4. *RESULTS AND DISCUSSION*

4.1. First experiment:

4.1.1. Total egg weight per female (g) and egg weight (g) per gm of body weight:

Total egg weight (g) per female (EW/F) and egg weight (g) per gm of body weight (EW/GF) as affected by the year of hatching are presented in Table (2). The averages of EWF were13.35 and 19.24 g and the averages of EW/GF (Table 2) were 0.038 and 0.035 g for the two years 2002 and 2003, respectively. These results indicate that, EW/F for year 2003 were higher than that obtained in year 2002 but EW/G for 2002 were higher than that obtained in the year 2003. The differences between the means of each of EW/F and EWG were non significant (Table 2).

With regard to effect of male body weights, Table (2) show that, EW/F were 13.33 and 19.26g and EW/GF were 0.038 and 0.35 g for the two male groups 300 and 400 g, respectively, and the differences between averages due to the effect of the two male weights were non significant.

With regard to the effect of body weight of female on EW/F, Table (2) shows that EW/F increased gradually as female body weight increased. EW/F for the three groups 300, 400 and 500 g were 12.33, 14.64 and 21.91g, respectively. Analysis of variance (Table 3) shows that, the differences among EW/F means for to the effect of female body weights were non significant. These results are in accordance with those obtained by **Rana (1988)**. **Watanabe and Kuo (1985)** reported about the increase of egg weight produced by

Table (2): Least squares means and standard error for some factors affecting on **egg weight (g)/fish** and **egg weight (g) /gm** of fish body weight.

Variable	No.	EW/F	EW/GF
Year			
Y1 2002	300	13.35±3.87	0.038±0.001
Y2 2003	300	19.24±3.87	0.035±0.001
Male			
M1 300 g	300	13.33±3.87	0.038±0.001
M2 400 g	300	19.26±3.87	0.035±0.001
Female			
F1 300 g	200	12.33±4.74	0.045±0.002a
F2 400 g	200	14.64±4.74	0.040±0.002b
F3 500 g	200	21.91±4.74	0.038±0.002b
Year × Male			
Y1 × M1	150	13.91±5.47b	0.040±0.002a
Y1 × M2	150	12.79±5.47b	0.030±0.002b
Y2 × M1	150	24.61±5.47a	0.040±0.002a
Y2 × M2	150	13.88±5.47b	0.040±0.002a
Year × Female			
Y1× F1	100	11.42±6.7c	0.040±0.003a
Y1× F2	100	15.33±6.7b	0.040±0.003a
Y1× F3	100	13.31±6.7a	0.030±0.003b
Y2× F1	100	13.24±6.7c	0.040±0.003a
Y2× F2	100	13.95±6.7a	0.030±0.003b
Y2× F3	100	13.54±6.7b	0.030±0.003b
Male × Female			
M1× F1	100	12.68±6.7c	0.050±0.003a
M1× F2	100	15.08±6.7a	0.040±0.003b
M1× F3	100	13.02±6.7b	0.030±0.003c
M2× F1	100	11.98±6.7c	0.040±0.003b
M2× F2	100	14.20±6.7b	0.040±0.003b
M2× F3	100	13.82±6.7b	0.040±0.003c
Year ×Male × Female			
Y1× M1 × F1	50	12.35±9.48c	0.050±0.004a
Y1× M1 × F2	50	16.08±9.48a	0.040±0.004b
Y1× M1 × F3	50	13.31±9.48b	0.040±0.004b
Y1× M2 × F1	50	10.49±9.48c	0.030±0.004c
Y1× M2 × F2	50	14.58±9.48b	0.040±0.004b
Y1× M2 × F3	50	13.30±9.48a	0.030±0.004c
Y2× M1 × F1	50	13.00±9.48c	0.040±0.004b
Y2× M1 × F2	50	14.08±9.48b	0.030±0.004c
Y2× M1 × F3	50	16.73±9.48a	0.030±0.004c
Y2× M2 × F1	50	13.47±9.48c	0.040±0.004b
Y2× M2 × F2	50	13.82±9.48b	0.030±0.004c
Y2× M2 × F3	50	14.35±9.48a	0.030±0.004c

+ Means with the same letter in each column are not significantly differences ($P < 0.05$).

Table (3): Analysis of variance for some factors affecting on **egg weight (g)/fish** and **egg weight (g) /gm** of fish body weight.

S.O.V	**df**	**f-ratio**	
		EW/F	**EW/GF**
Year	1	1.16	1.39
Male	1	1.17	3.33
Female	2	1.12	10.14***
Year * Male	1	0.77	3.06
Year * Female	2	1.10	0.4
Male * Female	2	0.88	1.57
Year * Male * Female	2	1.08	1.92
Remainder df	588		
Remainder MS		16.30	0.036

*** $P < 0.001$

large and old tilapia. **Rana (1988)** found that, the egg number produced by a fish was more related to body weight, while **De Silva,** (**1986**) claimed that the increase was related to body length. **Cisse (1988)** found no significant correlation between spawner weight and number of spawning.

