COMPARATIVE GROWTH PERFORMANCE AND FEED UTILIZATION OF FOUR LOCAL STRAINS OF NILE TILAPIA *(Oreochromis niloticus* L.) COLLECTED FROM DIFFERENT LOCATIONS IN EGYPT

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Abstract

Brood stocks of Nile tilapia, *Oreochromis niloticus* L. were collected from Lakes Nasser (Aswan), Manzalah, Maryut, and Abbassa fishponds. Fingerlings of F1 of each strain were fed diet containing 27% CP for 90 days. The results showed that Aswan strain was superior to other tilapia strains in growth performance. Survival rate was not significantly different among Nile tilapia strains. Crude protein contents in fish body was insignificantly different among Abbassa, Aswan and Manzalah strains, whereas the less protein content was observed in Maryut strain. There was no significant difference in total lipids content in Abbassa and Manzalah strains and between Aswan and Maryut strains. Ash content did not significantly differ in all tilapia strains. The highest feed intake was observed in Aswan strain, while there was no significant difference in feed intake among other tilapia strains. The lowest FCR value was obtained in Aswan strain, whereas the higher ones were obtained in Abbassa and Manzalah strains. The maximum PER was recorded in Aswan strain, while the less ones were obtained in Abbassa and Manzalah strains. The maximum PPV value was obtained in Manzalah strain, whereas the lowest was observed in Abbassa strain, and there was no significant difference between Aswan and Maryut strains. It could be concluded that Aswan strain was more efficient in feed utilization and protein turnover than the other strains where higher growth performance with higher PER and lesser FCR values were observed in Aswan strain.

Introduction

In Egypt, tilapias are widespread in the Nile River and its attributes as well as in the lakes. Of these species, Nile tilapia, *Oreochromis niloticus* L. is an important food fish and it is considered as the best species for culture because of its high tolerance to adverse environmental conditions, its relatively fast growth and it could be easily bred.

Tilapia intensive culture requires the formulation of efficient food with optimum potency to meet the protein requirements in fish culture (Kenawy, 1993) and the selection of genetically improved tilapia strain (Eknath, 1996). Therefore, identification of relatively fast growing individuals early in their life cycle is an important consideration in genetic selection programs in aquaculture management (Wickins, 1987). For selection to be effective, it is

imperative to understand the growth characteristics of individuals or groups of individuals under communal stocking in target fish farming environments.

To realize the potential of Nile tilapia culture, development of adapted farm races of this species should be part of the genetic improvement programs (Eknath *et al.*, 1991; Bentsen and Gjerde, 1994). There is no comparative data available on the growth of different tilapia strains in Egypt. Therefore, this study was carried out to compare the growth performance and feed utilization of different strains of Nile tilapia, *Oreochromis niloticus* L. collected from Nasser (Aswan), Manzalah and Maryut Lakes as well as Abbassa fishponds.

Materials and methods

The experimental design

Healthy parents of Nile tilapia; *Oreochromis niloticus* L. were collected from Nasser Lake at Aswan, Maryut Lake and Manzalah Lake as well as Abbassa fishponds of Central Laboratory for Aquaculture Research, Abbassa, Abo-Hammad, Sharqia. The rearing and successive processes for fry production (F1) of each strain were carried out in the Department of Fish Genetic and Breeding, Central Laboratory for Aquaculture Research, Abbassa, Abo-Hammad, Sharqia. Fish weighing 10-15 g/fish were acclimated in indoor tanks for 2 weeks to laboratory conditions. Fifty fish were frozen at -20^{o}C for chemical analyses. The fingerlings of mixed sex were distributed randomly in 130-liter capacity glass aquaria at a rate of 20 fish/aquarium containing 100 liters aerated water. Each aquarium was supplied with compressed air via air-stones from air pumps. Well-aerated water supply was provided from a storage fiberglass tank. The temperature was adjusted at 27±1^{o}C by using thermostatically controlled heaters. Siphoning a portion of water from each aquarium was done every day for excreta removal, after which an equal volume of freshwater was added as replacement. Dead fish were removed and recorded as soon as observed.

