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Effect of Physiochemical Parameters on the Growth performance of Clarias *gariepinus* fed with Commercial and Local Fish Feed

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The physiochemical parameters of the ponds: pond A (coppens) pond B (30% *Moringa oleifera*) and pond C (23% *Telfairia occidentalis*) were in the range of temperatures 25°C to 29°C, pH 6, dissolved oxygen, biochemical oxygen demand, conductivity, nitrate and Ammonium were measured. The physiochemical parameters were in the range of 25°C to 29°C, 6.14 to 7.5, 6.45 to 70 mg/L, 2.1 to 6.2 mg/L, 18.05 to 20.55 u5/cm, 0.02 to 0.06 mg/L, and 0.14 to 0.09 mg/L respectively. Statistical analysis using mean, mode, median, minimum values and maximum values of all the experimental ponds to test the suitability of the water for fish growth. The mean initial weight ranged from 10.4 g to 11.4 g while mean final weight was 31.0 g to 40.6 g. Coppens has the highest average weight of 40.6 g while 30% moringa and 23% ugu (*Telfairia occidentalis)* has 33.0 g and 31.0 g respectively. 30% moringa had highest death rate. The daily weight gain (g/d) of treatment for pond A, B and C were 0.35 g/d, 0.28g/d and 0.25g/d respectively. The relative weight gain was highest in pond A (coppens) 256.1 while pond C (23% ugu) was the lowest with 198.0. It showed that fish yield was dependent on the quality management of pond water characteristic.

Keywords: Commercial and local fish feed, physiochemical parameters, Growth performance of clarias *gariepinus*

INTRODUCTION

Fish growth depends on water quality, in order to boost the quality of fish, the physiochemical parameters of the water needed to be ascertained (Ugwumba and Ugwumba, 1993). Knowledge of hydrological conditions of water body is not only useful in accessing its productivity but will also permit a better understanding of the population and life cycle of the fish community. Adebisi, (1981); Ayodele and Ajani, (1999); Dhawan and Kaur, (2002) observed that feeding and fertilization work together to make efficient increase in fish production. It then follows that the stocking rate of ponds will determine to a large extent, the optimum quality of fish to be reared per unit area of ponds, since there is always a complex way of feeding (food chain) which results from the close association of various organisms that will grow and multiply in water (Boyd and Lichtkoppter, 1985). In the presence of environment stress, such as low dissolved oxygen, high temperature and high ammonia (Boyd, 1981) the ability of organisms to maintain and reproduction is reduced (Ezra and Nwankwo, 2001). In view of this, monitoring water quality which centres on determination of optimal, sub-lethal and lethal values of physiochemical parameters standard for fish culture should be embraced (Boyd and Lichtkoppler 1985). Such physiochemical parameters include temperature, dissolved oxygen (DO), pH, conductivity and biological oxygen demand (BOD). However pond habitats can be easily manipulated by controlling the water characteristics for an optimum environment yielding high level fish production. Water quality is frequently a prominent concern where aqua culture is practiced. Maintaining a healthy environment is not only important to the organisms being cultured but also to the flord and fauna that are indigenous to through and around the site (Environmental review, 2008). Monitoring of water quality can quantify the scope and duration of fish culture early identification of water quality degradation through routine monitoring permits Aqua culturist to implement minor operational changes to correct identified problems before it reaches an extreme condition. Some water quality factors that are more liked to be implicated with fish includes, dissolved oxygen, temperature and ammonia. Others such as pit, Alkalinity, hardness and clarity can affect fish but usually not directly toxic (Steven 2007). Each water quality factor interacts with and influences other parameters, sometimes in complex ways (Meade, 1989). The determination and frequency of monitoring of water quality depends upon the rearing intensity of production system used. All biological and chemical process in an aqua range where it grows best, at temperature above or below optimum, fish growth is affected. Mortalities may occur at extreme temperatures (Piper *et al.,* 1982). Turbidity determines light penetration in water and the amount of vegetation and algae that will grow in the pond this affecting the rate of photosynthesis and primary productivity (USDA, 1996; Environmental review, 2008). Chemical characteristics include water quality parameters that are chemical in nature within the pond. The essence of this study is to determine the physiochemical parameters of fish pond in view to providing useful information to farmers in raising fish at a site for long period of time while maximizing impacts to the environment.

