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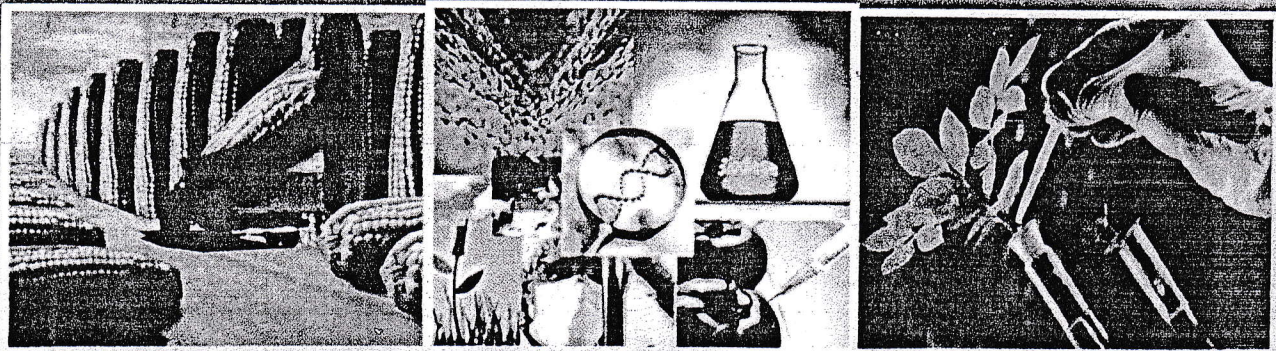
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**INFLUENCE OF DIFFERENT TEMPERATURE LEVELS ON SOME GROWTH PARAMETERS AND SURVIVAL RATES OF *Clarias anguillaris* FINGERLINGS UNDER LABORATORY CONDITIONS IN MINNA, NIGERIA.**

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**ABSTRACT**

The effects of different temperature levels on some growth parameters and survival rates of *Clarias anguillaris* fingerlings under laboratory conditions were investigated. The Set-up consisted of 4 treatments and 2 replicates each. Temperatures were fixed at 30°C, 32°C, 34°C and 26.66±0.2°C (control). Each of the experimental tanks was stocked with randomly selected 50 fingerlings. Growth and physicochemical parameters were determined weekly based on standard procedures. The survival rates were monitored daily while exchange of water was done twice a week. The fishes were fed to satiation twice daily. Temperature had no significant influence ( $P>0.05$ ) on fish length. However, body weights were not significantly different ( $P>0.05$ ) in the tested temperature levels in weeks 1, 3, and 5. Body weight (1.97±0.33g) of the fingerlings raised at 32.00°C reduced significantly ( $P<0.05$ ) in week 2. Temperature had no significant influence ( $P>0.05$ ) on pH, DO, BOD, survival and specific growth rates. Ammonia concentration increased significantly ( $P<0.05$ ) as temperature increased from 1.11±0.10 at 26.66±0.28°C to 1.98±0.06 mg/L at 34°C. Temperature increased significantly ( $P<0.05$ ) the electrical conductivity ranged from 519.92±5.08µS/cm at 26.66±0.28°C to 586.33±17.50µS/cm at 30°C. Fingerlings raised from 26.66±0.2°C to 32°C were significantly ( $P<0.05$ ) higher in final body weights (ranged from 7.57±1.17 at 32°C to 8.32± 1.21g at 30°C) and weight gains (ranged from 6.27 at 32°C to 7.02g at 30°C). Percentage weight gain (540.00%) was significantly ( $P<0.05$ ) highest at 30°C. The final body weight, weight gain and percentage weight gain reduced at 34.00°C. The electrical conductivity and ammonia concentration of cultured media of *C. anguillaris* fingerlings increased with increase in water temperature. Water temperatures between 26.66 – 32.00°C would support the growth and survival rates of *C. anguillaris* fingerlings.