Averages weight of egg per gm of fish (EW/GF) as affected by female body weight were 0.045, 0.040 and 0.038 g for the three studied female body weight groups 300, 400 and 500g, respectively and the differences between means of this trait were non significant (Table 3). As shown in (Table 2) EW/GF decreased with the increase in body weight of female. These results are in agreement with those found by **Mostafa (1988),** who found that, average weights of egg per kg of live weight increased from 158 to 200 and 227 g as body weight of common carp increased from 3 to 4 and 5 kg, respectively, then decreased gradually from 198 to 195 and 173 as body weights increased from 6 to 7 and 8 kg, respectively. **Morsy (2001)** found that, average weight of egg per kg of live weight increased from 59.84 and 103.03 g as body weight of black carp increased from 5-6 and 6.5-7.5 kg, respectively, then decreased gradually from 103.03 to 95.23 as body weight increased from 6.5-7.5 to 8-9 kg, respectively.

The differences between averages of EW/F and EW/GF due to the effect of the interaction among the three factors were non significant.

4.1.2. Absolute and relative fecundity (ABS) and (REL):

Results presented in Table (4) showed that, averages of absolute fecundity (ABS) as affected by the year were 1215.39 and 1411.71 for the two years 2002 and 2003, respectively, and the differences between means were significant ($p<0.001$) and the same trend was also observed for relative fecundity (REL), where the averages were 3.31 and 3.66 for the two year, respectively.

With regard to the effect of male body weights on the absolute and relative fecundity. Table (4) showed that, the absolute fecundity were 1327.03 and 1300.07 and the relative fecundity were 3.55 and 3.41. Analysis of variance (Table 5) showed that, male had non significant effect on both absolute and relative fecundity.

Results presented in table (4) showed that, absolute fecundity for the body weights of female groups were 1264.73, 1376.1 and 1299.84 for the three females groups 300, 400 and 500 g, respectively. Analysis of variance (table 5) showed that, the differences in absolute fecundity as affected by female body weight were highly significant ($P<0.01$). The obtained results indicate that, absolute fecundity increased from 1264.73 to 1376.1 as body weight increased from 300 to 400g and then decreased from 1376.1 to 1299.84 as body weight increased from 400 to 500 g. These results indicated that, the best absolute fecundity was recorded with the second size group (400 g) of female compared with the first and the third size groups (300 and 500 g), respectively. In this respect, **Hashem and El-Agamy (1977)**, revealed that, fecundity is a function related to length, weight and age of different fish species and it increased with increase in these parameters. **Watanabe and**

Kuo (1985) reported that, absolute fecundity increased by using large and old tilapia. **Rana (1988) and Bhujel (2000)** indicated that, absolute fecundity is related to body weight, while **De Silva (1986)** found that, absolute fecundity is related to body length.

With regard to the effect of body weight of female on the relative fecundity, table (4) showed that, the averages relative fecundity were 4.14, 3.49 and 2.82 for the three females groups 300, 400 and 500g, respectively. These results indicate that, increasing in body weight of female lead to decrease in relative fecundity. Analysis of variance (table 5) show that, the effect of female body weight on relative fecundity were significant ($P<0.001$). These results are in agreement with **Estay *et al.*, (1997)** who foundthat, the relative fecundity decreased with increasing of female body weight. On the other hand, **Rana (1986)** and **Bhujel (2000)** stated that, relative fecundity decreased with the decrease in age, body weight and body length of female Nile tilapia The differences between averages of ABS and REL, due to the effect of the interactions between female weight and year of hatching were significant ($P<0.01$ and $P<0.001$) which indicate that the simple effect of female weight factor changed as year of hatching changed. The same significance was obtained in case of REL due to the interaction among the three factors studied.

Table (4): Least squares means and standard error for some factors affecting on **absolute and relative fecundity**.

Variable	No.	Absolute fecundity	Relative fecundity
Year			
Y1 2002	300	1215.39±18.67b	3.31±0.06b
Y2 2003	300	1411.71±18.67a	3.66±0.06a
Male			
M1 300 g	300	1327.03±18.67	3.55±0.06
M2 400 g	300	1300.07±18.67	3.41±0.06
Female			
F1 300 g	200	1264.73±22.87b	4.14±0.07a
F2 400 g	200	1376.10±22.87a	3.49±0.07b
F3 500 g	200	1299.84±22.87b	2.82±0.07c
Year × Male			
Y1 × M1	150	1244.33±26.4	3.44±0.08
Y1 × M2	150	1186.45±26.4	3.18±0.08
Y2 × M1	150	1409.73±26.4	3.67±0.08
Y2 × M2	150	1413.69±26.4	3.65±0.08
Year × Female			
Y1× F1	100	1108.32±32.34c	3.77±0.1b
Y1× F2	100	1325.50±32.34a	3.48±0.1b
Y1× F3	100	1212.36±32.34b	2.67±0.1c
Y2× F1	100	1421.13±32.34a	4.51±0.1a
Y2× F2	100	1426.70±32.34a	3.50±0.1b
Y2× F3	100	1387.31±32.34b	2.97±0.1c
Male × Female			
M1× F1	100	1293.04±32.34b	4.31±0.1a
M1× F2	100	1388.26±32.34a	3.53±0.1b
M1× F3	100	1299.80±32.34b	2.81±0.1c
M2× F1	100	1236.41±32.34b	3.97±0.1b
M2× F2	100	1363.94±32.34a	2.44±0.1c
M2× F3	100	1299.87±32.34b	2.83±0.1c
Year ×Male × Female			
Y1× M1 × F1	50	1192.66±45.73c	4.15±0.14a
Y1× M1 × F2	50	1321.84±45.73a	3.48±0.14b
Y1× M1 × F3	50	1218.50±45.73b	2.67±0.14c
Y1× M2 × F1	50	1023.98±45.73c	3.40±0.14b
Y1× M2 × F2	50	1329.16±45.73a	3.48±0.14b
Y1× M2 × F3	50	1206.22±45.73b	2.67±0.14c
Y2× M1 × F1	50	1393.42±45.73a	4.47±0.14a
Y2× M1 × F2	50	1454.68±45.73a	3.59±0.14b
Y2× M1 × F3	50	1381.10±45.73a	2.95±0.14c
Y2× M2 × F1	50	1448.84±45.73a	4.55±0.14a
Y2× M2 × F2	50	1398.72±45.73a	2.41±0.14c
Y2× M2 × F3	50	1393.52±45.73a	2.99±0.14c