MATERIALS AND METHODS

Study area

The experiment was carried out in the Biological garden, University of Abuja Main Campus, Airport Road, Abuja.

Source of experimental fish

Sixty juvenile *clarias gariepinus* were obtained from God's time farms in Kado Fish Market, Kado, Abuja. The fish were transported to the fisheries laboratory; Department of Biological Sciences, University of Abuja, in 100 litres plastic bowls and acclimatized for one week. During the period of acclimatization, the fish were fed coppens (Anibeze and Eze 2000) at 2% body weight twice daily (Okoye *et al.,* 2001) with a formulated diet of 40% crude protein. Feed not consumed and faecal matters were siphoned out every two days interval. At the end of the acclimatization, the fishes were randomly selected and stocked into three plastic bowls with each bowl holding 20 fishes. Feeding was suspended 24 h before the feeding trial to increase appetite and reception for new diet (Madu and Akilo 2007).

Feeding

The juvenile were fed twice in a day at a rate of 2% of their body biomass. The pelleted feeds was crushed into crumbs before they were administered and adjusted every week based on estimated biomass after weekly sampling for growth. The feeding trial was conducted in an experimental unit containing a set of three plastic bowls, each with a capacity of 70 litres of water. 60 catfish *clarias gariepinus* of average weight of 11.5 g, 11.2 g and 10.9 g were used for the experiment. Feeding were done in the morning 9:00am and 5:00pm, exception sampling days when they will not be fed till the next day after weighing.

Sample analysis

One imported feed pond A (coppens) and two local feeds pond B and C (30% *Moringa oleifera* and 23% *Telfairia occidentalis*) were obtained. The feeds contain different levels of crack protein. Water samples were taken for each experimental pond at the sites daily, morning and evening for eight weeks. Readings of sort water parameters were done on the site while the others were estimated at the laboratory. Water samples from the pond were collected in labeled bottles. The collected water samples were analyzed for different physiochemical parameters such as pH, temperature, dissolved oxygen, biochemical oxygen demand, ammonia, nitrites and conductivity by following the standard protocols (APHA, 1989).

Sampling and preservation

Water samples for all the physiochemical analysis were collected on weekly schedules from each of the study pond, using 250 ml sampling bottles and transported to the Agricultural Science Laboratory of the University of Abuja for analysis. Water samples were taken on the same day and at the same sampling points for ease of reference. Water samples were collected into 250ml high density polyethylene (HDPE) plastic vials pre-treated with 4M HNO_3 and properly rinsed with deionized water followed by doubly distilled water before used. Samples handling and preservations were done in accordance with standard method (Bothner *et al.*, 2008).

Fish

Clarias gariepinus was cultured in the three fish ponds; weight (g) and length (cm) of fish were measured using top leading meter balance and a meter wooden board respectively. A random sampling of 20 fish per pond was used and the average weight and length were estimated at the start and at the end of the experiment.

Determination of physiochemical parameters of the pond

Surface water temperature

This was determined by using mercury-in glass thermometer by dipping it into the water and allowing it to stabilize for 5 seconds. It was then removed and temperature in degree Celsius was read immediately and recorded (APHA, 2005).

pH

This was determined using the pH meter. The procedure is as follows:

(i) The pH meter was standardized
(ii) The pH meter consists of an electrode which was rinsed with distilled water.
(iii) 50 ml of water sampled was measured into a beaker.
(iv)The electrode was dipped into the water and pressed the read button.
(v) The reading was taken and recorded.

Electrical conductivity

This was determined using WTW, LF 90 conductivity meter:

(i) The conductivity meter electrode was rinsed and zeroed using distilled water.
(ii) 20 ml of the water sample was measured into the beaker.
(iii) The electrode was dipped into it, waited for the meter to stabilize and reading was taken.
(iv) The displayed value was recorded in (u5/cm).

Dissolved oxygen (DO)

The winkers method was employed for the estimation of dissolved oxygen in the water samples.