**Keywords:** Temperature, *Clarias anguillaris*, growth parameters, survival rates, and physicochemical parameters.

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**INTRODUCTION**

Temperature is a necessary environmental factor that plays an important role in freshwater biomes. It is regarded as a significant factor among countless environmental factors affecting the aquatic environment as well as the metabolism of exotherms (Sreeya and Lipton, 2012). Therefore,

any increase in the atmospheric temperature as a result of industrialization, urbanization and global warming would directly affect the ambient water temperature of fresh water fishes cultured in ponds (Currie *et al.*1998). Gubbins *et al.*(2000) and Bellgraph *et al.*(2010) documented that the temperature of an aquatic environment is very essential for the distribution, survival and normal

metabolic activity of a fish. Appropriate water temperature may lead to high growth rate, efficient food conversion and a good condition of the fish. Thus, high fluctuation in the temperature greatly affects the biological activities of the fish (Azevedo *et al.* 2008). Water temperature had also been reported to significantly influence the body weight of some freshwater fish such as of *Tilapia spp (Oreochromis niloticus)* whose body weight decreased at higher body temperature (Decroux *et al.*, 2004; El-Sheriff and El-Feky, 2009).

Gumaa and Salih (1986) documented that young *Oreochromis niloticus* preferred water temperature between 30-36°C while higher temperatures of about 41°C proved lethal to the fishes. Fish culture, with particular reference to *Clarias anguillaris*, exhibits traits that are desired globally (Bartley *et al.*, 2000 and Okechi, 2004). Several environmental factors affect optimum fish production in Nigeria. Therefore, the present study was carried out to evaluate the influence of different temperature levels viz: 26.66(control), 30.00, 32.00 and 34.00°C on some growth parameters, survival rates and physicochemical parameters of *Clarias anguillaris* fingerlings under laboratory conditions.

## MATERIALS AND METHODS

### Experimental Site

The study was conducted at the Biology laboratory of the School of Life Sciences, Bosso Campus, Federal University of Technology, Minna, Niger State.

### Source of the Experimental Fish

Four hundred(400) four weeks old *Clarias anguillaris* fingerlings with initial mean weight, standard and total lengths of  $1.30 \pm 0.23\text{g}$ ,  $5.01 \pm 0.27\text{cm}$  and  $5.73 \pm 0.29\text{cm}$  respectively were purchased from a private fish in Lagos, Lagos State, Nigeria.

### Acclimatization of the Fingerlings

The *Clarias anguillaris* fingerlings were acclimatized in rearing tanks for a period of seven days to allow them to recover from transportation stress (Adewolu *et al.*, 2008, Ayanwale *et al.*, 2014). During this period, the fish were fed on a commercial diet (Coppens) to satiation, morning and evening following the method of Koeypudsa and Jongjareanjai, (2011). Water exchange was done when necessary in the morning. The left overfeed and faecal samples were siphoned immediately after feeding (Ghanbari *et al.*, 2012).

### Experimental Design

A Completely Randomised Design (CRD) with a total of 4 treatments replicated 2 times was adopted in this experiment.

### Experimental Set-up

The experiment consisted of four treatments with two replicates per treatment, each with a stocking density of fifty (50) fingerlings per replicate. Eight plastic indoor aquaria tanks of 30litres capacity (35x55x33) cm<sup>3</sup> were filled with borehole water up to 25cm level. Treatment 1 was the control ( $26.66 \pm 0.28^\circ\text{C}$ ), while treatments 2, 3 and 4 had temperatures fixed at 30.00, 32.00 and 34.00°C respectively. These temperature levels were kept constant with electrically operated thermo regulators, Model: Life Tech,2009 (El-Sheriff and El-Feky,2009; Ayanwale *et al.*,2014).The average daily hours of exposure to electricity during experimental period was 2.00hours (minimum) and 6.00hours (maximum).The fingerlings were fed on a commercial diet to satiation, following the methods of Ayanwale *et al.*(2014).The physicochemical parameters of experimental tanks were monitored weekly during the morning hours (08.00 and 10.00 hours). Tanks were drained twice a week and replaced

with fresh borehole water every morning. The left over feed and faecal samples were siphoned immediately (Ghanbari *et al.*, 2012). The experiment was monitored for a period of six (6) weeks.

