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Growth Performance, Feed Utilization and Body Composition of the Nile and Red Hybrid Tilapia Fingerlings Reared in Mono and Polycultures

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ABSTRACT

The present work aimed to investigate the impact of stocking density of two types of fish species, the Nile tilapia (NT) and the red hybrid tilapia (RHT) fingerlings, reared in monoculture or polyculture, on their growth performance, feed utilization and chemical body composition. The experimental groups were designed as the following: G_1: contained 40 fingerlings of NT that stand for 100% of NT; G_2: contained 30 fingerlings of NT and 10 fingerlings of RHT, representing a portion of 75% of NT and 25% of RHT; G_3: contained 10 fingerlings of NT and 30 fingerlings of RHT, providing a portion of 25% of NT and 75% of RHT, and G_4: contained 40 fingerlings of RHT that were a 100% of RHT. All tested groups received the same diet of 32.2% crude protein and 4638 kcal for 60 days. The result showed that polyculture (G_2 and G_3)showed the highest final weight (FW), total body weight gain (TBWG) and average daily gain (ADG) in comparison with monocultures (G_1 or G_4). Survival ratio was decreased with rearing two types of fingerlings together in one hap (polyculture), compared to the other two fingerlings reared in monoculture for NT or RHT. Mono or polycultures affected significantly (P<0.05) their TBWG, FI, FCR; CPI and PER. While the body composition was not affected by the type of reared haps (mono or polycultures). G_1 recorded the highest value of energy retention (ER %, 108.10%); meanwhile, G_4 recorded the lowest value (66.61%). Protein productive value (PPV %) was a significant (P<0.05) affecting factor among the different groups. It can be mentioned that reared fingerlings of the Nile tilapia or the red hybrid tilapia together in one hap (polyculture) can be realized successfully without occurring any adverse effect on growth performance, feed utilization, and body composition..

INTRODUCTION

In Egypt, as reported by **GAFRD (2012)** and **Abdel-Hakim1 *et al.* (2014)**, the total fish productions from all resources during 2012 were 1371975 ton. In addition, all aquaculture activities contributed by 1017738 ton during the same year, which represented about 74.18% of the total national fish production. During 2012, Egypt imported 335023 ton (**GAFRD, 2012**) to increase the fish per capita consumption in the country from 16.48 to 20.55kg/ year. **Abdel-Hakim1 *et al.* (2014)** recorded that, the facts mentioned above reflect the importance of aquaculture activities in securing the fish protein demand for the Egyptian people. Because of the limited fresh water resources required to increase the production of fresh water fish species (Tilapia, Mullets and Carp species …. etc), it is necessary to develop a system to increase the production of fish vertically by performing new methods concerned with fish feeding, fish cultured species and the fish stocking density. On the other hand, applying the developed method in aquaculture activities could help the fish farmer increase his production vertically per unit area. Meanwhile, it is considered to be one of the important factors affecting fish growth **(Liu & Chang, 1992)**. Additionally, **Chang (1988)** postulated that, fish stocking density is an important factor used in aquaculture as it can influence natural food availability, the efficient utilization of food resource and total fish yield in ponds. Furthermore, poly culture of fish is usually used to combine omnivorous tilapia sp. with benthphagic mullet sp. **(Malecha *et al.*, 1981)**. As noted by **Ellis *et al.* (2002)**, the increase in stocking density may cause stress which subsequently depresses growth. Morever, **Thorarensen and Farrell (2010)** mentioned that, the fish increase the swimming speed to obtain food, which requires energetic cost. Furthrmore, increasing the stocking density may cause an increase in competition between the fish for space and food, and thus decreasing their growth **(Quiros, 1999)**. **Dos Santos *et al.* (2007)** and **Ponzonia *et al.* (2008**) mentioned that, different strains of the Nile tilapia show different growth performance, yield, mortality and resistance for environmental changes. Moreover, **Wohlfarth *et al.* (1985)** showed that growth performance and survival of tilapia were influenced by their stocking rate, the species of fish co-stocked with them and feeding regimes. In this context, **Herrera (2015)** reported that, most studies pointed a decrease in final weight when stocking density increased, and added that survival is depressed by increasing the stocking density. However, he discussed that the yield fish is high at the higher stocking density in many references. The FCR is decreased by increasing the density. In addition, he reported that some researchers observed the deterioration of water quality at higher densities.