Fish diets and feeding regime

A semi-moist basal diet was prepared from purified ingredients and was used to formulate an identical diet containing 91.8% dry matter, 27.4% crude protein, 6.4% total lipids, 6.6% ash and 438.4 kcal/g gross energy. Three aquaria were randomly assigned for each tilapia strain. Fish were fed frequently at a rate of 3% of live body weight twice daily for five days a week. This lasted for 90 days. Fish in each aquarium was biweekly weighed and the amount of given feed was accordingly readjusted. The amount of consumed feed for each aquarium was subsequently calculated.

Proximate analysis of diet and fish

The tested diet and fish from each treatment were chemically analyzed according to the standard methods of AOAC (1990) for dry matter, protein, fat and ash. Dry matter content was estimated by heating samples in an oven at 85^{o}C till constant weight was obtained. Nitrogen content was measured using a Microkjeldahl apparatus and crude protein was estimated by multiplying nitrogen content by 6.25. Total lipids content was determined by ether extraction for 16 hr and ash was determined by combusting samples in a muffle furnace at 550^{o}C for 6 hr.

Growth parameters

Growth performance was determined and feed utilization was calculated as following:

Weight gain = $W_2 - W_1$

Specific growth rate (SGR) = 100 ($\ln W_2 - \ln W_1$)/T

where W_1 and W_2 are the initial and final fish weight, respectively, and T is the number of days in the feeding period.

Feed conversion ratio (FCR) = Feed intake / Weight gain

Protein efficiency ratio (PER) = Weight gain / Protein intake

Protein productive value (PPV) = Protein gain / Protein intake

Statistical analysis

Data of growth, feed utilization, survival rate and proximate chemical composition of whole fish body of each strain were subjected to one-way ANOVA following Snedecor and Cochran (1982). Differences between means were done at the 5% probability level using Duncan's new multiple range test (Duncan, 1955).

Results

Data in Table 1 and Figure 1 show that the highest final weight was obtained in Aswan strain (37.3 g/fish), while other strains exhibited approximately similar final weights (29.8, 28.7 and 30.9 g/fish for Abbassa, Manzalah and Maryut strains, respectively). Similarly, weight gain and specific growth rate (SGR) exhibited the same trend.

Table 1. Growth performance of different strains of Nile tilapia, *O. niloticus* fed diets containing 27% crude protein.

Tilapia strains	Final weight (g/fish)	Weight gain (g/fish)	SGR (%/d)	Survival rate (%)
Abbassa	29.8 b ± 0.8	17.8 b ± 0.8	1.003 b ± 0.03	96.7 a ± 2.04
Aswan	37.3 a ± 0.8	25.2 a ± 0.8	1.277 a ± 0.03	93.3 a ± 2.04
Manzalah	28.7 b ± 0.8	16.6 b ± 0.7	0.976 b ± 0.03	100.0 a ± 0.0
Maryut	30.9 b ± 1.3	18.7 b ± 1.3	1.059 b ± 0.05	100.0 a ± 0.0

Mean values in the same column having the same letters are not significantly different (P>0.05).

