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# EFFECT OF STOCKING DENESITY AND FEEDING RATE ON PRODUCTION OF EARTHENPONDS CULTURED WITH NILE TILAPIA *(Oreochromis niloticus)*.

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## ABSTRACT

The study was conducted over a 98 days period in order to study effects of stocking density and feeding rate on production of earthen ponds cultured with Nile tilapia *(Oreochromis niloticus)*. Each hapa measuring 2*4*1m was suspended in an earthen pond (4000m$^2$). There were 6 treatments, each consisting of three replicates, stocked with fish of mean individual initial bodyweigh19g. A total number of 32, 64 and 128 Nile tilapia were randomly distributed into 6 treatment groups, representing 3 stocking rates, and were fed daily at rates (zero, 3, and 4%) of fish live bodyweight. Fish were fed a balanced diet of 28.5% crude protein along the period of the experiment. The treatments were stocking densities (4, 8, and 16 fish/m$^3$) and feeding rates (zero, 3, and 4%). The results indicate that the best final bodyweight, feed utilization, physiological status, and chemical composition was obtained by group T7 (stocking density 4fish/m$^3$ and feeding rate 4%).

**Keywords**: Nile tilapia, stocking density, feeding rate, earthen pond, growth performance, chemical composition.

## INTRODUCTION

Tilapias have a high reproduction capacity, fats growth, extensive feeding, and high resistance to disease; therefor, they have been recommended by the FAO to be a good culture species. There is a great need to increase fish production via aquaculture in Egypt to fill the gap in animal protein in the country. In 2006, fish production from aquaculture activities contributed by 61.28% of total fish production which amounted 970.9l3 metric tons. GAFRD (2006) stated that the full utilization of space for maximum fish production through intensive culture can improve the profitability of the fish farm. Fish intensification by increasing stocking density is also found suitable to overcome the problem of land shortage (Chakraborty and Banerjee, 2010). However, Chang (1988) reported that fish stocking density and feeding rates are important factors used in aquaculture as it can affect natural food availability, the efficient utilization of food resource and total fish yield in ponds. The objective of the present study was to determine the effect of different stocking densities and feeding rates on growth performance, feed utilization, carcass composition and blood analysis of Nile tilapia reared in floating hapas in an earthen pond.

## MATERIALS AND METHODS

The present work was conducted in a fish farm in Kafr El-Sheikh governorate during season 2013 in order to evaluate daily feeding rates (0, 3, and 4%) and stocking densities (4, 8, and 16 fish /$m^3$) on growth performance and chemical composition under Egyptian conditions.

**Fish culture system:**

A total number of 1344 Nile tilapia fish *(Oreohcromis niloticus)* with an average bodyweight of 19 g were obtained from (a private fish farm at) Metobese area, belonging to Kafr El-Sheikh governorate, Egypt. Each size of fishes was randomly distributed among 18 hapa. Each hapa measuring 2*4*1m as width, length, and depth, respectively. Hapas were suspended in an earthen pond of 4200 $m^2$. The stocking densities were 4, 8 and 16 fish/$m^3$). Thirteen fish were kept frozen at -20 $C^0$ for chemical analysis at the beginning of the experiment. The pond was supplied with fresh water from Metobese area. The water exchange rate was 15% of total pond's water volume/day. The experimental period was 98 days (from 1/6 to 30/8/ 2014). Water pH was measured using pH meter (model 68 Engineered system and Designs). Water dissolved oxygen and temperature were measured p.m. by oxygen meter (WPA 20 scientific instrument).

**Experimental diets:**

Fingerlings were fed a commercial diet (Go-Traid, Industrial Area, $6^{th}$ of *october*) containing 28.5% crude protein and 4000 Kcal/Kg at feeding rates of 3%, and 4% of fresh biomass in each hapa (six days per week). Fish were fed two times daily at 8 am and 2 pm with feed amounts adjusted at approximately 14 day-intervals in response to the actual weight. Ingredients and composition of the experimental diet are presented in Table 1.