Thus the main objective of this work aimed to investigate the impact of mono culture and poly culture on growth performance, feed utilization and body composition of the Nile and red hybrid tilapia fingerlings.

MATERIALS AND METHODS

This work was carried out at the Fish Experimental Station belonging to the Animal Production Department, Faculty of Agriculture, Al-Azhar University, Cairo, Egypt in a co-operation work for the Animal Production Department, National Research Centre, 33 El-Bohouth Street, P.O. Box: 12622, Dokki, Cairo, Egypt.

The present study aimed to determine the influence of mono or poly cultures on the two types of fish fingerlings, including both the Nile tilapia *(O. niloticus)* and the red hybrid tilapia (*O. niloticus x O. mosambicus*).

Description of experimental aquaculture units

Fish were reared in haps (1 x 1 x 1m), with four haps (four replicates) per treatment. Fish specimens were randomly distributed approximately at the rate of 10 fish in each hap, with an average initial weight of 10 g / fish. All experimental haps were supplied with air through an aeration system which connected with air pump (5hp). The fish used in this study were red hybrid tilapia (*O. niloticus* x *O. mosambicus*) and *O. niloticus* fingerlings. The experimental fish were transported in the early morning using a special fish transport car equipped with aeration facilities. They were acclimated for 14 days before starting the experiment.

Feeding rate and techniques

Feeding ration amounted to 5% of total body weight daily throughout the experimental period (60 days). All the experimental groups received the same diet in a dried form, suitable to the fish size. Fish were fed 6 days per week, and the amount of feed was divided into four equal portions at 9:00 & 10.30 am and at 12:00 & 2:00 pm. Every 60 days, the fish in each hap were weighed, and the amount of feed was corrected according to the new fish biomass throughout the experimental period **(Sveier *et al*., 2000)**. The experimental design used in the present study is presented in **diagram** (**1**).

Diagram 1. The experimental design used in the study

Treatment	Replication	Haps size	Stocking density		Species
T_1	R_1 / T_1	$1M^3$	10	Total 40 fingerlings	The Nile tilapia (*Oreochromis niloticus*)
	R_2 / T_1		10		
	R_3 / T_1		10		
	R_4 / T_1		10		
T_2	R_1 / T_2		10	Total 40 fingerlings	25 % Red hybrid tilapia (RHT) + 75 % Nile Tilapia (*Oreochromis niloticus*)
	R_2 / T_2		10		
	R_3 / T_2		10		
	R_4 / T_2		10		
T_3	R_1 / T_3		10	Total 40 fingerlings	75 % Red hybrid tilapia (RHT) + 25 % Nile Tilapia (*Oreochromis niloticus*)
	R_2 / T_3		10		
	R_3 / T_3		10		
	R_4 / T_3		10		
T_4	R_1 / T_4		10	Total 40 fingerlings	Red hybrid tilapia (RHT)
	R_2 / T_4		10		
	R_3 / T_4		10		
	R_4 / T_4		10		

Experimental diet

The experimental diets were purchased from the Scrating Industrial Company in 10th Ramadan City. The experimental diets were in the form of pelleted floating diets, with a diameter of 2mm; they were offered for the first eight weeks of the experiment, followed by pellets with a diameter of 3mm, with 32% protein till the end of the experimental period. The experimental diet composition as well as its proximate chemical analysis is shown in Table (1).