+ Means with the same letter in each column are not significantly differences ($P < 0.05$).

Table (5): Analysis of variance for some factors affecting on **absolute and relative fecundity.**

S.O.V	**df.**	**f-raios**	
		Abs	**Rel**
Year	1	55.28***	19.83***
Male	1	1.04	3.07
Female	2	1.37**	2.30***
Year * Male	1	6.22	95.06
Year * Female	2	5.52**	7.07***
Male * Female	2	0.39	1.78
Year * Male * Female	2	2.59	3.82*
Remainder df	588		
Remainder MS		1313.55	3.48

** P < 0.01 *** P < 0.001

4.1.3. The ratio of number of eggs / one gram of egg (NE/GE):

As shown in Table (6), the average number of eggs in one gm of egg (NE/GE) for the two years 2002 and 2003 were 94.63 and 103.004, respectively. Results in Table 6 indicated that, NE/GE ratio of the year 2003 were higher than the ratio obtained for the year 2002 and these results may be due to increase in fish body weight. Analysis of variance (Table 7) indicate that, there were highly significant ($P<0.001$) effect of years on the averages number of eggs in one gm of egg (NE/GE).

As shown in table (6) the (NE/GE) were 99.06 and 98.58 for the two male groups 300 and 400 g, respectively. Analysis of variance for the effect of body weight of male on number of eggs in one gm of egg (NE/GE) was non significant (Table 7).

With regard to the effect of female body weight on average number of eggs in one gram of egg (NE/GE) Table (6) indicate that, the averages were 103.64, 97.63 and 95.19 for the three weight groups 300, 400 and 500 g, respectively. The differences between (NE/GE) attributed to female body weight were significant ($P<0.001$) (table 7).

The differences between averages of NE/GE due to the interaction effect between female weights with each of male weights and year of hatching were significant ($P<0.05$).

These results indicate that, increase in body weight of female lead to decrease in the averages (NE/GE). These results are in agreement with that obtained by **Hussein (1986)**, **Mostafa (1988)** and **Su (1996)** who observed a slight decrease in the average number of eggs in one gram as females' body weight increased. On

Table (6): Least squares means and standard error for some factors affecting on **number of eggs/gram of egg.**

Variable	No.	NE/GE
Year		
Y1 2002	300	94.630±0.61b
Y2 2003	300	103.004±0.60a
Male		
M1 300 g	300	99.060±0.61
M2 400 g	300	98.580±0.61
Female		
F1 300 g	200	103.640±0.74a
F2 400 g	200	97.630±0.74b
F3 500 g	200	95.190±0.74c
Year × Male		
Y1 × M1	150	94.940±0.86a
Y1 × M2	150	94.330±0.86b
Y2 × M1	150	103.170±0.86a
Y2 × M2	150	102.840±0.86a
Year × Female		
Y1× F1	100	98.330±1.05b
Y1× F2	100	93.300±1.05c
Y1× F3	100	92.540±1.05c
Y2× F1	100	108.950±1.05a
Y2× F2	100	102.240±1.05a
Y2× F3	100	97.830±1.05b
Male × Female		
M1× F1	100	102.480±1.05a
M1× F2	100	99.120±1.05b
M1× F3	100	95.570±1.05c
M2× F1	100	104.790±1.05a
M2× F2	100	96.150±1.05b
M2× F3	100	94.800±1.05c
Year ×Male × Female		
Y1× M1 × F1	50	97.000±1.49b
Y1× M1 × F2	50	94.940±1.49c
Y1× M1 × F3	50	92.880±1.49c
Y1× M2 × F1	50	99.660±1.49b
Y1× M2 × F2	50	91.120±1.49c
Y1× M2 × F3	50	92.290±1.49c
Y2× M1 × F1	50	107.470±1.49a
Y2× M1 × F2	50	103.290±1.49a
Y2× M1 × F3	50	98.250±1.49c
Y2× M2 × F1	50	109.930±1.49a
Y2× M2 × F2	50	101.180±1.49ab
Y2× M2 × F3	50	97.410±1.49b

+ Means with the same letter in each column are not significantly differences (P < 0.05).