**Table 1: Ingredients and chemical analysis (%) of the commercial diet.**

| Ingredients | Commercial diet |
|---|---|
| Fish meal | 14.0 |
| Soybean meal | 40.0 |
| Yellow corn | 20.0 |
| Wheat bran | 11.0 |
| Vegetable oil | 4.0 |
| Vitamins & Minerals premix | 0.6 |
| Rice bran | 10.0 |
| Limestone | 0.4 |
| Total | 100 |
| Chemical analysis | |
| Dry matter (DM) | 90 |
| Crude protein (CP) | 28.5 |
| Ether extract (EE) | 6.8 |
| Crude fiber (CF) | 6.2 |
| Ash | 8.9 |
| Nitrogen-free extract (NFE)* | 49.6 |
| GE (kcal/kg)** | 3755 |
| DG (kcal/kg) | 2816 |
| ME (kcal/kg) | 3100 |
| P/E (mg CP/Kcal GE) | 99.7 |

*** Nitrogen. Free extract NFE=100(CP%+EE%+CF%+ash %)**

*** *GE= Gross energy was calculated by multiply the Factors 4.1, 6.5 and 9.44 Kilo GE/g DM for carbohydrate, protein and Fat, respectively(Jobling,1983).**

**Growth parameters:**

Average total gain (ATG), average daily gain (ADG), specific growth rate (SGR), feed conversion ratio (FCR), protein efficiency ratio (PER), protein productive value (PPV) and survival rate (SR) were calculated according to the following equations:

ATG (g/fish) = [Average finale weigh (g)-Average initial weigh (g)].

ADG (g/fish/ day) =ATG/experimental period (d).

SGR (%/day) = [Ln final body weight –Ln initial body weight *100/ experimental period (d)].

FCR= feed intake (g)/live weight gain.

PER = Live weight gain (g)/protein intake (g).

PPV (%) =100[final fish body protein (g) –initial fish body protein (g)/crude protein intake (g).

SR (%) = 100[total No of fish at the end of the experimental period /total No of fish at the start of the experiment.

**Proximate analysis:**

Dry matter, crude protein, ether extract, (crude fiber), and ash contents of the commercial diet and whole body of fish at the beginning and at the end of the experimental were preformed according to A.O.A.C (1990).

**Blood parameters determination:**

At the end of the experimental period, blood samples from the different groups were taken from the caudal vein for analysis. Adequate amounts of whole blood in small plastic vials containing heparin were used. Blood plasma (after the centrifugation of the whole blood samples) was sent immediately to a private human clinical laboratory for determination of the biochemical parameters (using commercial kits obtained from Diamond Diagnostic Company, Egypt) including total proteins (TP) after the method of Henry (1964) and albumin according to the method of Kohin (1958). Whereas globulin was calculated by mathematical subtraction of albumin value form total proteins (Kohin 1958). Alanine aminotransferase (ALT) and aspartate aminotransferase (AST) activities were assayed according to the method of Reitman and Frankel (1957) using commercial kits purchased from Randox Company. Glucose was determined calorimetrically according to Trinder (1969). Cortisol levels were determined by an electrochemiluminometric assay using the Elecsys and Cobas e 411 Immunoassay Analyzer (Roche Diagnostics, Indianapolis, IN, USA). Other biochemical parameters were determined using commercial kits too.

**Statistical analysis:**

Analysis of variance (ANOVA) was used for analyzing collected data with the aid of statistical analysis system (SAS, 2006), Duncan's (1955) test was used to assess the significance between different stocking densities and feeding regimes.

## RESULTS AND DISCUSSION

**Chemical composition of the experiment of diets:**

Chemical composition and calculated energy of deferent diets are presented in Table 1. The CP content was between 28 to 28.5% on DM basis. Such level was within the range suggested by NRC (1993). The calculated gross energy (GE) was 375.5 Kcal/100g.