Table 1. Composition and chemical analysis (%) of the experimental diet used

Feed ingredient	**%**
Yellow corn	20
Wheat bran	20
Fish meal (72% CP)	10
Meat meal	20
Soy bean meal (44% CP)	24
Corn oil	3
Bone meal	1
Vitamin premix	1
Mineral premix	1
Total	100
Proximate chemical analysis (%)	
Moisture	9.86
Chemical composition on DM basis	
Organic matter (OM)	90.50
Crude protein (CP)	32.20
Ether extract (EE)	7.60
Crude fiber (CF)	4.21
Ash	9.50
Nitrogen free extract (NFE)	46.49
Gross energy kcal/ kg *	4638
Gross energy cal/ g DM	4.638

* Gross energy (kcal/kg DM) was calculated according to **(Blaxter 1968)** where, each g CP= 5.65 Kcal, g EE= 9.40 Kcal and g (CF & NFE) = 4.15 Kcal.

Biological evaluation of fish growth performance

A number of fish was selected from each hap as samples to be measured and weighed individually every two weeks (2WKS) in order to readjust the amount of feed required for the next two weeks. The dead fish were immediately removed from the experimental haps, and the mortality rate was recorded. At the end of the experiment, the final harvest was carried out through drainage of water by the water pump. The growth performance of each treatment group was determined, and the feed use was calculated as described by **Sveier *et al*. (2000)** as follows:

Growth performance parameters

Fish growth performance, weight gain, average body weight gain, specific growth rate and survival rate were determined applying the following equations:

Body weight gain (BWG) = $(W_1) – (W_0)$

Where, W_0: initial weight, and W_1: final weight.

Specific growth rate (SGR, % / day) = $[\text{Ln } W_1 – \text{Ln } W_0 / T]$ 100

Where, Ln = the natural log; W_1 = final weight at the certain period (g);

W_0 = initial weight at the same period (g) & T = experimental period (day).

Survival rate (SR %) = Number of fish at final / Number of fish at start X100

Calculation of feed conversion ratio (FCR)

The feed conversion ratio (FCR) is expressed as the proportion of total dry matter intake (TDMI), g / total live body weight gain (TBWG), g as the following equation:

FCR = total dry matter intake, (TDMI), g / total body weight gain (TBWG), g.

Calculation of crude protein efficiency ratio (CPER)

(CPER) = total body weight gain (TBWG), g / total crude protein intake (TCPI), g.

Feed efficiency

Generally, the following equation using in calculation the feed efficiency

Feed efficiency (FE %) = [Weight gain (g) / Feed intake (g)]

Protein productive value (PPV %) = [PR_1– PR_0 / PI] 100.

Where, PR_1 is the total fish body protein at the end of the experiment (on dry matter basis);

PR_0 is the total fish body protein at the start of the experiment (on dry matter basis), &

PI = Protein intake.

Energy retention percentages (ER %)

The energy retention percentage was calculated according to the following equation: Energy retention (ER %) = E-E_0 / E_F X 100

Where, E= the energy in fish carcass (kcal) at the end of the experiment;

E_0= the energy in fish carcass (kcal) at the start of the experiment, &

E_F = the energy (kcal) in feed intake

Body composition of different experimental group fish

At the end of feeding trial, thirty two representative fish weights from each treatment were randomly chosen to determine the body composition.

Analytical procedures

Chemical analysis of the basal diets fed to all tested groups and samples of body composition of fish were analyzed according to **AOAC (2005)** methods.

Calculated data

According to **Blaxter (1968)**, the gross energy (kcal/ kg DM) of basal diet and body composition of tested group fish were calculated to evaluate the energy retention percentages, using the following values; each g CP= 5.65 Kcal, where g EE= 9.40 Kcal and g (CF & NFE) = 4.15 Kcal.