Table (7): Analysis of variance for some factors affecting on **number of eggs/gram of egg.**

S.O.V	**df**	**F-ratios**
		NE/GE
Year	1	95.18***
Male	1	0.3
Female	2	0.03***
Year * Male	1	34.27
Year * Female	2	3.45*
Male * Female	2	3.18*
Year * Male * Female	2	0.18
Remainder df	588	
Remainder MS		98.82

* P < 0.05 *** P < 0.001

the other hand, **Watanabe and Kuo (1985) and El-Ebiary (1994)** found that, increase in number of egg produced by large and old tilapia. **Morsy (2001)** studied the effect of body weight of black carp females on number of egg in one gram egg found that, the averages of number of egg in one gram were 939.63, 940.38 and 942.00 for the three weight groups, 5-6, 6.5-7.5 and 8-9 kg, respectively.

4.1.4. Hatchability percentage:

Averages of hatchability percentage as affected by years were 81.44 and 82.73% for the two years 2002 and 2003, respectively, (Table 8). With respect to the effect of male body weight, the hatchability percentages were 80.69 and 83.48% for the two male groups studied 300 and 400g, respectively. Analyses of variance (Table 9) showed that, the differences in hatchability attributed to year and male were significant (P<0.001).

Averages of hatchability percentages as affected by weight of Nile tilapia females were 82.68, 82.36 and 82.22% for the three weight groups, 300, 400 and 500 g, respectively (Table 8).

Results presented in this table showed that, hatchability percentage slightly decreased with the increase in body weight of females. The analysis of variance of obtained data indicates that, female body weight has a significant (P<0.001) effect on the hatchability percentage (Table 9). The differences between the percentages of hatchability due to the interaction between female weight with each of male weight and year were significant (P<0.001).

Table (8): Least squares means and standard error for some factors affecting on **hatchability percentage**.

Variable	No.	Hatchability %
Year		
Y1 2002	300	81.44±0.19b
Y2 2003	300	82.73±0.19a
Male		
M1 300 g	300	80.69±0.19b
M2 400 g	300	83.48±0.19a
Female		
F1 300 g	200	82.68±0.24a
F2 400 g	200	82.36±0.24a
F3 500 g	200	82.22±0.24b
Year × Male		
Y1 × M1	150	80.31±0.27c
Y1 × M2	150	82.58±0.27ab
Y2 × M1	150	81.08±0.27b
Y2 × M2	150	84.37±0.27a
Year × Female		
Y1× F1	100	82.76±0.34a
Y1× F2	100	81.31±0.34b
Y1× F3	100	80.25±0.34c
Y2× F1	100	82.59±0.34a
Y2× F2	100	81.40±0.34b
Y2× F3	100	84.90±0.34c
Male × Female		
M1× F1	100	81.96±0.34a
M1× F2	100	80.90±0.34b
M1× F3	100	79.22±0.34c
M2× F1	100	83.39±0.34a
M2× F2	100	81.81±0.34b
M2× F3	100	85.22±0.34a
Year ×Male × Female		
Y1× M1 × F1	50	81.68±0.48a
Y1× M1 × F2	50	80.46±0.48b
Y1× M1 × F3	50	78.78±0.48c
Y1× M2 × F1	50	83.85±0.48a
Y1× M2 × F2	50	82.16±0.48a
Y1× M2 × F3	50	81.72±0.48a
Y2× M1 × F1	50	82.24±0.48a
Y2× M1 × F2	50	81.34±0.48ab
Y2× M1 × F3	50	79.66±0.48c
Y2× M2 × F1	50	82.94±0.48a
Y2× M2 × F2	50	81.46±0.48ab
Y2× M2 × F3	50	88.72±0.48a

+ Means with the same letter in each column are not significantly differences ($P < 0.05$).

Table (9): Analysis of variance for some factors affecting on **hatchability percentage.**

S.O.V	**df**	**f-ratio**
Year	1	21.9***
Male	1	102.42***
Female	2	3.47***
Year * Male	1	7.94
Year * Female	2	23.4***
Male * Female	2	34.6***
Year * Male * Female	2	21.5***
Remainder df	588	
Remainder MS		92.08

*** $P < 0.001$

The significance was obtained for hatchability percentage due to the interaction among the three factors together.

These results are in agreement with those obtained by **(Gunasekera *et al.*, 1996 and Su *et al.*, 1996)** who stated that, hatchability decreased by the increase in body weight of females.

On the other hand, **Morsy (2001)** who found that, averages of hatchability percentages as affected by black carp females were 49.76, 58.44 and 88.69% for the weight groups 5-6, 6.5-7.5 and 8-9 kg respectively, these results indicated that, hatchability percentage increased with the increase in body weight of female.

4.1.5. Fry number per fish and fry number per gram of female body weight:

4.1.5.1. Fry number per fish (FN/F):

The average fry number per fish (FN/F) as affected by year, male and female body weight are listed in Table (10). As shown in this table, the averages fry number per fish (FN/F) as affected by year were 869.73 and 1017.52 fry/fish for the two years 2002 and 2003, respectively, and the differences between these averages were significant (P<0.001). This indicated that, the fry number produced per fish in year 2003 was better than those of year 2002. Table (10) also showed that, the fry number per fish were 950.36 and 936.89 for the two male groups studied 300 and 400 g, respectively, with non significant differences between averages of fry number / fish attributed to male weight effect (Table 10).