**Quality Parameters of rearing water:**

All tested water quality criteria (Table 2) were suitable for rearing Nile tilapia fingerlings as cited by Abdel-Hakim *et al.* (2002). Since water temperature ranged between 24.9 and 26.5C$^0$, pH values 6.8 and 6.9, ammonia ranged between 0.09 and 0.11 mg/l, nitrate ranged between 0.23 and 0.26 mg/l, and nitrite ranged between 0.15 and 0.26. Also, Abdelhamid *et al*. (2002) suggested that these values are suitable for rearing Nile tilapia.

**Table 2: Effect of stoking density and feeding rate on water quality of Nile tilapia *(Oreohcromis niloticus)*.**

| Stocking density | Feeding rate | Temperature (C°) | Dissolved Oxygen ($mgl^{-1}$) | PH | Ammonia ($mgl^{-1}$) | Nitrate ($mgl^{-1}$) | Nitrite ($mgl^{-1}$) |
|---|---|---|---|---|---|---|---|
| 4/m$^3$ | 3% | 24.9± 0.1 | 3.8± 0.22 | 6.9± 0.103 | 0.11± 0.017 | 0.242± 0.82 | 0.20± 0.038 |
| | 4% | 25.5± 0.0 | 4.1± 0.22 | 6.8± 0.103 | 0.09± 0.017 | 0.234± 0.82 | 0.26± 0.038 |
| | | 25.1± 0.0 | 4.0 ± 0.15 | 6.9± 0.07 | 0.10± 0.012 | 0.240± 0.58 | 0.23± 0.027 |
| 8/m$^3$ | 3% | 26.1± 0.1 | 3.8± 0.22 | 6.8± 0.103 | 0.09± 0.017 | 0.250± 0.82 | 0.25± 0.038 |
| | 4% | 25.5± 0 .02 | 4.0± 0.22 | 6.9± 0.103 | 0.09± 0.017 | 0.250± 0.82 | 0.26± 0.038 |
| | | 26.2± 0.1 | 3.9± 0.15 | 6.80± 0.07 | 0.09± 0.012 | 0.250± 0.58 | 0.20± 0.027 |
| 16/m$^3$ | 3% | 25.5 ± 0.6 | 3.8± 0.22 | 6.9± 0.103 | 0.10± 0.017 | 0.260± 0.82 | 0.26± 0.038 |
| | 4% | 26.5± 0.1 | 4.1± 0.22 | 6.8± 0.103 | 0.09± 0.017 | 0.234± 0.82 | 0.26± 0.038 |
| | | 26.4± 0.8 | 3.9± 0.15 | 6.9± 0.07 | 0.1± 00.012 | 0.250± 0.58 | 0.26± 0.027 |

**Growth performance and survival rate:**

At the end of the experimental period, both groups T6 and T1 (4 fish/m$^3$, and feeding rate 4% and 4 fish/ m$^3$, and feeding rate zero). followed by T4 (4 fish/m$^3$ and feeding rate 3%) gave significant increases in total weight gain (TWG), average daily gain (ADG), specific growth rate (SGR), and survival rate (SR). There were significant (P≤ 0.05) differences among various groups of fish concerning final body weight, daily gain, specific growth rate, and survival rate of the experimented fish, being the best values in favor of T6 and T1, which seem even more better than the T2, T3, T5, T6, T8, and T9. These results are demonstrated in Table 3. These results are supported by those of Amar (2009) and Awad 92015). Abdel–Hakim *et al.* (1995) who reported that growth performance of Nile tilapia cultured in earthen ponds decreased as the stoking density increased from 3000 to 4500 or 6000 fish/feddan. In this connection, Pagan (1970), Suwanasart (1971), and Cohche (1976) showed that growth rate of fish in general decreased with increasing stocking rate. Furthermore, Moav *et al.* (1977) and Barlarin (1979) showed that body weight and growth rate of fish stocked at higher rates showed depression, may be attributed to crowding, social interaction and aggression. Also, results in Table 3 are in agreement with the finding of Abdel-Hakim *et al.* (2008) who reported that lower stocking densities (16000 fish/feddan) resulted in significantly higher final weights and lengths of fish compared with the 19000 and 22400 fish/feddan. Furthermore, Zannatul *et al*. (2014) indicated in general that the highest initial weights influences the bodyweight during the growth period, it gives the highest final weight and highest SGR. Results of Abdel- Hakim *et al* .(2001) showed that increasing tilapia stocking density from 50 to 100 or 150 fish /$m^3$ of tank water decreased significantly final body weight and length of fish.