Statistical analysis

Data collected were subjected to statistical analysis as one way analysis of variance according to **SPSS (2008)**. **Duncan's Multiple Range Test** (**Duncan, 1955)** was used to separate means when the dietary treatment effect was significant according to the following model:

$Y_{ij} = \mu + T_i + e_{ij;}$

Where, Y_{ij} = observation; μ = overall mean;

T_i = effect of experimental rations for i = 1–4; 1 = G_1 composed of *40* fingerlings of *O. niloticus* (100% *O. niloticus)*; G_2 composed of *40* fingerlings divided into 10 fingerlings red tilapia plus 30 fingerlings *O. nilotic*us (25 % Red tilapia + 75 *% O. nilotic*us); G_3 composed of *40* fingerlings divided into 30 fingerlings red tilapia plus 10 fingerlings *O. nilotic*us (75 % red tilapia + 25 *% O. nilotic*us), and G_4 is composed of 40 fingerlings of red tilapia (100% red tilapia).

e_{ij} = the experimental error.

RESULTS AND DISCUSSION

Growth performance of different experimental group fish reared in mono or poly cultures

Data in Table (2) show that the stocking density for poly culture that is composed of both G_2 (75% of fingerlings Nile tilapia plus 25% of RHT) and G_3 (25% of fingerlings Nile tilapia & 75% of RHT) exhibited the highest FW, TBWG and ADG, compared to (mono cultures) the other two groups (G_1 or G_4 that contained only one type of fingerlings of fish either the Nile tilapia (G_1) or RHT (G_4). These improvements in their FW, TBWG and ADG reached 12.91, 19.73 and 18.75 % for G_2, compared to G_1. Meanwhile, it was improved by 3.46, 5.29 and 3.13% for G_3 compared to G_1. On the other hand, the same parameters mentioned above were improved by 40.65, 71.44 and 72.73 % for G_2 compared to G_4. However, it was improved by 28.88, 50.75 and 50.00 % for G_3 compared to G_4.

Table 2. Growth performance and survival ratio of different experimental groups

Item	Experimental groups				SEM	Sign. P<0.05
	Nile tilapia (G_1)	75% Nile tilapia +25% of RHT (G_2)	25% Nile tilapia + 75% of RHT G_3	Red hybrid tilapia (RHT) (G_4)		
Initial weight, g (IW)	10	10	10	10	0.072	NS
Final weight, g (FW)	28.90^b	32.63^a	29.90^b	23.20^c	1.077	*
Total body weight gain, g (TBWG)	18.90^b	22.63^a	19.90^b	13.20^c	0.876	*
Duration experimental period	60 days					
Average daily gain, g (ADG)	0.32^b	0.38^a	0.33^b	0.22^c	0.015	*
Specific growth rate (SGR), %/ day	0.81	0.91	0.84	0.59	-	-
Number of fish at the starter	40	40	40	40	-	-
Number of fish at the end	36	32	24	36	-	-
Survival rate	90 %	80 %	60 %	90 %	-	-
Mortality rate percentages	10	20	40	10	-	-

a, b and c: Means in the same row having different superscripts differ significantly (P<0.05).

SEM: Standard error of mean NS: Not significant *: Significant at (P<0.05).

G_1: contained 40 fingerlings of Nile tilapia (*Oreochromis niloticus*) that equal 100% of Nile tilapia.

G_2: contained 40 fingerlings of fish composed of 30 fingerlings of Nile tilapia and 10 fingerlings of red hybrid tilapia (RHT); that equal portion was 75% of the Nile tilapia and 25% of RHT.

G_3: contained 40 fingerlings of fish composed of 10 fingerlings of the Nile tilapia and 30 fingerlings of red hybrid tilapia (RHT), that equal portion was 25% of the Nile tilapia and 75% of RHT.

G_4: contained 40 fingerlings of red hybrid tilapia (RHT) that equal 100% of RHT.

Survival rate was decreased with rearing two types of fingerlings together in one hap compared to the fingerlings reared as individually or one type of fingerlings for the Nile tilapia or RHT that recorded 90% for G_1 or G_4, compared to G_2 or G_3 that recorded 80 and 60% of the survival ratio, respectively. Furthermore, the survival ratio was decreased from 90% to 80 and 60%, with increasing the level of inclusion of RHT in haps and decreasing percentages of the Nile tilapia, as described in the present design or plan of work. In contrast, mortality rate percentages were increased with increasing the level of RHT inclusion in haps and decreasing percentages of the Nile tilapia. The mortality rate values were 10, 20, 40 and 10% for G_1, G_2, G_3 and G_4, respectively.

