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SURVIVAL AND GROWTH OF *Clarias gariepinus* FRY REARED AT DIFFERENT STOCKING DENSITIES

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ABSTRACT

In catfish hatchery facilities, 15 circular plastic tanks 100L volume were stocked with *C. gariepinus* fry (0.533±0.03 g) at five densities of T_1 (20), T_2 (40), T_3 (60), T_4 (80) and T_5 (100) fry/L. 15% body weight 4 times a day commercial fry feed (45% crude protein; crude fiber 6.2%; fats content 8.8%; ash content 8.1% and 22.76 KJ GE/100 g) were added daily for 42 days. By continues flow, water quality parameters was adjusted at the ranged of 26-28.3 ^{0}C, 6.8-3.3 mg/L, 6.5-8.0 and 0.05 – 0.18 mg/L for temperature, dissolved oxygen, pH and total ammonia respectively. The result showed that water quality, growth parameters and survival rate was density dependence. Final weight, weight gain, daily weight gain, RGR, PER and survival rate were significantly ($p<0.05$) stocking density dependent. FCR was significantly ($p<0.05$) increase with the increasing stocking density of fry. The best growth performances and survival rate were recorded in lower stocking density T_1 (20fry/L) while the lowest was in high stocking level T_5 (100fry/L). The result also showed that to achieve better growth and best survival for maximizing the production of *C. gariepinus* 40 fry/L in plastic tanks with conditioning of continues water flow under good quality commercial diet were applied.

Keywords: Growth performance, Survival, *Clarias gariepinus*, fry, stocking density.

INTRODUCTION

In Sudan, the production of African catfish has increased rapidly and great attention has been paid to culture in earthen pond, concert pond, cage, lagoon, pools, water harvest and enclosures in the last few years and apparently market demand also showed greatly increasing (Hagar, 2016). The high values, hardly nature, tolerance to adverse ecological conditions facilities its culture (El-Sayed, 2002). The good quality catfish seed and blending of mass quantity have been a major problem to producers for targeting high yields (Haylor, 1992). Most of African catfish seeds were collected from the wild in breeding areas thus the depletion of stock (Boujard *et al.*, 2002), multi species, variation in size (Schram *et al.*, 2006) and disease transition (Hagar, 2015) were taken place. Studies on the hatching of African catfish *C. gariepinus* abound but information of intensive of fry rearing and suitability densities are limited. In intensively production of fry and finger-lings several factors influence survival and growth such as feeding (Kerdchuen, 1992), water quality (Brazil and Wolters, 2002), and stocking density (Sahoo *et al*., 2004, Rahman *et al.*, 2005). Stocking density of fry is an important factor determining the growth and the successful production quantity (Engle and Valderrama, 2001). Many studies in the this field have been studied on some fishes, *Heterobranchus longifilis* (Ewa-Oboho and Enyenihi, 1999), *Clarias batrachus* (Coulibaly *et al*., 2007) and *Chrysichthys nigrodigitatus* (Pangni *et at*., 2008). For successful production of *C. gariepinus* fry and finger-lings in good quality and rational quantities research, practices and more information was requires to achieve optimum growth and survival rate. The objective of this research is to study the effects of varying stocking densities on growth performance and survival rate of *C. gariepinus* fry reared in plastic tank in continues flow of water.

MATERIALS AND METHODS

The experiment was conducted using 15 plastic tanks (100 L) filled with 80 L of well uniformly aerated water. The early *C. gariepinus* fry (0.53 g) obtained from hatchery in same farm were stocked randomly according to the following densities 20, 40, 60, 80 and 100 fry/L. Each treatment was carried out in triplicate. Fry were fed commercial diet (45% crude protein; crude fiber 6.2%; fats content 8.8%; ash content 8.1% and 22.76 KJ GE/100 g) 4 times daily at 15% of the total biomass. The excess, left over and uneaten feed or fecal wastes were drained out with continues water flow. Fish weight was recorded every 5 days, a total of 50 fry were taken from each tank and weighed using an table digital balance model: V21HD15 accuracy of 1.01±0.01mg. The average weight was calculated to readjust the dose of feed requirement. Dead fish in each tank were removed and recorded. Water was changes gradually three times a day and water quality parameters was evaluated and measured two time a day, such parameters were measured water temperature, dissolved oxygen, pH and total ammonia were estimated one time a day. After 42 days of rearing all survival fry were collected, counted, weighed, and individual body weight was recorded. Final weight, weight gain, daily weight gain, relative growth rate, feed conversion ratio, protein efficiency ratio and survival rate were calculated using following equations:

- Weight Gain (g/fish): $WG = W2 – W1$.
- Daily Weight Gain: $DWG = \{W2 – W\ 1\} \div T$.
- Relative growth rate: $RGR = \{(W2–W1)\div W2\}\times 100$.
- Feed conversion ratio: FCR = Feed intake (g) ÷ Weight gain (g)
- Protein efficiency ratio: PER = Weight gain (g) ÷ Protein intake (g)

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Volume:04, Issue:02 "March-April 2018"

- Survival Rate (%) ={(Final no.fish–Initial No.fish)÷Initial no.fish×100
  - Where:
    - W1 = the initial weight (g).
    - W2 = the final weight (g).
    - T = Experimental period in days.

