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Short Communication

Stocking Density and its Effect on Growth Parameters of Catfish *Rita rita* (Hamilton) Reared in Cemented Cisterns

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Authors' Contributions
SJ did experimental work and the article is part of his PhD work. NTN supervised the research and presented the idea. PK analysed the data. YMJ collected the samples.

Key words
Stocking density, Growth parameters, Catfish, *Rita rita*, Cemented cisterns.

ABSTRACT

The present paper deals with stocking density and its effect on growth parameters of *R. rita* reared in cemented cisterns during June to August 2016. Three stocking densities with 10, 20 and 30 fish/1.25m^2 cemented cisterns were maintained and growth of fish was observed. Significantly highest growth in terms of weight gain was recorded with density of 20 fish /cistern (26.4 g) as compared with cistern containing 10 fish (11.7 g) or 30 fish/cistern (8.8 g). The survival and specific growth rates were also found highest in cistern II with 20 fish (100% and 0.48) followed by cistern I with 10 fish (90% and 0.36). While significantly ($p<0.05$) lowest survival rate and SGR was recorded (80% and 0.31) for cistern III. It was concluded that the suitable stocking density 20 fish/m^2 (II) exhibited significantly higher growth of *Rita rita* in cemented cisterns among the treatment. The temperature 28.1-30.7°C, pH 7.0-7.60, DO 3.9-4.9 (mg/L), alkalinity 155-175 (mg/L), ammonia 0.37-0.52 (mg/L) and nitrate 0.168-0.174 (mg/L) were found to provide optimum condition to the fish.

In aquaculture stocking density is important variables as it has direct influences on survival, growth, behavior, health, water quality, feeding and production (Backiel and Le Cren, 1978). For better growth and survival of any fish spices, largely depending upon the suitable stocking density Sardar and Mollah (1991). Successful aquaculture requires careful species selection, appropriate diet and management of water quality parameters (Barua, 1990). Narejo *et al*., (2010) recommends that the growth of fish is inversely proportionate to density in fish culture operations that may be regarded for better growth and survival. Stocking density may influence with water quality availability of food and condition of the environment (Zahida and Zidni, 2015). The catfish, *Rita rita,* locally known as Khagga is a medium to large sized demersal commercially important catfish which generally attains length up to 150 cm (Mirza, 1980; Talwar and Jhingran, 1991). There is a prospect for culture of catfish in Pakistan, if the fishery of *Rita rita* could be developed, Pakistan would be able to earn a lot of foreign exchange by exporting this fish is future.

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Materials and methods

For the present study 150 juveniles of experimental fish *R. rita* of mean initial weight of 9.70±1.2g were procured from the stock, maintained in cemented cisterns (size 1.25m^2) in the University. The experiment was started from June-August 2016 in three cemented cisterns with 10, 20 and 30 fish/cisterns.

The experimental fish was fed with the chicken viscera procured from the local market once a day at 8 AM in the morning at the rate of 5% of body weight. The amount of feed was adjusted after weighing the fish after monthly sampling.

Water quality parameters like pH, temperature, dissolved oxygen, alkalinity, and ammonia nitrate were monitored fortnightly with the help of analyzer number C-6020 throughout the study period.

Results

The growth of *R. rita* in cemented cisterns showed variation among different densities. 20 fish/cistern exhibited significantly ($p >0.05$) highest growth in terms of weight gain (26.4 g) followed by 10 (11.7 g) and 30 (8.8 g) fish/cistern. The specific growth (SGR% day) and survival rates was also highest with 20 fish/cistern (0.48

and 100%) in comparison to 10 (0.36 and 90%) and 30 (0.31 and 80%) fish/cistern (Table I).

Table I.- Data on growth performance of catfish, *Rita rita* (Hamilton) under different stocking densities reared in cemented cisterns fed with chopped chicken viscera.

Parameters	Cistern I (n=10)	Cistern II (n=20)	Cistern III (n=30)
Mean initial wt. (g)	9.4 [a1] ± 0.33[2]	9.4 [a1] ± 0.58[2]	9.4 [a1] ± 0.14[2]
Mean final wt. (g)	20.1[b] ± 0.28	35.8[a] ± 0.84	18.20[c] ± 0.42
Mean wt. gain (g)	11.7[b] ± 0.35	26.4[a] ± 0.53	8.8[c] ± 0.28
Wt. gain (%)	113.82[b]±2.57	174.46[a]±2.06	82.97[c]±1.75
SGR (%per day)	0.36[b] ± 0.014	0.48[a] ± 0.014	0.31[c] ± 0.013
FCR	3.61[b] ± 0.19	2.57[c] ± 0.23	4.08[a] ± 0.13
Survival rate (%)	90.0[b] ± 1.0	100.0[a] ± 0.0	80.0[c] ± 2.0
Production (kg/m^3/90 days)	0.308[b] ± 0.0012	0.206[c] ± 0.001	0.406[a] ± 0.001

[1]Figure in the same row having same superscripts are not significantly ($p<0.05$) different when compared on the basis of Duncan's new Multiple Range test. [2]Standard deviation. Wt., weight.