The present results are in harmony with those found by **Eid *et al.* (2019)** who stated that, stocking density of 30 fry/L^3 improved the growth performance, compared to the other stocking densities (10, 20 and 40 fry/L^3). Also, **Abou Zied *et al.* (2005)** noted that, when the Nile tilapia and grey mullet were stocked at densities of 6000; 7700; 8000 and 11000 fish/feddan, the highest harvesting values of both species were recorded by the density of 7700 fish/feddan, followed by the density of 8000 fish/ feddan, 6000 fish/feddan and 11000 fish/feddan, respectively. Furthermore, **Abou Zied and Hassouna (2007)** observed that, culturing the Nile tilapia and mullet (15000 tilapia + 750 mullet/ feddan) with 0.0 or 150 or 300 meager/ feddan for 180 days in earthen ponds showed significant improvement in weight when meager was stocked at a rate of 300 fingerlings/ feddan. **Aksungur *et al.* (2007)** investigated the impact of stocking density of Turbot (30, 60, 90 and 120 fish m^2) reared in sea cages for 206 days and noted that the mean final weight were 178.3; 182.7; 196.1 and 164.6 g, respectively.

Feed utilization of different experimental group fish reared in mono or poly cultures

Data in Table (3) reveal that the reared fish fingerlings in different cultures as designed in the present study (mono culture that includes G_1 and G_4) or (poly culture that includes G_2 and G_3) significantly (P<0.05) affected their TBWG, FI, FCR; CPI and protein efficiency ratio (PER). The best values of TBWG and FCR were recorded in G_2; meanwhile, the highest values of FI, CPI and PER were recorded by G_3. **Abdel-Hakim *et al.* (2014)** reported that, the stocking density showed a significant difference in dry matter, protein NFE and gross energy contents of tilapia's whole body. In aadition, our results were in agreement with those of **Abdel-Hakim *et al.* (2001)**, **Abdel-Hakim and Ammar (2005)** and **Abdel-Hakim and Salah (2008)**. These studies postulated that, in the lower stocking density, more live food was available to be consumed than in higher stocking densities where the fish were more dependable on the artificial diet which increased the FCR. In this context, **Herrera (2015)** observed that FCR increases with increasing density.

Body composition of different experimental group fish reared in mono or poly cultures

All parameters of body composition of different experimental groups (Table 4) were not affected by the type reared haps (mono or poly cultures). However, values of moisture for G_2 and G_3 (poly culture) were significantly (P>0.05) lower, compared to G_1 and G_4 (mono culture). On the other hand, G_2 recorded the highest value of CP content (65.99 %); meanwhile, G3 recorded the highest value of EE content (25.65 %) and ash (13.96 %). Furthermore, the values of gross energy were 5852, 5703, 5823 and 5821 Kcal/ kg for G_1, G_2, G_3 and G_4, respectively. **Abo-State *et al.* (2021)** detected no significant differences among all treatments for the body composition of the Nile tilapia fingerlings.

Table 3. Feed utilization of different experimental groups

Item	**Experimental groups**					
	Nile tilapia (G_1)	**75% Nile tilapia + 25% of RHT (G_2)**	**25% Nile tilapia + 75% of RHT (G3)**	**Red hybrid tilapia (RHT) (G_4)**	**SEM**	**Sign. *P*<0.05**
Total body weight gain, g (TBWG)	18.90^{b}	22.63^{a}	19.90^{b}	13.20^{c}	0.876	*
Feed intake (FI), g	22.06^{d}	26.31^{b}	27.64^{a}	24.87^{c}	0.479	*
Feed conversion ratio (FCR)	1.167^{a}	1.163^{a}	1.389^{b}	1.884^{c}	0.067	*
Crude protein %			0.3220 %			
Crude protein intake (CPI), g	7.10^{d}	8.47^{b}	8.90^{a}	8.01^{c}	0.154	*
Protein efficiency ratio (PER)	2.66^{b}	2.672^{b}	2.236^{a}	1.648^{a}	0.096	*