**Table 3: Effect of stoking density and feeding rate on growth performance of Nile tilapia *(Oreochcromis niloticus)*.**

| Feeding rate (FR) | Overall regardless of feeding rate | | | FR-Level 3% | | | FR-Level 4% | | |
|---|---|---|---|---|---|---|---|---|---|
| | T1 | T2 | T3 | T4 | T5 | T6 | T7 | T8 | T9 |
| Stocking density | 4 f/m3 | 8 f/m3 | 16 f/m3 | 4 f/m3 | 8 f/m3 | 16 f/m3 | 4 f/m3 | 8 f/m3 | 16 f/m3 |
| Initial body weight (g) | 19.61± 0.07a | 19.58± 0.03a | 19.62± 0.07a | 19.58± 0.14a | 19.63± 0.07a | 19.32± 0.09a | 19.63± 0.05a | 19.71± 0.03a | 19.53± 0.09a |
| Final body weight (g) | 173.58± 4.68a | 139.56± 2.79b | 103.25± 1.46c | 169.93± 8.02a | 139.00± 5.29b | 102.59± 1.72c | 177.23± 5.65a | 140.12± 3.26b | 103.92± 2.70c |
| WG (g) | 153.97± 4.62a | 119.84± 2.82b | 83.83± 1.41c | 150.35± 7.88a | 119.27± 5.36b | 83.27± 1.63c | 157.60± 5.61a | 120.41± 3.26b | 84.39± 2.63c |
| FI (g) | 189.21± 38.80c | 164.00± 63.46b | 124.24± 75.39a | 158.88± 23.17c | 137.59± 6.85b | 108.67± 24.27a | 219.53± 21.24c | 190.41± 15.56b | 139.81± 15.6a |
| SGR (%/d) | 2.42± 0.17a | 2.17± 0.17b | 1.85± 0.17 c | 2.34± 0.24a | 2.17± 0.24b | 1.85± 0.24c | 2.44± 0.24a | 2.18± 0.24b | 1.85± 0.24c |
| SR (%) | 99.2 | 98.3 | 94.5 | 99.3 | 98.3 | 98.0 | 99.0 | 98.3 | 91.0 |

**Means bearing different small letters are significant at ($P<0.05$).**
**T1= 4 fish/$m^3$ and feeding rate zero, T2= 8 fish/$m^3$ and feeding rate zero, T3= 16 fish/$m^3$ and feeding rate zero, T4= 4 fish/$m^3$ and feeding rate 3%, T5= 8 fish/$m^3$ and feeding rate 3%, T6= 16 fish/$m^3$ and feeding rate 3%, T7= 4 fish/$m^3$ and feeding rate 4%, T8= 8 fish/$m^3$ and feeding rate 4%, T9= 16 fish/$m^3$ and feeding rate 4%.**

**Feed and protein utilization:**

All criteria studied and presented in Table 4 showed again that T6 and T1 were the best ($P\leq0.05$) and followed by T4 (even than the T2, T3, T5, T6, T8, and T9) concerning FE, FCR, PER, and PPV in Nile tilapia. There were significant differences between T6 and T1 in data of FCR, FE, PER, and PPV. Again, T3 and T6 were the worst, compared to other treatments. This agreed with the results obtained by Amar (2009), Chakraborty and Banerjee (2010) and Kapinga *et al*. (2014). Abdel- Tawwab *et al.* (2010) found that PER and FCR decreased with increasing dietary protein content. Moreover, fish stocking density could affect the efficiency of feed utilization as the number of fish stocked in a pond increase; the amount of feed available to each fish decreases (Chang, 1988). The FCR (3.03 to 6.20) in the current study is higher than the recommended FCR of 1.5 for aquaculture. The slight differences could stem from the differences in feed sources, environmental conditions and the particular strain or species of fish used. The protein efficiency ratio (PER) decreased with increasing fish density.