Table II.- Month-wise variation in water quality parameters of cemented cisterns throughout the study period.

Para-meters	Months			Ref. ranges*
	June	July	August	
	Mean (Range)	Mean (Range)	Mean (Range)	
Temp. (ºC)	29.1±1.0 (28.1-30.1)	30.6±0.1 (30.5-30.7)	30.3±0.2 (30.1-30.5)	18.5-30.0
pH	7.30±0.3 (7.0-7.6)	7.45±0.1 (7.35-7.55)	7.55±0.5 (7.50-7.60)	6.5-8.5
D.O. mg/L	4.7±0.2 (4.5-4.9)	4.0±0.1 (3.9-4.1)	4.1±0.1 (4.0-4.2)	4.0-9.0
Alkalinity mg/L	160±5.0 (155-165)	170±5.0 (165-175)	159±1.0 (158-160)	100-200
Ammonia mg/L	0.38±0.1 (0.37-0.39)	0.44±0.2 (0.42.0.46)	0.50±0.2 (0.48-0.52)	0. 5- 1.0
Nitrite mg/L	0.169±0.01 (0.168-0.170)	0.172±0.2 (0.170-0.174)	0.170±0.2 (0.168-0.172)	0.1-0.2

*WHO (2000).

Water quality parameters were taken into consideration like power of hydrogen ion concentration (pH), temperature (°C), conductivity, dissolved oxygen, nitrate, ammonia were recorded on monthly basis throughout the study period (Table II). The values of temperature (28.1-30.7), pH (7.0-7.60), DO (3.9-4.9), alkalinity (155-175) ammonia (0.37-0.52) and nitrate (0.168-0.174). It was observed from values of above parameters were found to be within the ranges of fish culture operations.

Discussion

The impact of density on survival and growth rate of catfish *Rita rita* under different densities like 10, 20 and 30 fish/cistern, results of the experiment showed highest survival, specific growth rate and growth in 20 fish/cistern. No competition for food and space observed at low density culture of this fish. Number of researchers have indicated that this may be due to less competition, environmental conditions, and more space for movement at low density in relation to high density (Narejo *et al*., 2005; Begum *et al*., 2008; Alla *et al*., 2016; Wang *et al*., 2017; Darmawan and Suharyanto, 2017). Survival rate in aquatic animals negatively correlated with stocking. It could be due to high competition and space for the fishes. Darmawan and Suharyanto (2017) observed that *Pangasius larnandi* attained an average weight of 0.45 kg on the termination of one year and 1.0 kg in two years when stocked 25fish/m^3 while *P. sutchi* attained 4.0 kg in two years. de Assis Lago *et al*. (2014) commented that less density gave more survival and growth in *Brycon orthotaenia*. Begum *et al*. (2008) were of the view that low density resulted high growth and survival of *Mystus gulio*. Alla *et al*. (2016) observed high survival rate with rise in density of catfish, *Heterobranchus bidorsalis*. Hossain *et al*. (1998) reported stocking density of *Clarias gariepinus* fingerlings and resulted as highest growth at low density the rate of survival also found to be density affected. Narejo *et al*. (2005) worked on density of *Heteropneustus fossilis* have applied three stocking densities 8, 16 and 24 fishes/m^{3}and found significantly ($P<0.05$) highest growth at low density. Variation among the survival rates of *R. rita* ranged between 100 and 80%. Gree (2011) observed that the channel catfish could be raised at low density and effective water quality. Besides that several researchers (Narejo *et al*., 2003, 2005; Begum *et al*., 2008; Suleiman and Soloman, 2017; Sindhu *et al*., 2017) have shown that low growth resulted with high density and high growth at low stocking density and lowest growth rate with high stocking density which conforms to the present findings.

The temperature of water in the present study varied from 26.8-30.6 which was influenced by the variation in temperature during morning and evening. The various authors (Kadiri, 2002; Atoma, 2004; Julian *et al*., 2008; Ask *et al*., 2009) have given the temperature values and ranges that are similar to the present study. Range of DO in current study was 4.0-4.8. Dastagir *et al*. (2014) also supports the present findings. Boyd and Tucker (1998) describes the content of oxygen in the ponds, stream and lakes is mainly due to various reasons such as temperature, movement in water, pollution and supply of fresh water.

In the present study the pH ranged between 7.30-7.55. Chnadrashekhar *et al*. (2003); Dastagir *et al*. (2014) and Rahim *et al*. (2017) reported pH values for fish culture operations ranged between 6. 5- 8.5. The above mentioned ranges are in agreement with the present findings.

Statement of conflict of interest

Authors have declared no conflict of interest.

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