#### Determination of Some Physicochemical Parameters

Water temperature of the control treatment was determined with mercury in bulb thermometer (10-110°C range). Dissolved Oxygen, Biochemical Oxygen Demand (BOD), Hydrogen Ion Concentration (pH), Ammonia (NH<sub>3</sub>) and Electrical Conductivity of the cultured water were determined based on standard methods (American Public Health Association, 1995).

#### Determination of Growth Parameters

At the end of every week, five fingerlings from each tank were randomly sampled as described by (Ayanwale *et al.*, 2014). The Standard Length (SL) was determined by measuring the length between the mouth and the caudal peduncle while the Total Length (TL) was determined by measuring the interval between the mouth and the tail fin. The weight of the fish was determined weekly by taking the individual weight of five randomly

sampled fingerlings. Weight was determined by using a sensitive compact scale; model CS 2000 HAUS.

Weight gain, Percentage weight gain and Survival rate were determined according to the methods described by Adewolu *et al.*, 2008. Specific Growth Rate (SGR) was also determined according to the method described by Dong Han *et al.* (2005).

#### Data Analysis of the Experiment

The data collected were analyzed for significant differences ( $P < 0.05$ ) by the analysis of variance (ANOVA) using a Computer Statistical Package for Social Sciences (SPSS). Duncan Multiple Range Test (Duncan, 1955) method was used to separate the means where there were statistically significant differences ( $P < 0.05$ ).

## RESULTS

The results of the mean  $\pm$  standard deviation of Standard Length (SL) of *Clarias anguillaris* fingerlings exposed to different temperature levels is presented in Table 1. The SL of *C. anguillaris* fingerlings ranged from 5.60  $\pm$  0.36 at 26.66  $\pm$  0.28°C (control) to 9.18cm  $\pm$  0.45cm at 30.00°C were not significantly different ( $P > 0.05$ ) in all the treatments.

Table 1: Mean  $\pm$  Standard Deviation of Standard length of *Clarias anguillaris* Fingerlings exposed to Different Temperature Levels for a Period of six weeks

Temperature Levels(0°C)	WEEKS					
	1	2	3	4	5	6
26.66 $\pm$ 0.28 (control)	5.60 $\pm$ 0.36 <sup>a</sup>	6.61 $\pm$ 0.17 <sup>a</sup>	7.18 $\pm$ 0.30 <sup>a</sup>	9.11 $\pm$ 0.53 <sup>a</sup>	8.85 $\pm$ 0.55 <sup>a</sup>	9.00 $\pm$ 0.42 <sup>a</sup>
30.00	6.22 $\pm$ 0.53 <sup>a</sup>	6.52 $\pm$ 0.25 <sup>a</sup>	7.13 $\pm$ 0.32 <sup>a</sup>	9.18 $\pm$ 0.47 <sup>a</sup>	9.13 $\pm$ 0.55 <sup>a</sup>	9.10 $\pm$ 0.42 <sup>a</sup>
32.00	5.82 $\pm$ 0.22 <sup>a</sup>	5.59 $\pm$ 0.23 <sup>a</sup>	7.21 $\pm$ 0.34 <sup>a</sup>	8.46 $\pm$ 0.45 <sup>a</sup>	9.10 $\pm$ 0.50 <sup>a</sup>	8.78 $\pm$ 0.44 <sup>a</sup>
34.00	6.15 $\pm$ 0.38 <sup>a</sup>	6.04 $\pm$ 0.23 <sup>a</sup>	6.90 $\pm$ 0.42 <sup>a</sup>	8.02 $\pm$ 0.34 <sup>a</sup>	8.80 $\pm$ 0.42 <sup>a</sup>	8.43 $\pm$ 0.32 <sup>a</sup>

Values followed by the same superscript, in the same column, are not significantly different at (P >0.05) tested by DMRT.