With regard to the effect of female body weight on (FN/F) table (10) showed that, the averages fry number / fish were 896.25, 987.42 and 997.22 for the three female body weight groups 300, 400 and 500 g, respectively. Analysis of variance (Table 11) showed that, the differences between averages of fry number per fish attributed to female weight were highly significant ($P<0.001$).

Thorpe (1984) found that, larger eggs produce significantly larger swim-up fry of tilapia**. Springate and Bromage, (1985)** said that, there is no relationship between egg size and survival rates of the eggs, hatched fry and swim-up**. Morsy (2001)** reported that, as black carp female body weight increased, egg weight /fish, absolute fecundity, relative fecundity, larvae number / fish and hatchability percentage increased and this may be followed by increase in the fry number produced by females of black carp.

4.1.5.2. Fry number per gram of female body weight (FN/GF):

Averages of fry number per gram fish (FN/GF) as affected by year, male and female body weight are presented in Table (10). As shown in this table the averages (FN/GF) were 1.18 and 1.32 for the two years 2002 and 2003, respectively, and the differences between these averages were significant ($P<0.001$). **Morsy (2001)** found that, the effect of year of hatching on fry number per kg body weight were 41.73 and 39.56 for the two years 1999 and 2000, respectively.

With regard to the effect of body weight of male on Fry number per gram were 1.27 and 1.23 for the two male groups 300 and 400 g, respectively and the differences between these averages were non significant (Table 11).

Table (10): Least squares means and standard error for some factors affecting on **fry number/fish and fry number/ gram of fish**.

Variable	No.	FN/F	FN/G
Year			
Y1 2002	300	869.73±13.35b	1.18±0.03b
Y2 2003	300	1017.52±13.35a	1.32±0.03a
Male			
M1 300 g	300	950.36±13.35	1.27±0.03
M2 400 g	300	936.89±13.35	1.23±0.03
Female			
F1 300 g	200	896.25±16.35b	1.47±0.04a
F2 400 g	200	987.42±16.35a	1.25±0.04b
F3 500 g	200	997.22±16.35a	1.02±0.04c
Year × Male			
Y1 × M1	150	885.81±18.88b	1.50±0.06b
Y1 × M2	150	853.66±18.88b	1.45±0.06b
Y2 × M1	150	1014.92±18.88a	1.68±0.06a
Y2 × M2	150	1020.12±18.88a	1.62±0.06a
Year × Female			
Y1× F1	100	776.04±23.13c	1.73±0.08b
Y1× F2	100	944.29±23.13b	1.48±0.08bc
Y1× F3	100	888.87±23.13b	1.20±0.08c
Y2× F1	100	1016.45±23.13a	1.94±0.08a
Y2× F2	100	1030.54±23.13a	1.65±0.08b
Y2× F3	100	1005.57±23.13a	1.35±0.08c
Male × Female			
M1× F1	100	906.77±23.13b	1.87±0.08a
M1× F2	100	991.64±23.13a	1.59±0.08bc
M1× F3	100	952.68±23.13b	1.30±0.08c
M2× F1	100	885.72±23.13c	1.81±0.08a
M2× F2	100	983.19±23.13a	1.54±0.08bc
M2× F3	100	941.76±23.13a	1.25±0.08c
Year ×Male × Female			
Y1× M1 × F1	50	823.98±32.70b	1.94±0.11c
Y1× M1 × F2	50	936.28±32.70b	2.45±0.11ab
Y1× M1 × F3	50	897.16±32.70b	2.87±0.11a
Y1× M2 × F1	50	728.10±32.70c	1.93±0.11c
Y1× M2 × F2	50	952.30±32.70a	2.48±0.11ab
Y1× M2 × F3	50	880.58±32.70b	2.45±0.11ab
Y2× M1 × F1	50	989.56±32.70a	2.15±0.11b
Y2× M1 × F2	50	1047.00±32.70a	2.58±0.11ab
Y2× M1 × F3	50	1008.20±32.70a	3.17±0.11a
Y2× M2 × F1	50	1043.34±32.70a	2.13±0.11b
Y2× M2 × F2	50	1114.08±32.70a	2.47±0.11b
Y2× M2 × F3	50	1002.94±32.70a	3.27±0.11a

+ Means with the same letter in each column are not significantly differences ($P < 0.05$).

Table (11): Analysis of variance for some factors affecting on **fry number/fish and fry number/ gram of fish.**

S.O.V.	**df**	**f-ratios**	
		FN/F	FN/G
Year	1	61.28***	21.33***
Male	1	0.51	2.89
Female	2	0.98***	94.88***
Year * Male	1	7.81	2.45
Year * Female	2	6.23**	7.67***
Male * Female	2	0.04	1.21
Year * Male * Female	2	2.42	4.06*
Remainder df	588		
Remainder MS		943.63	0.27

* P < 0.05 ** p < 0.01 *** P < 0.001

With regard to the effect of body weight of female on (FN/GF) Table (10) show that, the averages of fry number / gm were 1.47, 1.25 and 1.02 for the three body weight groups, 300, 400 and 500 g, respectively. Analysis of variance of the effect of body weight of female on fry number per gram (Table 10) show that, the differences between averages were significant ($P<0.001$).

These results are in agreement with **Morsy (2001)** he found that, the effect of female body weights on fry number per kg were 42.02, 41.53 and 38.39 for the three weight groups, 5-6, 6.5-7.5 and 8-9 kg, respectively.