a, b, c and d: Means in the same row having different superscripts differ significantly (*P*<0.05).
SEM: Standard error of mean NS: Not significant *: Significant at (*P*<0.05).
G_1: contained 40 fingerlings of the Nile tilapia (*Oreochromis niloticus*) that equal 100% of the Nile tilapia.
G_2: contained 40 fingerlings of fish composed of 30 fingerlings of the Nile tilapia and 10 fingerlings of red hybrid tilapia (RHT); that equal portion was 75% of the Nile tilapia and 25% of RHT.
G_3: contained 40 fingerlings of fish composed of 10 fingerlings of Nile Tilapia and 30 fingerlings of red hybrid tilapia (RHT); that equal portion was 25% of the Nile tilapia and 75% of RHT.
G_4: contained 40 fingerlings of red hybrid tilapia (RHT) that equal 100% of RHT.
Feed conversion ratio (FCR) expressed as g FI / g. gain
Protein efficiency ratio (PER) expressed as g. gain / g. of CPI.

Table 4. Body composition of different experimental groups

Item	**Experimental groups**					
	Nile tilapia (G_1)	**75% Nile tilapia +25% of RHT (G_2)**	**25% Nile tilapia + 75% of RHT (G3)**	**Red hybrid tilapia (RHT) (G_4)**	**SEM**	**Sign. *P*<0.05**
Moisture	77.94	73.69	72.36	75.13	2.12	NS
Dry matter (DM)	22.06	26.31	27.64	24.87	1.15	NS
Chemical analysis on DM basis						
Organic matter (OM)	87.56	87.00	86.04	87.00	0.15	NS
Crude protein (CP)	63.42	65.99	60.39	62.85	0.76	NS
Ether extract (EE)	24.14	21.01	25.65	24.15	0.96	NS
Ash	12.44	13.00	13.96	13.00	0.19	NS
Gross energy kcal/ kg	5852	5703	5823	5821	12.20	NS
Gross energy cal/ g DM	5.852	5.703	5.823	5.821	0.06	NS

SEM: Standard error of mean NS: Not significant
G_1: contained 40 fingerlings of the Nile tilapia (*Oreochromis niloticus*) that equal 100% of the Nile tilapia.
G_2: contained 40 fingerlings of fish composed of 30 fingerlings of the Nile tilapia and 10 fingerlings of red hybrid tilapia (RHT); that equal portion was 75% of the Nile tilapia and 25% of RHT.
G_3: contained 40 fingerlings of fish composed of 10 fingerlings of the Nile tilapia and 30 fingerlings of red hybrid tilapia (RHT); that equal portion was 25% of the Nile tilapia and 75% of RHT.
G_4: contained 40 fingerlings of red hybrid tilapia (RHT); a portion of 100% of RHT.

Additionally, the results of the present study seemed to be near the results obtained by **Abdel-Hakim *et al.* (2014)** who recorded that the averages of DM were 28.53; 27.49 and 30.57 % for T_1, T_2 and T_3, respectively, and those of DM followed a decreasing order (P<0.05) by T_1 and T_2, respectively. Moreover, the present results coincide with those of **Abdel-Hakim *et al.* (2013)** who reported that, DM contents in whole tilapia bodies ranged between 30.65 and 27.29%. On other hand, **Abdel-Hakim *et al.* (2014)** noted that, for the CP contents in tilapia whole bodies, the values were 64.20 and 64.85 and 65.40% for T_1; T_2 and T_3, respectively, and in T_3 the CP value was higher, compared to those of the other two groups, T_1 and T_2.

Energy retention (ER) and protein productive value (PPV) % of different experimental group fish reread in mono or poly cultures

Data on energy retention (ER) and protein productive value (PPV) percentages presented in Table (5) show that G_1 that contained 100 % of the Nile tilapia (mono culture) recorded the highest value of energy retention (ER) % (108.10%); while, G_4 that contained 100 % of RHT displayed the lowest value of ER % (66.61%). On the other hand, both G_2 and G_3 reared in poly culture haps recorded moderate values of ER % (105.76 vs. 90.40%) for G_1 and G_2, respectively.