Results of the mean  $\pm$  standard deviation of TL of *C. anguillaris* fingerlings exposed to different temperature levels is depicted in Table2. Similarly, like their respective SL, there

were no significant differences (P>0.05) in the TL (range=6.39 $\pm$ 0.43cm at 26.66 $\pm$ 0.28°C to 10.51 $\pm$ 0.62cm at 30.00°C) of *C. anguillaris* fingerlings exposed to all the treatments.

Table 2: Mean  $\pm$  Standard Deviation of Total length of *Clarias anguillaris* Fingerlings exposed to Different Temperature Levels for a Period of six weeks

Temperature Levels(0°C)	WEEKS					
	1	2	3	4	5	6
26.66 $\pm$ 0.28 (control)	6.39 $\pm$ 0.43 <sup>a</sup>	7.47 $\pm$ 0.18 <sup>a</sup>	7.47 $\pm$ 0.18 <sup>a</sup>	8.11 $\pm$ 0.35 <sup>a</sup>	10.21 $\pm$ 0.58 <sup>a</sup>	10.14 $\pm$ 0.64 <sup>a</sup>
30.00	6.96 $\pm$ 0.59 <sup>a</sup>	7.37 $\pm$ 0.28 <sup>a</sup>	7.37 $\pm$ 0.28 <sup>a</sup>	8.01 $\pm$ 0.37 <sup>a</sup>	10.36 $\pm$ 0.54 <sup>a</sup>	10.51 $\pm$ 0.62 <sup>a</sup>
32.00	6.54 $\pm$ 0.25 <sup>a</sup>	6.43 $\pm$ 0.29 <sup>a</sup>	6.43 $\pm$ 0.29 <sup>a</sup>	8.10 $\pm$ 0.40 <sup>a</sup>	9.48 $\pm$ 0.42 <sup>a</sup>	10.46 $\pm$ 0.60 <sup>a</sup>
34.00	6.95 $\pm$ 0.42 <sup>a</sup>	6.94 $\pm$ 0.27 <sup>a</sup>	6.94 $\pm$ 0.27 <sup>a</sup>	7.80 $\pm$ 0.46 <sup>a</sup>	9.07 $\pm$ 0.38 <sup>a</sup>	10.02 $\pm$ 0.50 <sup>a</sup>

Values followed by the same superscript, in the same column, are not significantly different at (P >0.05) tested by DMRT.

The results of the mean  $\pm$  standard deviation of bodyweight of *C. anguillaris* fingerlings is presented in Table3. There were no significant effects (P>0.05) on the body weight (range = 2.27  $\pm$  0.45g at 26.66 $\pm$ 0.28°C to 8.37  $\pm$  1.46g at 32.00°C) of *C. anguillaris* fingerlings exposed to all the temperature treatments in weeks 1,3 and 5. However, the body weight (1.97  $\pm$  0.33g) of *C. anguillaris* fingerlings

cultured at 32.00°C was significantly reduced (P<0.05) in week 2. Similarly, the bodyweight (6.71 $\pm$ 0.73g) of *C. anguillaris* fingerlings cultured at 34.00°C was also significantly reduced (P<0.05) at the end of the study when compared with the bodyweights (range=8.10  $\pm$  1.21g at 26.66  $\pm$  0.28°C to 8.32  $\pm$  1.21g at 30.00°C) of *C. anguillaris* fingerlings raised under control and 30.00°C regimens.

Table 3: Mean  $\pm$  Standard Deviation of Body weight of *Clarias anguillaris* fingerlings exposed to different temperature levels for a period of six weeks

