rahman, 1992). For a successful aquaculture venture, the dynamics and management of water quality in culture media must be taken into consideration (Davies and Ansa, 2007). Fish are totally susceptible to changes in water quality owing to the fact that they live, breathe, feed, grow, reproduce and excrete wastes within water. For fish to maintain an optimum level of health, avoid stress or disease then the water quality of the water must be monitored and controlled 24/7. Fish become stressed when key water quality parameters such as temperature, pH, nitrogenous waste, dissolved oxygen and salinity are not kept with specified thresholds (Loh, 2017). Water is the physical support in which aquatic organisms carry out their life functions such as feeding, breeding, digestion and excretion (Bronmark and Hansson, 2005).

The success of any fish production system depends on suitable water quality, which is any characteristics of water that affects the survival, reproduction, growth, production or management of fish (Boyd & Lichtkoppher (1979).

In this study, the water quality in the culture of *Cyprinus carpio* fingerlings fed raw and corn cob ash processed *mucuna pruriens* was investigated.

MATERIALS AND METHODS

Treatment of *M. pruriens* Seeds with Maize Cob Ash (MCA) Solution:

About 300 g of ash was obtained from maize cobs burnt on a metal tray and put in plastic container with 1 mm holes at the bottom. The ash was pressed down slight to form a filter bed. Distilled water (1.5 l) was added slowly making sure that the ash layer was not disturbed. The filtrate, amounting to about 750 ml was collected in a container. One hundred milliliters (100 ml) of the filtrate was diluted to 500 ml with distilled water to make a solution of 1:4 dilution. The samples (100 gm) of mucuna seeds were boiled in 1.5 litres of the maize cob ash solution in enamel pot for duration of 60 minutes then water was drained off using raffia basket after which the processed bean sample was washed with distilled water and dried in an open air under a shed for 3 days. The dried sample was then weighed, grinded and preserved in cellophane bag and kept in the refrigerator at 4°C for analysis.

Experimental Diet Composition and Preparation

Materials used in the test diets formulation included mucuna seed meal, fishmeal, full-fat soya bean meal, yellow maize flour, cassava flour (binder), vegetable oil and vitamin premix as shown in Table 1.

Table 1: Composition of Treatment Diets Fed to *Caprinus carpio* Fingerlings for 8 Weeks

Ingredients (%DM)	Control (CD) 0%	Raw	MCD1 20%	MCD2 50%
Mucuna meal		49.97	9.98	24.99
Soya bean meal	49.97	-	39.99	24.99
Maize flour	35.03	35.03	35.03	35.03
Fish meal	10.00	10.00	10.00	10.00
Veg. Oil	3.00	3.00	3.00	3.00
Fish Oil	2.00	2.00	2.00	2.00
Vitalyle*	2.00	2.00	2.00	2.00
Cassava flour	8.00	8.00	8.00	8.00
Total	100.00	100.00	100.00	100.00
Protein (%)	35.00	32.24	32.16	31.16

*1kg of Vitalyte premix contains: Vitamin A (5,000,000 I.U), Vitamin D3. (1,000,000 I.U), Vitamin E (16,000 mg), Vitamin K3 (800 mg), Vitamin B1 (1,200 mg), Vitamin B2 (22,000 mg), Niacin (22,000 mg), Calcium pantothenate (4,600 mg), Vitamin B6 (2,000 mg), Vitamin B12 (10 mg), Folic acid (400 mg), Biotin (32 mg), Choline chloride (200,000 mg), Manganese (48,000 mg), Iron (40,000 mg), Zinc (32,000 mg), Copper (3,400 mg), Iodine (600 mg), Cobalt (120 mg), Selenium (48 mg)

MCD1 and MCD2: Processed *M. pruriens* was used for soybean protein at inclusion levels of 20% and 50% respectively.

Experimental Fish

500 fingerlings of Common carp (*C. carpio*) of weight sizes between 15.10-15.20 gm were selected from a stock (mixed sex full sibling) and kept in oxygenated concrete tank (2 m x 5 m x 1.5 m) while being fed two times a day, on commercial pelleted diet (Vital Fish Feed, 25% Crude protein) for 10 days. The feeding was done daily at 10:00 hour.