(i) Water samples were collected with care in BOD Bottles without bubble formation.
(ii) 1ml of $MnSO_4$ was added to the sample and then 1ml of alkali –Iodide azide solution was added in the same.
(iii) The precipitates formed were dissolved by adding 2ml of concentrated suphuric acid (H_2SO_4).
(iii) 100 ml of water sample was taken from this and titrated against 0.025N sodium thiosulphate. Starch is used as an indicated to estimate iodine generated and the end point is noted as the solution turned to colourless. (APHA,1998).

The DO is calculated using following formula:

$$DO\ mg/L = B.R*N*1000.$$

Amount of sample taken in ml,
Where B.R = Burette reading (Amount of titrant used N).
N=Normality of sodium thiosulphate.

Biochemical oxygen demand

The winkers method also employed for estimation of biochemical oxygen demand with care in BOD bottles without bubbles formation, the DO was then fixed by adding 1ml each of MnSO4 and alkali-iodate azide reagent. The precipitates formed were dissolved by adding 2 ml of concentrated sulphuric acid (H_2SO4). 100 ml of water sample was taken and then titrated against 0.025 N sodium thiosulphate; starch is used as an indicator to estimate iodine generated and the end point is noted as the solution turns colourless, (APHA 2008). The BOD sample was incubated in the dark for 5 days at 20°C.

The BOD was calculated using the following formula

$$BOD\ mg/L = B.R*N*1000$$

Amount of sample taken in (ml),
Where B.R = Burette reading (amount of titrant used), N = normality of sodium thiosulphate.

Nitrites

This was determined using the spectrophotometer.
The procedure is as follows:

(i) 10 ml of the water sample was collected into the test tube.
(ii) A sachet of nitrite powder phthalate was added into the test tube.
(iii) The pH thalate powder was allowed to dissolve for 60 seconds and the reading was taken.

Ammonia

This was also determined by using spectrophotometer.
The procedure is as follows:

(i) 10 ml of water sample was measured into the test tube.
(ii) A sachet of ammonia reagent powder was added into the test tube and shaken.
(iii) The reagent powder was collected to dissolve for 60 seconds and the reading was taken.

Growth response

To determine the growth response of the fish the weight grain was recorded every two week from this the mean weight grain, relative growth rate, mortality rate and survival rate were calculated using the following formula.

Data analysis

Data was analyzed by using SPSS to calculate.The mean, minimum, maximum values and the sum of the physiochemical parameters

Relative growth rate (RGR)

$$\text{RGR }(\%) = \frac{Wf - Wi \;\; x \;\; 100}{Wi}$$

Where Wf = final weight at the end of the experiment
Wi = initial average weight at the beginning of the experiment

Mortality Rate

$$M\ (\%) = \frac{D \text{ x } 100}{N}$$

Where M = Mortality,
D = total number of dead fish at end of experiment, N= total number of stocked fish at beginning of experiment.

Survival Rate

$$(\%) = \frac{Ni \text{ x } 100}{N}$$

RESULTS AND DISCUSSION

Physiochemical parameters were determined for 12 weeks from the month of July to September 2017, which are shown in (Tables 1 to 4 and Figure 1); the tables show the results of each parameter for each pond (A, B and C) with different treatments. Table 4 shows the mean initial weight ranged from 10.4 to 11.4 g, while the mean final weight was from 31.8 g to 40.6 g. Coppens has the highest average weight of 40.6 g and 30% *Moringa oleifera* has 33.0 g followed by 23% *Telfairia occidentalis* leaf has 31.8 g while 30% moringa has highest death rate. The daily weight gain (gld) of pond A (coppens) was 0.35 gld, pond B (*Moringa oleifera* 30%) was (0.23 gld) and pond C (23% *Telfairia occidentalis*) was 0.25 gld.

Temperature

Temperature was found in the range of 25.0°C to 29.0°C. The lowest temperature was recorded in pond C (*Telfairia occidentalis*) 25°C and the highest was recorded in pond A (coppens) 29.0°C. Wide fluctuation in temperature (*Telfairia occidentalis*) pond and coppens might be due to variation in feeds content.

pH

pH values varied from 6.14 to 7.5 which indicate favourable condition of productivity. This is generally the normal range of pH in fresh water, unless contaminated by acidic or alkaline wastes. High pH was observed in pond A 7.5 (coppens) followed by pond B 6.6 (*Moringa oleifera*) and C 6.1 (*Telfairia occidentalis*).