The differences between the averages of FN/F and FN/GF, due to the effect of the interaction between female weight and year of hatching were significant ($P<0.001$). Also, the averages of FN/G, due to the interaction among the three factors were significant ($P<0.05$).

4.1.6. Fry body weight:

Body weight of fry aged 2, 10, 20 and 30 days after hatching as affected by year, male and female body weight are presented in Table (12) and. As shown in this table, after 2 days the averages of body weight of fry in year 2002 and 2003 were 0.02g. However, after 10 days the averages of body weight of fry were 0.036 and 0.034g, respectively. The differences between the averages of the 2 years were significant ($P<0.01$). After 20 days the averages of body weight of fry were 0.125 and 0.110g, respectively, and the differences between the averages of the 2 years were significant ($P<0.05$). The averages of body weight of fry after 30 days were 0.42

and 0.45g, respectively, and the differences between averages were significant (P<0.01) (Tables 12 and 13).

The effect of two male body weights 300 and 400 g on averages of fry body weight after 2,10 and 20 days was 0.02, 0.036 and 0.129g for the two years, respectively, with non significant differences between averages of the 2 males weights. The averages of body weight of fry after 30 days were 0.44 and 0.43g. Analysis of variance indicate that Table (13) least squares means for the male body weights had no significant effect on fry body weight after 2, 10, 20 and 30 days after hatching (Table 13).

With regard to the effect of female body weight on fry body weight, results in Table (12) indicate that, the averages of fry body weight after 2 days were 0.02 g for the three weight groups, 300, 400 and 500 g, respectively. After 10 days the averages body weight of fry were 0.034, 0.036 and 0.035g and the differences between fry body weights attributed to female body weight (Table 13) were significant (P<0.001). After 20 days the averages body weight of fry were 0.11, 0.12 and 0.12 g, respectively. The differences between averages due to the effect of female groups were significant (P<0.05). Table (12) also showed that, the averages of body weight of fry after 30 days were 0.45, 0.43 and 0.43 g, respectively. These results indicate that, the increase in female body weight leads to decrease in fry body weight. Analysis of variance (Table 13) indicate that, the differences between averages were significant (P<0.01).

Table (12): Least squares means and standard error for some factors affecting on **body weight of Nile tilapia fry**.

Variable	No.	2 days	10 days	20 days	30 days
Year					
Y1 2002	300	0.020±0.005	0.036±0.005a	0.125±0.005a	0.42±0.005b
Y2 2003	300	0.020±0.005	0.034±0.005b	0.110±0.005b	0.45±0.005a
Male					
M1 300 g	300	0.020±0.007	0.035±0.007	0.12±0.007	0.44±0.007
M2 400 g	300	0.020±0.007	0.035±0.007	0.12±0.007	0.43±0.007
Female					
F1 300 g	200	0.020±0.007	0.034±0.007c	0.11±0.007b	0.45±0.007a
F2 400 g	200	0.020±0.007	0.036±0.007a	0.12±0.007a	0.43±0.007b
F3 500 g	200	0.020±0.007	0.035±0.007b	0.12±0.007a	0.43±0.007b
Year × Male					
Y1 × M1	150	0.020±0.005	0.036±0.005ab	0.12±0.005b	0.41±0.005b
Y1 × M2	150	0.020±0.005	0.037±0.005a	0.13±0.005a	0.42±0.005b
Y2 × M1	150	0.020±0.005	0.034±0.005c	0.11±0.005b	0.46±0.005a
Y2 × M2	150	0.020±0.005	0.034±0.005c	0.11±0.005b	0.45±0.005a
Year × Female					
Y1× F1	100	0.020±0.008	0.033±0.008c	0.12±0.008b	0.39±0.008b
Y1× F2	100	0.019±0.008	0.039±0.008a	0.13±0.008a	0.43±0.008c
Y1× F3	100	0.020±0.008	0.036±0.008b	0.13±0.008a	0.43±0.008c
Y2× F1	100	0.020±0.008	0.034±0.008c	0.11±0.008c	0.50±0.008a
Y2× F2	100	0.020±0.008	0.033±0.008c	0.11±0.008c	0.44±0.008c
Y2× F3	100	0.020±0.008	0.034±0.008c	0.11±0.008c	0.42±0.008c
Male × Female					
M1× F1	100	0.020±0.008	0.035±0.008b	0.11±0.008c	0.45±0.008a
M1× F2	100	0.020±0.008	0.037±0.008a	0.12±0.008b	0.43±0.008b
M1× F3	100	0.020±0.008	0.033±0.008c	0.13±0.008a	0.43±0.008b
M2× F1	100	0.020±0.008	0.033±0.008c	0.12±0.008b	0.44±0.008b
M2× F2	100	0.020±0.008	0.036±0.008ab	0.12±0.008b	0.44±0.008b
M2× F3	100	0.020±0.008	0.036±0.008ab	0.12±0.008b	0.43±0.008b
Year ×Male × Female					
Y1× M1 × F1	50	0.020±0.012	0.035±0.012b	0.11±0.012c	0.39±0.012c
Y1× M1 × F2	50	0.020±0.012	0.039±0.012a	0.13±0.012a	0.42±0.012b
Y1× M1 × F3	50	0.020±0.012	0.033±0.012c	0.13±0.012a	0.43±0.012b
Y1× M2 × F1	50	0.020±0.012	0.031±0.012d	0.12±0.012b	0.39±0.012c
Y1× M2 × F2	50	0.020±0.012	0.039±0.012a	0.13±0.012a	0.43±0.012b
Y1× M2 × F3	50	0.020±0.012	0.039±0.012a	0.13±0.012a	0.44±0.012b
Y2× M1 × F1	50	0.020±0.012	0.034±0.012c	0.11±0.012c	0.55±0.012a
Y2× M1 × F2	50	0.020±0.012	0.034±0.012c	0.11±0.012c	0.44±0.012b
Y2× M1 × F3	50	0.020±0.012	0.034±0.012c	0.11±0.012c	0.43±0.012b
Y2× M2 × F1	50	0.020±0.012	0.031±0.012d	0.11±0.012c	0.49±0.012ab
Y2× M2 × F2	50	0.020±0.012	0.033±0.012c	0.11±0.012c	0.44±0.012b
Y2× M2 × F3	50	0.020±0.012	0.035±0.012b	0.11±0.012c	0.42±0.012b