The four experimental diets were fed to the *C. carpio* fingerlings in a completely randomized design (CRD) experiment. Each treatment was replicated twice with 15 fish per replicate. All the fish were fed

experimental diets twice a day in two equal parts between 08:00 – 09:00 h and 15:00 – 16:00 h at a feeding rate of 5% body weight per day. The duration of the experiment was eight (8) weeks (56 days).

Water Quality Parameters

The standard methods employed in the determination of the various water physico-chemical parameters which include temperature, pH, total alkalinity, free carbon dioxide, dissolved oxygen and ammonia were those described by APHA/AWWA/WPCF (1985).

Statistical Analysis.

All experimental data obtained were subjected to one-way Analysis of Variance (ANOVA). Standard errors (SE) of the means for each replicate were calculated and the means were compared using Duncan's multiple-range test (Duncan, 1955) to determine significant differences ($P < 0.05$) among treatments.

RESULTS

The water quality parameters monitored during the experimental period were not significantly ($P > 0.05$) different as shown in Table 1. The water temperature varied between 22.90 to 22.96°C similar to the room temperature. The pH ranged between 7.02 and 7.07, while dissolved oxygen ranged from 6.24 to 6.34 ppm.

Table 2: Water Quality Parameters Measured During the Experimental Period

Parameters	Control	Raw	MCD1 (20%)	MCD2 (50%)	SEM
Temperature (°C)	22.90	22.92	22.94	22.96	0.63
Dissolved oxygen (mg/l)	6.34	6.30	6.26	6.24	0.13
Free Carbondioxide (mg/l)	2.14	2.88	3.18	3.32	0.23
Total alkalinity (mg/l)	22.80	24.80	26.00	27.00	1.34
pH	7.02	7.02	7.06	7.07	0.04
Ammonia (unionized NH ₃)	0.22	0.22	0.22	0.22	0.01

MCD1 and MCD2: Processed *M. pruriens* was used for soybean protein at inclusion levels of 20% and 50% respectively

SEM = Standard Error Mean

DISCUSSION

The aquatic environment governs fish life, hence, water quality should be suitable for fish culture. The successful aquaculture depends on the quality of different water parameters (Rahman, 1992). For a successful aquaculture venture, the dynamics and management of water quality in culture media must be taken into consideration (Davies and Ansa, 2007). Temperature as a water quality parameter is important as it directly affects the amount of oxygen that can be dissolved in water but also the growth of organisms and bacteria that can cause disease. Temperature also controls the rate at which food is transformed into energy which then in turn affects breathing, food intake, bodily growth and physiological behaviour. An increase in temperature will decrease the dissolved oxygen content in water which will in turn increase the fish metabolic rate and its demand for oxygen. The results obtained for this study is within the acceptable range which is in line with the report of Boyd (1981). Dissolved Oxygen (DO) is considered by most to be the most important water quality parameter in aquaculture. Depending on the size and type of fish farm, DO levels can change very quickly indeed and can therefore endanger the lives of the fish in a matter of minutes or hours. Although fish can tolerate a drop in dissolved oxygen below 5-6 mg/L for short periods of time, it will lead to significant stress or indeed death if not increased to healthy levels. The results obtained for this study is within the acceptable range which is in line with the report of Boyd (1981). The recommended pH range for fish and vertebrates is between 7.0 and 8.0 as the average blood

pH is around 7.4. With water passing through the fish gills and skin they are susceptible to changes in pH. Fish therefore become stressed if pH falls outside the pH range 5-10. pH does vary throughout the day and depends on the oxygen demand in the water and photosynthesis. CO₂ is also released overnight hence lowering pH by morning but rises to its peak in the afternoon when CO₂ consumption by algae (photosynthesis) is at its peak. Fish have a reduced capacity to carry oxygen if pH levels fall to critical levels but if the pH goes critically high, the portion of ammonia that is toxic also increases. The results obtained for this study is within the acceptable range which is in line with the report of Boyd (1981). Ammonia is the main waste product by fish and is regarded as the second most important water quality parameter after dissolved oxygen in intensive fish farming. Even in relatively small concentrations, ammonia can cause significant stress and damage to fish especially bacteriological infections. In higher concentrations where the nitrogen cycle is not in balance ammonia can wipe out whole fish stocks. The results obtained for this study is within the acceptable range which is in line with the report of Boyd (1981).

CONCLUSION

The results obtained for this study is within the acceptable range without adverse effect on the fish.

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