Dissolved oxygen (DO)

DO content was in the range of 6.5 to 7.0 the lowest level of dissolved oxygen was recorded in pond B (*Moringa oleifera*) as 6.5 mg/L while pond A (coppens) as 7.0 mg/L.

Ammonium and nitrate

The observed values of ammonium were 0.14 to 0.90 mg/L. Pond A (coppens) has the highest concentration of ammonium 0.90 mg/L followed by B (*Moringa oleifera*) 0.44 mg/L and pond C (*Telfairia occidentalis*) 0.14mg/L respectively. Nitrate concentration is very important for production and low dissolved oxygen also affects the nitrite concentration. The concentration of nitrite in the present study was 0.02 to 0.06mg/L in the experimental ponds. The nitrite was high in pond A (coppens) 0.06mg/L and low in pond B (*Moringa oleifera*) 0.02 mg/L.

Biochemical oxygen demand (BOD)

BOD of fish ponds range from 2.1mg/L to 6.2 mg/L. BOD was relatively low in pond B and C as 2.1mg/L and high in pond A 6.2 mg/L. The BOD in pond A was higher than the permissible unit; which is 6.0 mg/L.

Conductivity

Conductivity range from 18.05 to 20.55 uS/cm with the highest record in pond A 20.55 uS/cm and the lowest in pond B 18.05 uS/cm.

Conclusion

The physiochemical parameters such as temperature, PH, dissolved oxygen and biological oxygen demand (mg/L) were determined for abnormal concentration of any of these physiochemical parameters. The physiochemical parameters influencing *Clarias gariepinus* productivity were found in the range of 25°C to 29°C, 6.14 to 7.5, 6.5 to 7.0, 0.14 to 0.90 mg/L, 0.02 to 0.06mg/L, 2.1 to 6.2mg/L, 18.05 to 20.55us/cm for temperature, PH, dissolve oxygen, Nitrite, Ammonia, Biological oxygen demand and Conductivity respectively. The relationship between fish yield and water parameter showed that no single parameter can be singled out in

Table 1. Summary of the weekly mean, minimum, maximum and sum of physiochemical characteristics of tank A.

Parameters	Temperature (°C)	PH	DO (Mg/L)	Conductivity (u5/cm)	BOD (Mg/L)	NIT (Mg/L)	Ammonia (g/dL)
Mean	26.8416	6.65	6.728	19.142	5.426	0.048	0.458
Median	26.75	6.93	6.625	20.025	5.875	0.054	0.275
Mode	27.5	6.71	6.75	20.00	5.75	0.045	0.25
Minimum value	26.0	6.14	6.58	18.15	2.50	0.030	0.25
Maximum value	28.0	7.1	7.0	20.55	6.20	0.060	0.90
Total	322.1	79.88	80.74	229.7	65.120	0.573	5.50

DO = Dissolve oxygen BOD = Biochemical Oxygen Demand NIT = Nitrate.

Table 2. Summary of weekly mean, minimum, maximum and sum of physiochemical characteristics of tank B. 30% *Moringa oleifera.*

Parameters	Temperature (°C)	PH	DO (Mg/L)	Conductivity (u5/cm)	BOD (Mg/L)	NIT (Mg/L)	Ammonia (g/dL)
Mean	26.3917	6.457	6.58	18.975	4.445	0.034	0.254
Median	26.5	6.43	6.54	19.3	4.825	0.036	0.295
Mode	25.5	6.44	6.60	19.0	6.0	0.033	0.16
Minimum value	25.5	6.21	6.50	18.05	2.1	0.020	0.16
Maximum value	27.8	6.60	6.60	20.0	6.0	0.050	0.38
Total	316.7	77.48	78.96	227.7	53.34	0.408	3.05

DO = Dissolve Oxygen BOD = Biochemical Oxygen Demand NIT = Nitrite.