**Body composition:**

Values of dry matter (DM) crude protein (CP), ether extract (EE) and ash of the body is summarized in Table 5. The results of carcass composition of Nile tilapia showed that the difference were not significant ($P>0.05$) in crude protein, ether extract and ash percentages, but DM differed significantly. These results agree with the finding of Kapinga *et al.* (2014). The low lipid content of high-density–reared fish confirmed the findings of Montero *et al.* (1999), who found lower lipid levels in the liver of gilthead sea bream, reared at high density. Furthermore, changes in protein and lipid contents in fish body could be linked with changes in their synthesis and/or deposition rate in the muscles (Abdel-Tawwab *et al*., 2006). In contrast with the present results, Gallagher (1999) did not find significant differences is moisture, protein, lipid and ash contents in the whole body of sunshine bass fed with different protein levels.

**Biochemical parameters:**

The results of protein profile and kidney and liver functions (ALT, AST, creatinine, urea and uric acid) showed significant increases in total protein and globulin and significant decrease in albumin in the treatments T3, T6, T7 and T8, but there were no significances among fish groups T1, T2, T5 and T9. These results are illustrated in Tables 6 and 7. These results were supported by Kapinga *et al*. (2014). Results in tables (6 and 7) showed the cortisol glucose, cholesterol, total protein, albumin, globulin, RBCS, ALT, AST, creatinine , urea , uric acid and WBCS count in the experimental fish of treatment (Feeding rate 4% and stocking density 4 fish/m$^3$ ) were increased significantly (P≤ 0.05) compared with the among treatment (Feeding rate zero level , 3% and stocking density 8 fish/m$^3$ ). On the other side by increasing the stocking densities of fish, no significant (P≤0.05) differences were recorded in all above mentioned blood parameters compared with the treatment number (1). These results were supported by Rafatnezhad *et al*.,(2008) found that hematological parameters of the great sturgeon did not change in response to change of density.

**Table 4: Effect of stoking density and feeding rate on feed utilization of Nile tilapia of Nile tilapia *(Oreochcromis niloticus)*.**

| Feeding rate | Overall regardless of feeding rate | | | FR-Level 3% | | | FR-Level 4% | | |
|---|---|---|---|---|---|---|---|---|---|
| | T1 | T2 | T3 | T4 | T5 | T6 | T7 | T8 | T9 |
| Stocking density | 4 f/m$^3$ | 8 f/m$^3$ | 16 f/m$^3$ | 4 f/m$^3$ | 8 f/m$^3$ | 16 f/m$^3$ | 4 f/m$^3$ | 8 f/m$^3$ | 16 f/m$^3$ |
| FCR | 1.22± 0.23c | 1.37± 0.54b | 1.48± 0.90a | 1.06± 0.04c | 1.15± 0.30b | 1.30± 0.03a | 1.39± 0.22c | 1.58± 0.26b | 1.65± 0.70a |
| FE | 0.81± 0.02a | 0.73± 0.01b | 0.67± 0.00c | 0.95± 0.00a | 0.87± 0.01b | 0.77± 0.00c | 0.71± 0.02a | 0.63± 0.00b | 0.60± 0.00c |
| PER | 2.96± 0.07a | 2.60± 0.04b | 2.40± 0.01c | 3.36± 0.02a | 3.08± 0.03b | 2.72± 0.00c | 2.55± 0.06a | 2.25± 0.01b | 2.15± 0.01c |
| PPV (%) | 25.75± 1.69a | 11.50± 0.83b | 5.34± 0.27c | 22.30± 1.28a | 9.92± 0.27b | 4.80± 0.28c | 22.30± 1.28a | 9.92± 0.27b | 4.80± 0.28c |