Temperature Levels(0°C)	WEEKS					
	1	2	3	4	5	6
26.66 $\pm$ 0.28 (control)	2.27 $\pm$ 0.45 <sup>a</sup>	3.32 $\pm$ 0.27 <sup>a</sup>	4.41 $\pm$ 0.61 <sup>a</sup>	8.54 $\pm$ 1.78 <sup>a</sup>	7.60 $\pm$ 1.63 <sup>a</sup>	8.10 $\pm$ 1.21 <sup>a</sup>
30.00	3.41 $\pm$ 0.81 <sup>a</sup>	2.93 $\pm$ 0.35 <sup>a</sup>	4.16 $\pm$ 0.55 <sup>a</sup>	8.54 $\pm$ 1.33 <sup>a</sup>	8.06 $\pm$ 1.41 <sup>a</sup>	8.32 $\pm$ 0.62 <sup>a</sup>
32.00	2.38 $\pm$ 0.36 <sup>a</sup>	1.97 $\pm$ 0.33 <sup>a</sup>	4.76 $\pm$ 0.79 <sup>a</sup>	6.71 $\pm$ 1.17 <sup>a</sup>	8.37 $\pm$ 1.46 <sup>a</sup>	7.57 $\pm$ 1.17 <sup>a</sup>
34.00	2.93 $\pm$ 0.64 <sup>a</sup>	2.70 $\pm$ 0.19 <sup>a</sup>	3.95 $\pm$ 0.83 <sup>a</sup>	5.63 $\pm$ 0.67 <sup>a</sup>	7.75 $\pm$ 1.06 <sup>a</sup>	6.71 $\pm$ 0.73 <sup>a</sup>

Values followed by the same superscript, in the same column, are not significantly different at ( $P > 0.05$ ) tested by DMRT.

The results of mean  $\pm$  standard deviation of growth performance indices and survival rates of *C. anguillaris* cultured in different temperature levels are presented in Table 4. The final bodyweight(6.71g), weight gain(5.41g) and percentage weight gain(416.15%) of *C. anguillaris* fingerlings exposed to the highest temperature(34.00°C) were

significantly reduced' ( $P < 0.05$ ) at the end of the study. However there were no significant differences ( $P > 0.05$ ) in the specific growth rate (range = 3.91% day at 34.00°C to 4.42% day at 30.00°C) and survival rates (range = 89% at 34.00°C to 94.00% at the control temperature) of *C. anguillaris* fingerlings at the end of the study.

 Table 4: Mean  $\pm$  Standard Deviation of Growth Performance Indices and Survival rates of *Clarias anguillaris* exposed to Different Temperature Levels for a Period of six weeks

Indices of growth performance	Temperature Levels(°C)			
	26.66 (control)	30.00	32.00	34.00
Initial Bodyweight(g)	1.30 <sup>a</sup>	1.30 <sup>a</sup>	1.30 <sup>a</sup>	1.30 <sup>a</sup>
Final Bodyweight (g)	8.10 <sup>b</sup>	8.32 <sup>b</sup>	7.57 <sup>b</sup>	6.71 <sup>a</sup>
Weight gain (g)	6.80 <sup>b</sup>	7.02 <sup>b</sup>	6.27 <sup>b</sup>	5.41 <sup>a</sup>
Specific growth rate (%day)	4.36 <sup>a</sup>	4.42 <sup>a</sup>	4.19 <sup>a</sup>	3.91 <sup>a</sup>
Percentage weight gain (%)	523.08 <sup>c</sup>	540.00 <sup>d</sup>	482.30 <sup>b</sup>	416.15 <sup>a</sup>
Survival rate (%)	94.00 <sup>a</sup>	93.00 <sup>a</sup>	92.00 <sup>a</sup>	89.00 <sup>a</sup>

Values followed by the same superscript, in the same row, are not significantly different at ( $P > 0.05$ ) tested by DMRT.

The results of mean  $\pm$  standard deviation of physicochemical parameter measured during the study on effect of different temperature levels on *C. anguillaris* fingerlings for a period of six(6) weeks are depicted in Table 5. The water pH (ranged from 7.18  $\pm$  0.05 at control temperature to 7.28  $\pm$  0.05 at 34.00°C), dissolved oxygen concentration(ranged from 6.00  $\pm$  0.60

mg/L at control temperature to 7.20  $\pm$  0.60 mg/L at the higher temperature levels) and biochemical oxygen demand (ranged from 2.42  $\pm$  0.08 mg/l at lower temperature levels to 2.67  $\pm$  0.50 mg/l at 34.00°C) were not significantly different ( $P > 0.05$ ) at the end of the study. However, the electrical conductivity (519.92  $\pm$  5.08 $\mu$ s/cm) of cultured media of the controlled