Table 3. Summary of weekly mean, minimum, maximum and sum of physiochemical characteristics of tank C 23% *Telfairia occidentalis.*

Parameters	Temperature (°C)	PH	DO (Mg/L)	Conductivity (u5/cm)	BOD (Mg/L)	NIT (Mg/L)	Ammonia (g/dL)
Mean	26.208	6.45	6.75	19.12	4.275	0.031	0.255
Median	25.25	6.335	6.335	20.025	4.05	0.033	0.250
Mode	25.0	6.10	6.10	20.0	5.0	0.030	0.32
Minimum value	25.0	6.10	6.10	18.32	2.30	0.028	0.14
Maximum value	27.5	6.71	6.95	20.05	5.7	0.035	0.36
Total	314.5	77.3	81.03	229.48	51.30	0.377	3.06

Table 4. Growth performance, Nutrient utilization and survival of juvenile C*larias* with the treatment with the treatments feeds.

Parameters	TA	TB	TC
Initial mean weight	11.4	11.0	10.4
Final mean weight	40.6	33.0	31.0
Mean weight gain	25.5	20.2	19.9
Relative growth rate	256.1	200	198.0
% mortality	20	30	25
% survival	80	70	75
Mean weight gain/day (mg)	0.35	0.28	0.25

relation to fish growth and health. In conclusion there is no significant difference in the foreign and local feeds as the both support the growth of *Clarias gariepinus* and the pond water investigated was in general fit for fish productivity it is also important to note that regular monitoring is worthwhile in other to improve water quality.

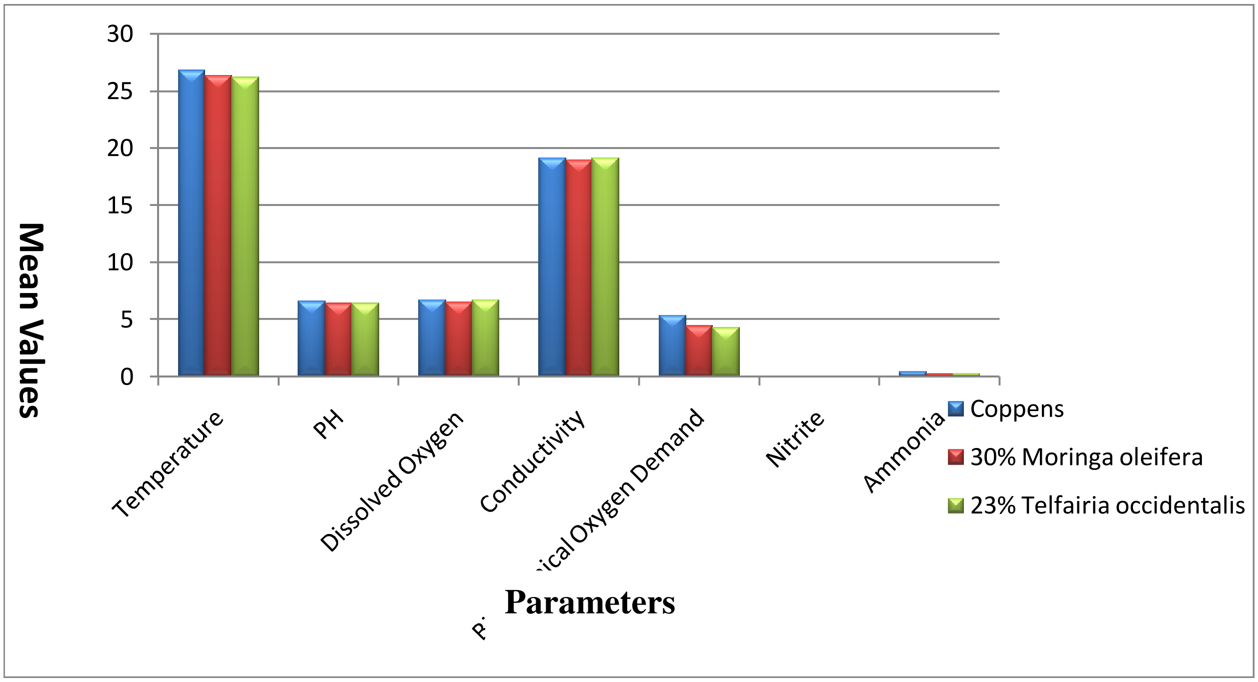

Figure 1. The mean variation of different physiochemical parameters of different meals.

Recommendation

It is recommend that further analysis should be carried out on the monitoring of the physiochemical parameters of fish pond because of the increase in anthropogenic activities, it is further recommended that proper education, monitoring and clean up procedures be carried out promptly in order to boost fish production.

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