+ Means with the same letter in each column are not significantly differences ($P < 0.05$).

Table (13): Analysis of variance for the effect of year, male and female on **body weight of Nile tilapia fry.**

S.O.V.	**Df**	**f-ratios**			
		2 days	**10 days**	**20 days**	**30 days**
Year	1	0.09	1.15**	0.92*	2.73**
Male	1	0.11	.39	0.58	0.01
Female	2	0.70	1.73***	2.53*	5.10**
Year * Male	1	0.10	.67*	0.46	0.75*
Year * Female	2	0.03	6.15***	3.12**	9.12***
Male * Female	2	0.78	2.73*	3.43*	7.18***
Year * Male * Female	2	0.11	0.85**	2.12***	6.15**
Remainder df	588				
Remainder MS		0.98	3.62	5.48	5.08

* $P < 0.05$ ** $p < 0.01$ *** $P < 0.001$

Morsy (2001) reported that, fry viability decreased from 86.92 to 85.77 and 73.52% as female body weight increased from 5-5, 6.5-7.5 and 8-9 kg, respectively. **Gisbert (1999)** found that, there was a positive correlation between egg size and total body weight and yolk-sac volume of newly hatched larvae.

The differences between the averages of fry body weights at 10, 20 and 30 days of age, due to the interaction effect between female weights and each of year of hatching and male weight were mostly significant ($P<0.05$, $P<0.01$ and $P<0.001$). The averages of fry body weights at the above ages, due to the interaction of the three factors were significant ($P<0.01$ and $P<0.001$)

4.1.7. Daily Weight Gain for fry (DWG):

Results of daily weight gain (DWG) for fry as affected by year, male and female weight are illustrated in (Table 14). As shown in this table, averages of DWG during the period 2-10 days in year 2002 were 0.012, 0.015, 0.010, 0.008, 0.014 and 0.014 for the six treatments, T1 (M1× F1), T2 (M1× F2), T3 (M1× F3), T4 (M2× F1), T5 (M2× F2) and T6 (M2× F3), respectively.

While in the same period in year 2003, the averages of the different treatments were relatively constant and equal to 0.010 g. The analysis of variance of averages for this period were highly significant ($P<0.001$) for year 2002 but there were no significant differences in fry body weight for 2003 (Table 15). As shown in Table (14) averages of DWG during the period 10-20 days were 0.050, 0.052, 0.060, 0.072, 0.054 and 0.054 g for the six treatments for year 2002 while fry body weight in the same period in year 2003 were

0.046, 0.046, 0.047, 0.045, 0.048 and 0.045, respectively. The differences between averages were non significant. Averages of DWG during the period 20-30 days were 0.17, 0.018, 0.18, 0.17, 0.18 and 0.19 for the six treatments for year 2002, while the same period in year 2003 were 0.233, 0.200, 0.190, 0.230, 0.200 and 0.190, respectively. Analysis of variance between averages were highly significant ($P<0.001$) for the two years.

Averages of DWG during the whole experimental period (2-30 days) were 0.022, 0.0240, 0.0243, 0.0230, 0.0244 and 0.0250 g in year 2002 while in year 2003 DWG during the whole experimental period were 0.0290, 0.0250, 0.0240, 0.0280, 0.0250 and 0.0240 g for the six treatments, respectively. These results indicate that, in year 2002, the highest value (0.025 g) of DWG was recorded for T6 (M2× F3) and the lowest value of DWG was T1 (M1× F1). In comparison with year 2003, the treatment T1 (M1× F1) gave the highest (0.029 g) value but treatments T3 (M1× F3) and T6 (M2× F3) gave the lowest (0.024 g) value of DWG. These results conclude that, the effect of year on Daily weight gain (DWG).

Jonsson (2000) and Gisbert (2000) who reported that, no significant relationship between egg size and weight gain of fry.