Data were analyzed using SPSS (version 22). Results were compared with ANOVA and considered significant at $p<0.05$. Duncan's test was used to identify statistically significant differences among treatment means.

RESULTS

The water quality parameters and the growth performance evaluate in well uniformly aerated water during experimental period are obtained in table (1) and (2):

Table 1: water quality parameters (means ± SE) of *C. gariepinus* fry reared under different stocking densities.

Variable	T_1	T_2	T_3	T_4	T_5
Temperature	$26.0^{a} \pm 0.58$	$28.3^{a} \pm 0.33$	$26.7^{a} \pm 0.67$	$27.7^{a} \pm 0.67$	$27.7^{a} \pm 1.33$
DO	$6.97^{b} \pm 0.77$	$6.87^{b} \pm 0.35$	$7.33^{b} \pm 0.59$	$4.20^{a} \pm 0.61$	$3.73^{a} \pm 0.91$
pH	$6.80^{ab} \pm 0.26$	$6.50^{a} \pm 0.23$	$7.67^{bc} \pm 0.23$	$7.73^{bc} \pm 0.50$	$8.00^{d} \pm 0.15$
Total ammonia	$0.05^{a} \pm 0.006$	$0.08^{b} \pm 0.007$	$0.09^{b} \pm 0.009$	$0.16^{c} \pm 0.007$	$0.18^{d} \pm 0.006$

Means with similar superscripts in a raw are statistically significantly indifferent ($p>0.05$); those with different superscripts are statistically significantly different ($p<0.05$).

From table (1) the temperature as variable doesn't resulted any variation between different stocking densities ($p>0.05$). Total ammonia were significantly increased with stocking density increase ($p<0.05$). However the means values of dissolved oxygen were significantly lower ($p<0.05$) in 80 fry/L and 100 fry/L. The growth performance and survival rate measured in table (2) enlighten that final weight, weight gain, RGR, PER and survival rate was decreases with increase the stocking density and Duncan test showed significantly differences ($p<0.05$) between five stocking density. Other parameters measured include FCR and mortality rate were significantly increase ($p<0.05$) with increasing the stocking density of fry. The stocking density showed significant effect ($p<0.05$) on water quality and growth rate. Survival rate was also significantly affected ($p<0.05$) by the stocking density which is dramatically decrease with the increase of the stocking density.

ISSN: 2455-6939

Volume:04, Issue:02 "March-April 2018"

Table 2: Growth performance of (means ± SE) *C. gariepinus* fry fed commercial diet reared under different stocking density.

Variable	T_1	T_2	T_3	T_4	T_5
Initial wt g	$0.546^a \pm 0.03$	$0.516^a \pm 0.01$	$0.533^a \pm 0.03$	$0.521^a \pm 0.02$	$0.551^a \pm 0.04$
Final wt g	$6.634^d \pm 0.28$	$5.469^c \pm 0.32$	$3.509^b \pm 0.27$	$2.420^a \pm 0.36$	$1.621^a \pm 0.31$
Weight gain g	$6.088^d \pm 0.30$	$4.952^c \pm 0.32$	$2.977^b \pm 0.25$	$1.899^a \pm 0.34$	$1.069^a \pm 0.27$
DWG g/d	$0.145^d \pm 0.01$	$0.118^c \pm 0.01$	$0.071^b \pm 0.01$	$0.045^a \pm 0.01$	$0.0256^a \pm 0.01$
RGR %	$91.711^c \pm 0.72$	$90.498^c \pm 0.57$	$84.763^{bc} \pm 0.66$	$77.767^b \pm 2.40$	$63.848^a \pm 5.59$
FCR	$1.91^a \pm 0.04$	$2.32^a \pm 0.25$	$2.90^a \pm 0.19$	$2.83^a \pm 0.14$	$4.76^b \pm 1.10$
PER	$0.14^d \pm 0.01$	$0.11^c \pm 0.01$	$0.07^b \pm 0.01$	$0.04^a \pm 0.01$	$0.02^a \pm 0.01$
Survival rate %	$66.49^d \pm 3.47$	$61.99^d \pm 2.07$	$51.69^c \pm 1.92$	$38.51^b \pm 3.71$	$28.95^a \pm 3.38$

Means with similar superscripts in a raw are statistically significantly indifferent ($p>0.05$); those with different superscripts are statistically significantly different ($p<0.05$).