**Means bearing different small letters are significant at (P<0.05).**
**T1= 4 fish/m$^3$ and feeding rate zero, T2= 8 fish/m$^3$ and feeding rate zero, T3= 16 fish/m$^3$ and feeding rate zero, T4= 4 fish/m$^3$ and feeding rate 3%, T5= 8 fish/m$^3$ and feeding rate 3%, T6= 16 fish/m$^3$ and feeding rate 3%, T7= 4 fish/m$^3$ and feeding rate 4%, T8= 8 fish/m$^3$ and feeding rate 4%, T9= 16 fish/m$^3$ and feeding rate 4%.**

**Table 5: Effect of stoking density and feeding rate on the chemical composition of the whole bodies of Nile tilapia *(Oreochcromis niloticus)*, % DM basis.**

| **Feeding rate** | | **Overall regardless of feeding rate** | | | **FR-Level 3%** | | | **FR-Level 4%** | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Stocking density** | | **T1 (4 f/m$^3$)** | **T2 (8 f/m$^3$)** | **T3 (16 f/m$^3$)** | **T4 (4 f/m$^3$)** | **T5 (8 f/m$^3$)** | **T6 (16 f/m$^3$)** | **T7 (4 f/m$^3$)** | **T8 (8 f/m$^3$)** | **T9 (16 f/m$^3$)** |
| **Parameters** | Initial analysis | | | | | | | | | |
| Dry matter (DM) | 36.97± 0.42b | 33.45± 0.13b | 33.55± 0.20b | 34.40± 0.27a | 34.47± 0.55a | 33.30± 0.3a | 33.40± 0.25a | 34.33± 0.24a | 33.80± 0.06ab | 33.50± 0.15b |
| Crud protein (CP) | 61.20± 0.21b | 68.97± 0.46a | 68.30± 0.51a | 67.68± 0.71a | 66.67± 1.09a | 67.60± 0.6a | 68.97± 0.87a | 68.70± 0.55a | 69.00± 0.61a | 68.97± 0.57a |
| Ash | 25.33± 0.07b | 19.28± 0.36a | 19.92± 0.17a | 19.77± 0.18a | 19.63± 0.30a | 20.00± 0.2a | 18.97± 0.66a | 19.90± 0.23a | 19.83± 0.28a | 19.60± 0.36a |
| Ether extract (EE) | 6.03± 0.15b | 4.97± 0.12a | 4.68± 0.24a | 4.80± 0.16a | 4.83± 0.33a | 5.03± 0.38a | 5.17± 0.12a | 4.77± 0.12a | 4.33± 0.12a | 4.77± 0.15a |
| NFE | 4.43± 0.20 | 4.57± 0.20a | 4.52± 0.07a | 4.85± 0.12a | 4.93± 0.22a | 4.60± 0.12a | 4.57± 0.44a | 4.77± 0.12a | 4.43± 0.03a | 4.57± 0.07a |

**Means bearing different small letters are significant at ($P<0.05$).**
**T1= 4 fish/m$^3$ and feeding rate zero, T2= 8 fish/m$^3$ and feeding rate zero, T3= 16 fish/m$^3$ and feeding rate zero, T4= 4 fish/m$^3$ and feeding rate 3%, T5= 8 fish/m$^3$ and feeding rate 3%, T6= 16 fish/m$^3$ and feeding rate 3%, T7= 4 fish/m$^3$ and feeding rate 4%, T8= 8 fish/m$^3$ and feeding rate 4%, T9= 16 fish/m$^3$ and feeding rate 4%.**