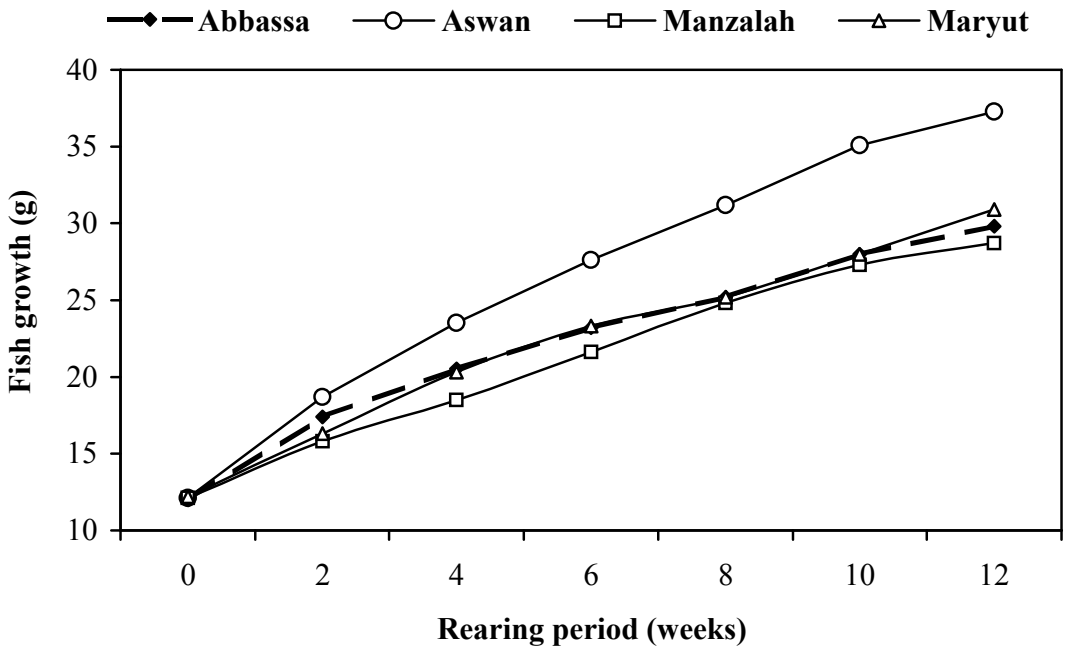

Figure 1. Changes in live body weight (g/fish) of different strains of Nile tilapia (*O. niloticus*) fed diet containing 27% crude protein.

Results of body composition of each fish strain fed diet containing 27% CP are summarized in Table 2. Crude protein contents in fish body were not significantly different among Abbassa, Aswan and Manzalah strains (55.7%, 54.8% and 55.9%, respectively), whereas the less protein content was observed with Maryut strain (53.5%; $P<0.05$). On the other hand, fish body of Abbassa and Manzalah strains contained similar values of total lipids (23.9% and 23.0%, respectively). Also, there was no significant difference in total lipids content between Aswan and Maryut strains (25.1% and 25.2%, respectively). Ash content did not significantly differ in all tilapia strains ($P>0.05$).

Table 2. Carcass proximate chemical analyses (mean ± SE) of different strains of Nile tilapia; *O. niloticus* fed diets containing 27% crude protein.

	Items (%)			
Tilapia strains	**Dry matter**	**Crude protein**	**Total lipids**	**Ash**
Abbassa	22.1 b ± 0.1	55.7 a ± 0.2	23.9 b ± 0.6	20.4 a ± 0.5
Aswan	23.9 b ± 0.1	54.8 ab ± 0.2	25.1 a ± 0.2	20.1 a ± 0.3
Manzalah	26.9 a ± 0.9	55.9 a ± 0.4	23.0 b ± 0.2	21.1 a ± 0.3
Maryut				

Results of feed intake, feed conversion ratio (FCR), protein efficiency ratio (PER) and protein productive value (PPV) were significantly different among the tilapia strains (Table

3). The Aswan strain (45.4 g feed/fish) had significantly higher feed intake and PER than all the other strains. Abbassa, Manzalah and Maryut strains were comparable in terms of feed intake. However, the Maryut strain had significantly the least PER. The lowest FCR value was obtained in Aswan strain (1.80), while the higher ones were obtained in Abbassa and Manzalah strains (2.21 and 2.17, respectively).

The Manzalah strain (30.7%) had significantly the highest PPV among all the strains studied. The significantly lowest PPV was observed in Abbassa strain (20.97%). There was no significant difference between Aswan and Maryut strains (28.83% and 28.47%, respectively).

It is worth mentioning that Aswan strain was more efficient in feed utilization and protein turnover than the other studied strains. This is because higher growth performance with higher PER and less FCR values were observed in Aswan strain.