DISCUSSION

Growth and survival is a concern issues of the final expected outcome of gains and losses within the consideration of different stocking density under well uniformly aerated water and commercial feeding conditions. In the present study the water quality in rearing tank were significantly affect by varying stocking density, in (T_5) (100 fry/L) low survival rate were expected due to unhygienic condition due to excessive accumulation of bio-organic which is resulted to low dissolved oxygen (3.73mg/L), high level of total ammonia (0.18 mg/L) and bio-chemical stress factors take place which is lead to change in water quality and mortality was expected (Owodeinde and Ndimele., 2011). From the other hand high levels of dissolved oxygen low level of ammonia were increase growth of African catfish *Clareas gariepinus* larvae and fry reared in tanks (Brazil and Wolters 2002). In general, high weight gain of catfish fry resulted when dissolved oxygen at level over 6.79mg/L such studies similar to result obtained by Ataguba *et al*. (2009). Regarding with growth parameters and growth performance the five stocking densities of fry showed highly significant differences ($p<0.01$) in final weight, weight gain, daily weight gain, PER and survival rate. These findings was in agreement of De Graaf *et al*. (1995); Ataguba *et al*. (2009) and Owodeinde and Ndimele (2011) in *C. gariepinus*. De Graaf *et al*. (1995) reported that the weight gain, percentage weight gain and average daily growth of pure breed fry of *C. gariepinus* induced with synthetic hormone were significantly ($p<0.05$) affected with different stocking densities. Adewolu *et al*. (2008) and Odedeyi (2007) showed that the hybrid *C. gariepinus* had the highest specific growth rate in in medium stocking densities. In fact, under crowded conditions at higher stocking densities, fish suffer stress as result of aggressive feeding interaction and eat less, resulting in growth retardation (Bjoernsson 1994). On the other hand high stocking density as a technique to maximize space usage and increase stock production has been shown to have an adverse effect on growth (Odedeyi, 2007). The present findings showed that the stocking level of 40 fry/liter produced the best growth rate (5.469 - 6.63g) and highest percentage survival (61.99 – 66.49%). The decline in growth performance was attributed to increasing of the stocking density and at lower stocking densities all fry received adequate amounts of food, compared to those of higher densities. According to Madu (1986) *C. gariepinus* maintained at a density of 100fry/m^3 grow faster than maintained at 500/m^3. In larvae and fry culture feeding and stocking density influence survival rate (Sahoo *et al*., 2004; Rahman *et al.*, 2005). Suziki *et al.* (2001) observed that increase in stocking density results in increasing stress, which leads to higher energy requirements, causing a reduction in growth, feed utilization and survival rate. In the current study the low mortality, good survival and appreciable growth were recorded in treatments with low stocking densities which available space, reduced stress related behaviors and competition for feed compared with high stocking densities which impaired the tank environmentally metabolic wastes, nitrogen compounds and low concentrations of dissolved oxygen. The present findings are in harmony with Wendelaar (1997); Eyo *et al*. (1998); Braun *et al*. (2010) and Bjoernsson (1994). Haylor (1992) reported that the stocking density did not affect survival of *C. gariepinus* fry reared in floating cages. This is probably due to continues supply of natural food and renewal of water. The feed efficiency were negatively correlated with stocking density. This may indicates that high stocking density reduced feed efficiency. Similar results have been reported in other fish species such as *Cyprinus carpio* larvae (Jha and Barat 2005) and *Tor putitora* larvae (Rahman *et al*., 2005).

CONCLUSION

According to the results can conclude that the stocking density had a significant effect growth performance and survival rate. Treatment T_1 (20 fry/L) produced the highest final weight gain and the highest survival rate while treatment T_2 (40 fry/L) gave the best benefit to the hatchery producers with expense of survival rate and total mass quantity. Refer to the general finding behind growing fish at different stocking density is to achieve the best growth performance and better survival rate for maximizing the production, this result has revels that *C. gariepinus* can be grown at density as high as 40 fry/L in plastic tanks in condition of continues flow of water under good quality commercial diet.

ISSN: 2455-6939

Volume:04, Issue:02 "March-April 2018"

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Volume:04, Issue:02 "March-April 2018"

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ISSN: 2455-6939

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