**Table 6: Effect of stoking density and feeding rate on blood biochemical parameters of Nile tilapia *(Oreochcromis niloticus)*.**

| **Feeding rate** | **Overall regardless of feeding rate** | | | **FR-Level 3%** | | | **FR-Level 4%** | | |
|---|---|---|---|---|---|---|---|---|---|
| **Stocking density** | **T1 (4 f/m$^3$)** | **T2 (8 f/m$^3$)** | **T3 (16 f/m$^3$)** | **T4 (4 f/m$^3$)** | **T5 (8 f/m$^3$)** | **T6 (16 f/m$^3$)** | **T7 (4 f/m$^3$)** | **T8 (8 f/m$^3$)** | **T9 (16 f/m$^3$)** |
| Cortisol (ug/l) | 4.12± 0.07 | 4.15± 0.14 | 4.17± 0.13 | 4.10± 0.00 | 4.17± 0.13 | 4.20± 0.32 | 4.13± 0.18 | 4.13± 0.92 | 4.13± 0.17 |
| Glucose (mg/dl) | 75.83± 1.47 | 76.17± 0.8 | 76.33± 1.05 | 74.33± 2.85 | 76.33± 0.33 | 77.33± 2.30 | 75.33± 0.67 | 76.00± 1.00 | 77.33± 0.67 |
| Cholesterol (mg/l) | 214.33± 2.14 | 217.67± 3.0 | 214.33± 3.16 | 213.67± 4.91 | 217.00± 2.08 | 221.33± 2.03 | 211.67± 3.38 | 214.00± 5.69 | 215± 5.03 |
| T3 (IU/L) | 2.32± 0.01 | 2.33± 0.03 | 2.32± 0.05 | 2.32± 0.01 | 2.33± 0.06 | 2.30± 0.0 9 | 2.31± 0.03 | 2.33± 0.01 | 2.33± 0.06 |
| T4 (IU/L) | 1.35± 0.06 | 1.30± 0.08 | 1.38± 0.09 | 0.37± 0.03 | 1.37± 0.15 | 1.47± 0.13 | 1.33± 0.13 | 1.23± 0.09 | 1.30± 0.12 |
| Lysozyme (IU/L) | 0.13± 0.01a | 0.12± 0.01 | 0.12± 0.01 | 0.12± 0.01 | 0.11± 0.01 | 0.13± 0.01 | 0.13± 0.01 | 0.12± 0.01 | 0.11± 0.01 |
| Total. protein (g/dl) | 5.53± 0.09 | 5.55± 0.12 | 5.63± 0.18 | 5.43± 0.15 | 5.43± 0.20 | 5.60± 0.17 | 5.63 ± 0.09 | 5.67± 0.15 | 5.67 ± 0.37 |
| Albumin (g/dl) | 3.53± 0.07 | 3.37± 0.08 | 5.63± 0.18 | 3.53± 0.13 | 3.23± 0.09 | 3.50± 0.06 | 3.53 ± 0.07 | 3.50 ± 0.06 | 3.37 ± 0.12 |
| Globulin (g/dl) | 2.0 | 2.2 | 2.2 | 1.9 | 2.2 | 2.1 | 2.1 | 2.2 | 2.3 |

**T1= 4 fish/m$^3$ and feeding rate zero, T2= 8 fish/m$^3$ and feeding rate zero, T3= 16 fish/m$^3$ and feeding rate zero, T4= 4 fish/m$^3$ and feeding rate 3%, T5= 8 fish/m$^3$ and feeding rate 3%, T6= 16 fish/m$^3$ and feeding rate 3%, T7= 4 fish/m$^3$ and feeding rate 4%, T8= 8 fish/m$^3$ and feeding rate 4%, T9= 16 fish/m$^3$ and feeding rate 4%.**