fingerlings was significantly reduced ( $P < 0.05$ ) when compared with the higher tested temperature levels (ranged from  $561.67 \pm 18.17 \mu\text{s/cm}$  at  $34.00^\circ\text{C}$  to  $586.33 \pm 17.50 \mu\text{s/cm}$  at  $30^\circ\text{C}$ ). The Ammonia concentration ( $1.11 \pm 0.10 \text{ mg/L}$ ) of cultured media of

controlled fingerlings was significantly reduced ( $P < 0.05$ ) when compared with the higher tested temperature levels (ranged from  $1.56 \pm 0.13 \text{ mg/L}$  at  $30.00^\circ\text{C}$  to  $1.98 \pm 0.06 \text{ mg/L}$  at  $34.00^\circ\text{C}$ ).

Table 5: Mean  $\pm$  Standard Deviation of physicochemical parameters measured during Experiment on influence of different Temperature on *Clarias anguillaris* fingerlings

Temperature Levels( $^\circ\text{C}$ )	pH	Dissolved Oxygen(mg/L)	Biochemical oxygen demand (mg/L)	Electrical conductivity ( $\mu\text{s/cm}$ )	Ammonia (mg/L)
26.66 $\pm$ 0.28 (control)	7.18 $\pm$ 0.05 <sup>a</sup>	6.00 $\pm$ 0.60 <sup>a</sup>	2.42 $\pm$ 0.08 <sup>a</sup>	519.92 $\pm$ 5.08 <sup>a</sup>	1.11 $\pm$ 0.10 <sup>a</sup>
30.00	7.23 $\pm$ 0.05 <sup>a</sup>	6.40 $\pm$ 0.60 <sup>a</sup>	2.42 $\pm$ 0.08 <sup>a</sup>	586.33 $\pm$ 17.50 <sup>a</sup>	1.56 $\pm$ 0.13 <sup>a</sup>
32.00	7.23 $\pm$ 0.05 <sup>a</sup>	7.20 $\pm$ 0.60 <sup>a</sup>	2.50 $\pm$ 0.50 <sup>a</sup>	576.67 $\pm$ 16.83 <sup>a</sup>	1.75 $\pm$ 0.25 <sup>a</sup>
34.00	7.28 $\pm$ 0.05 <sup>a</sup>	7.20 $\pm$ 0.60 <sup>a</sup>	2.67 $\pm$ 0.50 <sup>a</sup>	561.67 $\pm$ 18.17 <sup>a</sup>	1.98 $\pm$ 0.06 <sup>a</sup>

Values followed by the same superscript, in the same column, are not significantly different at ( $P > 0.05$ ) tested by DMRT.

### DISCUSSION

This study revealed that water temperature levels investigated (26.66 to  $34.00^\circ\text{C}$ ) had no influence on Total Length (TL) and Standard Length (SL) of *C. anguillaris* fingerlings. This observation was in agreement with the findings of Ayanwale *et al.* (2014) who reported that increasing water temperature from 26.91 to  $32.00^\circ\text{C}$  had no significant influence on TL and SL of *Heteroclaris* fingerlings. This growth response was expected since the *Heteroclaris* and *C. anguillaris* belong to the same family of fish known as Clariidae (Olaosebikan and Raji, 2005). However, Turan (2004) documented that phenotypic and genetic differences that usually characterize fish populations and the expression of morphometric attributes such as TL and SL have been found to be strongly influenced by fish species genetics not water temperature (Yakubu and Okunsebor, 2011). The