Table 3. Feed intake, feed conversion ratio (FCR), protein efficiency ratio (PER) and protein productive value (PPV) of different strains of Nile tilapia; *O. niloticus* fed diet containing 27% crude protein.

Tilapia strains	Feed intake (g/fish)	FCR	PER	PPV (%)
Abbassa	39.3 b ± 1.3	2.21 a ± 0.09	1.79 c ± 0.05	20.97 c ± 0.49
Aswan	45.4 a ± 1.2	1.80 c ± 0.05	2.20 a ± 0.06	28.83 b ± 0.49
Manzalah	36.1 b ± 0.9	2.17 a ± 0.07	1.82 c ± 0.05	30.70 a ± 0.71
Maryut	38.0 b ± 1.1	2.03 b ± 0.04	1.95 b ± 0.05	28.47 b ± 0.64

Mean values in the same column having the same letters are not significantly different (P>0.05).

Discussion

The Nile tilapia is suffering from genetic deterioration of cultured stocks due to widespread introgression of genes from other less desirable feral tilapia species (Macaranas *et al.*, 1986); and possible inbreeding depression. However, the expected genetic differences between groups of fish has been widely accepted as a valid technique for the efficient selection of the optimum strain that could be utilized for development of fish culture (Eknath *et al.*, 1993).

A number of studies in recent years has demonstrated that there are large differences in the relative culture performance of different populations and strains of tilapia across a range of different environments. In fish and particularly in tilapia strains or isolates are normally loosely designated according to their location or origin and commonly have no distinctive traits, which can lead to considerable confusion (Mair, 2001).

In the most comprehensive study of this kind, Eknath *et al.* (1993) and Palada-de Vera and Eknath (1993) compared the growth performance of eight different strains of Nile

tilapia reared in different farm environments. The strains include four African strains collected from Egypt (E1 & E2), Ghana, Kenya and Senegal, and four established Asian farmed strains known as Israel, Singapore, Taiwan and Thailand. They found that, the African strains performed the same as or better than the Asian strains and the fast growth was obtained from Egypt strain, while the lowest one was obtained from the Ghana strain. They attributed this difference to strain-specific effects of reproduction on growth. The imported Egyptian strain in the investigation by Eknath *et al.* (1993) was collected from Lake Manzalah near Alexandria and from creeks along desert road to Port Said (E1) and another collection was obtained from Abbassa and Ismailia (E2). Their results indicated that the Least Square Means on growth of E1 and E2 were not significantly different.

A study on Nile tilapia stocks was conducted by Capili (1995). She compared the growth performance of 11 strains of tilapia from various African origins and found that of the Egyptian strains had the fastest growth rate while the growth performance of three Kenya strains were relatively poor.

On the other hand, Dan and Little (2000) evaluated the culture performance of over-wintered fry of three strains of Nile tilapia; collected from Vietnam (Viet), ICLARM-Philippines (GIFT) and Thailand (Thai). They found that, among the three strains, the GIFT strain reached a larger individual size in both cages and ponds at final harvest than either the Thai or Viet strains. No significant difference in survival rate was observed among the different strains.

In growth trials of tilapia species and strains, changes in ranking of strains between environments are common, indicating significant genotype x environment interactions in many cases (Dahilig, 1992; Elghobashy *et al.*, 2000; Capili, 1995; Romana-Eguia and Doyle, 1992). However, in the study of Eknath *et al.* (1993), the analysis of the performance of the strains across environments led to the conclusion that the relative importance of genotype environment interaction was low compared to that of strain and sex differences.

Results in this study revealed that the growth performance of different local strains of Nile tilapia significantly differed where Aswan strain is the optimum one (in terms of cost/benefit ratio) for fish farming and tilapia intensification in Egypt. However, it realized the optimum growth and feed utilization at moderate dietary protein level of 27% CP. Therefore, it is recommended that the Nile tilapia hatcheries should renew the broodstock used for fry production from Nasser Lake at Aswan.

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