**Table 7: Effect of stoking density and feeding rate on blood parameters (liver and kidney functions) of Nile tilapia *(Oreochcromis niloticus)***

| Feeding rate | Overall regardless of feeding rate | | | FR-Level 3% | | | FR-Level 4% | | |
|---|---|---|---|---|---|---|---|---|---|
| Stocking density | T1 (4 f/m$^3$) | T2 (8 f/m$^3$) | T3 (16 f/m$^3$) | T4 (4 f/m$^3$) | T5 (8 f/m$^3$) | T6 (16 f/m$^3$) | T7 (4 f/m$^3$) | T8 (8 f/m$^3$) | T9 (16 f/m$^3$) |
| ALT (u/l) | 65.67± 0.67 | 63.17± 0.75 | 64.3± 1.12 | 66.33± 0.88 | 63.00± 1.00 | 65.33± 1.76 | 65.00± 1.00 | 63.33± 1.33 | 63.3± 30.33 |
| AST (u/l) | 55.83± 0.60 | 56.67± 0.95 | 56.00± 1.03 | 55.00± 0.58 | 57.00± 1.53 | 57.33± 1.86 | 56.67± 0.88 | 56.33± 1.45 | 54.67± 0.33 |
| Creatinine (mg/dl) | 1.160± 0.13 | 0.92± 0.13 | 1.00± 0.13 | 1.12± 0.18 | 0.81± 0.18 | 1.03± 0.18 | 1.20± 0.18 | 1.02± 0.18 | 1.00± 0.18 |
| Urea (mg/dl) | 22.0± 1.00 | 22.3± 1.00 | 23.7± 1.00 | 22.3± 1.42 | 21.7± 1.42 | 23.3± 1.42 | 21.7± 1.42 | 23.1 0.42 | 24.0± 1.42 |
| Uric acid (mg/dl | 2.37± 0.06 | 2.36± 0.06 | 2.30± 0.06 | 2.32± 0.09 | 2.33± 0.09 | 2.30± 0.09 | 2.41± 0.09 | 2.30± 0.06 | 2.30± 0.09 |

**T1= 4 fish/m$^3$ and feeding rate zero, T2= 8 fish/m$^3$ and feeding rate zero, T3= 16 fish/m$^3$ and feeding rate zero, T4= 4 fish/m$^3$ and feeding rate 3%, T5= 8 fish/m$^3$ and feeding rate 3%, T6= 16 fish/m$^3$ and feeding rate 3%, T7= 4 fish/m$^3$ and feeding rate 4%, T8= 8 fish/m$^3$ and feeding rate 4%, T9= 16 fish/m$^3$ and feeding rate 4%.**

## CONCLUSIONS

it was proved that Nile tilapia fingerlings reared in floating hapas (in an earthen pond) stocked at 4 fish/m$^3$ and fed a diet containing 28.5% crude protein at 4% of the biomass daily gave the best results at the end of the experiment (98 days), concerning growth performance, feed and nutrients utilization, chemical composition, and blood profile.

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## تأثير معدلات الكثافة و التغذية على إنتاج الأحواض الترابية المستزرعة بأسماك البلطى النيلى

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أجريت هذه الدراسة على مدى فترة ٩٨يوما لدراسة تأثير مستويات كثافة ومعدلات تغذية مختلفة على إنتاج الأحواض الترابية المستزرعة بأسماك البلطى النيلى، وتم استخدام الهابات المعلقة فى حوض ترابى بمساحة ٤٠٠٠م٢، وكانت أبعاد كل هابة ٢*٤*١م. وكانت عدد المعاملات ٦ مقسمة الى ثلاث مكررات بمجموع ١٨هابة. وكانت مستويات الكثافة التخزينية للأسماك ٤، ٨، ١٦سمكة/م٣)، فكانت أعداد الأسماك فى المجموعة ١ (٣٢) والمجموعه٢ (٦٤) والمجموعه٣ (١٢٨) على الترتيب، وكانت معدلات التغذية (صفر، ٣, ٤%) من الوزن الحى لجسم الأسماك .تم إتباع نظام غذائى متوازن على طول فترة التجربة باستخدام عليقة ذات بروتين خام ٢٨.٥% . تشير النتائج إلى أن المعامله ذات الكثافه ٤ أسماك/ م٣ والتى غُذيت بمعدل تغذية يومى ٤% هى الأفضل من حيث الوزن الحى لجسم الأسماك والاستفادة الغذائية وتركيب الجسم وكذلك الحالة الفسيولوجية.