growth (body weight) responses of *C. anguillaris* fingerlings to water temperatures studied in weeks 1, 3 and 5 were also in conformity with the works of Turan (2004); Yakubu and Okunsebor (2011). They reported that growth parameters had been found to be strongly influenced by fish species genetics not water temperature. The decrease in body weight, final body weight, weight gain and percentage weight gain of *C. anguillaris* fingerlings at higher temperature levels recorded in this study could be attributed to loss of appetite by the fish (fingerlings) during the study period (Woyanovich, 2011). However, the above submission was contrary to the works of El-Sheriff and El-feky (2009) who observed better fish growth performance at lower temperature ( $25.00^\circ\text{C}$ ) in *Tilapia* fingerlings than at higher temperatures possibly due to species difference. Water temperatures between 26.00 to  $34.00^\circ\text{C}$  studied also had no effect on the SGR of *C. anguillaris*

fingerlings. This observation was contrary to the reports of Saber *et al.* (2004) who noted that SGR was better at 25.00°C. Similarly, El-sayeed *et al.* (1996) also reported that there was a decrease in SGR at 15.00°C and 20.00°C in *O.niloticus* exposed to 15, 20, 25 and 30°C respectively for 60 days. Tested water temperature levels investigated might not have significant effect on SGR since the water temperatures studied were within the range of 22.00 to 35.00°C tolerated for optimum growth by fishes in the tropics (Howerton, 2001). The findings of this study indicated that *C.anguillaris* fingerlings in all the temperature treatments adapted readily and survived well in captivity under the indoor conditions (Ayanwale *et al.*, 2014). This observation was consistent with those of Saber *et al.* (2004) who reported the optimal temperature for growth and survival of *O.niloticus* fingerlings were between 20 to 36°C.

Water pH of the cultured media of *C.anguillaris* fingerlings was not influenced by temperature during the study. The changes in water pH values (range =  $7.18 \pm 0.05$  to  $7.28 \pm 0.05$ ) were within the tolerance range of 6.0 to 8.0 documented for juveniles of *H. bidorsalis* and *C. garipepinus* (Ivoke *et al.*, 2001). Similarly, temperature had no influence on dissolved oxygen concentration of cultured media of *C.anguillaris* fingerlings. The dissolved oxygen concentration range of  $6.00 \pm 0.60$  to  $7.20 \pm 0.60$  mg/L recorded in this study was above the range of 3.00 to 5.00 mg/L recommended for fry, fingerlings and adults as documented by Food Agriculture Organization (FAO, 2006). Temperature had no influence on the BOD of cultured media of *C.anguillaris* fingerlings because of constant exchange of water, siphoning of uneaten feed and faecal samples from the experimental tanks (Ghanbari *et al.*,

2012). The BOD range ( $2.42 \pm 0.08$  to  $2.67 \pm 0.50$  mg/l) recorded in this study was favourable for good fish growth performance when compared with the tolerance range of 1.00 to 5.00mg/l as reported by CIESE (2010).

The reduction observed in the electrical conductivity of cultured media of *C.anguillaris* fingerlings in the controlled fingerlings could be attributed to the reduction in the movement of the mineral or ion concentration of the cultured media. This submission was in consonance with the reports of Ayanwale *et al.*(2012) who documented that water temperature might probably influenced the mineral or ion concentration (conductivity) of the cultured media. However, the conductivity range from  $519.92 \pm 5.08$  to  $586.33 \pm 17.50$   $\mu\text{s}/\text{cm}$  was higher when compared with the range of 120 to 340 $\mu\text{s}/\text{cm}$  recommended for fish growth by Kolo (1996). The similar reduction recorded in the ammonia concentration of cultured media of controlled *C.anguillaris* fingerlings could be attributed to decrease in the metabolic activities at the lowest temperature level during the study period (Krishnamaorthy *et al.*, 2008). Although, the ammonia concentration range of  $1.11 \pm 0.10$  to  $1.98 \pm 0.06$ mg/L was above the range of 0.01 to 1.55mg/l for freshwater fingerlings as reported by Kohinoor *et al.* (1994).

## CONCLUSION

The final body weight, weight gain and percentage weight gain reduced at 34.00°C. The electrical conductivity and ammonia concentration of cultured media of *C.anguillaris* fingerlings increased with increase in water temperature. Water temperatures between 26.66 – 32.00°C could support the growth and survival rates of *C.anguillaris* fingerlings.



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