Table 5. Energy retention (ER) % and protein productive value (PPV) % of different experimental groups

Item	Experimental groups					
	Nile tilapia (G_1)	**75% Nile tilapia + 25% of RHT (G_2)**	**25% Nile tilapia + 75% of RHT (G3)**	**Red hybrid tilapia (RHT) (G_4)**	**SEM**	**Sign. *P*<0.05**
Initial weight (IW), g	10	10	10	10	0.072	NS
Final weight (FW), g	28.90^b	32.63^a	29.90^b	23.20^c	1.077	*
Calculation the energy retention (ER) %						
Energy content in body fish (cal / g body fish)	5.852	5.703	5.823	5.821	0.06	NS
Energy at the end in body fish (E)	169.12^c	186.09^a	174.11^b	135.05^d	4.349	*
Energy at the start in body fish (E_0)	58.52^a	57.03^b	58.23^a	58.21^a	0.144	*
Energy retained in body fish ($E-E_0$)	110.60^c	129.06^a	115.88^b	76.84^d	4.418	*
Energy of the feed (Cal / g feed)			4.638			
Quantity of feed intake	22.06^d	26.31^b	27.64^a	24.87^c	0.479	*
Total energy feed (EF)	102.31^d	122.03**b**	128.19^a	115.35^c	2.220	*
Energy retention (ER) %	**108.10^a**	**105.76^b**	**90.40^c**	**66.61^d**	3.799	*
Calculation the protein productive value (PPV) %						
Crude protein % in body fish	63.42	65.99	60.39	62.85	0.76	NS
Total protein at the end in body fish (PR_1)	18.33^b	21.53^a	18.06^b	14.58^c	0.567	*
Total protein at the start in body fish (PR_2)	6.34^{ab}	6.60^a	6.04^b	6.29^b	0.063	*
Protein energy retained in body fish (PR_3) = ($PR_1 - PR_2$)	11.99^b	14.93^a	12.02^b	8.29^c	0.546	*
Crude protein in feed (CP%)			32.20 %			
Total protein intake (PI), g	7.10^d	8.47^b	8.90^a	8.01^c	0.154	*
Protein productive value (PPV) %	**168.87^b**	**176.27^a**	**135.00^c**	**103.50^d**	6.726	*

a, b, c and d: Means in the same row having different superscripts differ significantly (P<0.05).

SEM: Standard error of mean NS: Not significant *: Significant at P<0.05.

G_1: contained 40 fingerlings of the Nile tilapia (*Oreochromis niloticus*) that equal 100% of the Nile tilapia.

G_2: contained 40 fingerlings of fish composed of 30 fingerlings of the Nile tilapia and 10 fingerlings of red hybrid tilapia (RHT), that equal portion was 75% of Nile Tilapia and 25% of RHT.

G_3: contained 40 fingerlings of fish composed of 10 fingerlings of the Nile tilapia and 30 fingerlings of red hybrid tilapia (RHT), that equal portion was 25% of the Nile tilapia and 75% of RHT.

G4: contained 40 fingerlings of Red hybrid Tilapia (RHT) that equal 100% of RHT.

Moreover, protein productive value (PPV) % was significantly (P<0.05) affected in the four different tested groups. The values of PPV % ranged from 103.50 to 176.27%, and G_2 recorded the highest value of PPV% (176.27%), followed by G_1 that recorded (168.87%) then G_3 (135.00 %) of PPV. Whereas, G4 recorded the lowest value of PPV% that was evaluated by 103.50%. These results agree with those of **Abo-State *et al.* (2021)**.

CONCLUSION

According to the results of the current study, reared of both the Nile red hybrid and the Nile tilapia in one hap (poly culture) could be realized or used successfully without occurring adverse effect on growth performance, feed utilization and body composition.

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