4.2. Second experiment:

4.2.1. Effect of flumequine on reproductive traits:

Averages of Total egg weight (g) per female (EW/F) and egg weight (g) per g of body weight (EW/GF) as affected by addition of flumequine in prepared diets for Nile tilapia are presented in table (16). The averages of EW/F were 10.82, 14.14, 14.70 and 11.27, while the averages of EW/G were 0.03, 0.04, 0.04 and 0.03g for the four treatments. These results indicate that, EW/F and EW/G for diets contain 10mg and 14mg flumequine were higher than that obtained by using 18mg and control (0 flumequine –without treatment) and the differences between the averages of EW/F were significant ($p<0.001$). These results are in agreement with **Hansen *et al.*, (1992)**, who found that, using 12 mg flumequine dose in diets per kg body weight gave higher average of EW/F in Atlantic halibut.

The averages number of eggs in one gram egg (NE/GE) as affected by addition of flumequine in prepared diets are presented in table (16). The averages (NE/GE) are 102.33, 97.73, 94.5 and 104.57 for the four treatments control, 10 mg, 14 mg and 18 mg FLU. These results did not indicate that a definite trend in flumequine concentration in (NE/GE). However, 18mg concentration of FLU increased the average of NE/GE. The differences between the averages were significant ($p<0.001$). The last result is in agreement with **Vanbelle *et al.*, (1990)** who found that, number of egg per gram egg increased by increasing doses of flumequine. Table (16), presents the absolute fecundity (ABS) and relative fecundity (REL) (Table 18) as affected by addition of flumequine (FLU) in prepared diets. The averages of (ABS) were

1112.07, 1322.6, 1355.67 and 1177.03 and the averages of (REL) were 3.27, 3.63, 3.86 and 3.33 for the four levels of flumequine control, 10, 14 and 18 mg, respectively. These results showed that ABS and REL were increased by increase in level of flumequine from 0 to 14 mg and decreased by increase in level 18mg of flumequine. The differences between the averages were highly significant for absolute fecundity (p<0.001) and significant for relative fecundity (p<0.005) as was found by **Muroga *et al.* (1990).** Table (18), shows the hatchability percentages (HAT) as affected by addition of flumequine in prepared diets. Averages of hatchability percentage were 89.81, 89.91, 93.27 and 89.74 for the four treatments control, 10mg, 14mg and 18mg, respectively (Table 18). The differences between averages were non significant (Table 19).

Table (18), also shows, the fry number per fish (FN/F) and fry number per gm. of female body weight as affected by addition of flumequine in prepared diets. The averages of (FN/F) were 767.5, 960.03, 996.37 and 829.87 fry for the four treatments control, 10 mg, 14 mg and 18 mg, respectively, and the averages treatments of (FN/G) were 2.25, 2.83, 2.84 and 2.36, respectively, for the four treatments. These results indicate that, the fry number per fish (FN/F) and the fry number per gm of body weight (FN/G) for 10 and 14 mg flumequine in diets showed the best reproductive traits than that obtained with the other doses (control and 18 mg). The differences between averages were significant (p<0.001). These results are in agreement with **Blaxter and Hunter (1982)** who reported that, addition of 10 mg FLU/kg body weight/day leads to increase in reproductive traits in elupeoid fish. **HolmeFjord *et al.*, (1994)** reported that, addition of 10 mg FLU/kg body weight/day leads to increase in reproductive traits in Atlantic halibut.

4.2.2. Fry Body Weight (WG):

As presented in Table (20), averages of initial body weight at 2 days after hatching was 0.02g in all treatments with no significant differences among averages fry body weights. These results indicate the complete randomization of fry distribution among the four treatments. Fifteen days after the start of the experiment average body weights were 0.078, 0.090, 0.080 and 0.080g with significant ($p<0.001$) differences between experimental diets (Table 21). After 30 days, table (20) showed that, averages of body weight were 0.28, 0.51, 0.42 and 0.34 g for the four treatments, respectively, with highly significant ($p<0.001$) differences between these averages (Table 21) and the same trend was also observed during experimental periods 45, 60 and 75 days.

After 75 days the averages of body weight among treatments were 5.37, 7.82, 7.65 and 5.23 g for the four treatments control, 10 mg, 14 mg and 18 mg flumequine / kg of body weight/day, respectively. These results indicate that, body weight for fish fed the diet contained 10 mg flu/kg of body weight were higher than that fed the other treatments, and the differences between averages of body weight were highly significant ($p<0.001$).

Results of the present study are in agreement with those of **Azab *et al.*, (2003)** who found that, (10 mg FLU / kg of body weight / day caused a significant increase in body weights of Nile tilapia at the experimental periods 3, 6 and 9 weeks from the experimental start compared by control group.

4.2.3. Specific Growth Rate (SGR):

Results of SGR of Nile tilapia fry as affected by flumequine (FLU) doses are illustrated in Table (22). As shown in this table SGR for the period of (2-15 days) were 10.90, 11.20, 10.85 and 10.90 for the four treatments, respectively, with non significant differences between averages of SGR. As shown in Table (22) SGR for the period of (15-30 days) averaged 11.72, 11.15, 9.7 and 8.64% for the four treatments. Analysis of variance Indicate that, SGR significantly ($p<0.001$) affected by FLU doses. The same non significant effects were also observed at the other experimental periods i.e., 30-45, 45-60 and 60-75days after experimental start.

Average SGR values during the whole period i.e, (2-75 days) were 7.72, 8.15, 8.13 and 7.73 % for the four treatments, respectively (Table 22 and Fig 19).With significant ($p<0.001$) differences between the averages of SGR. Flumequine (FLU) doses of 10 and 14mg FLU/kg of body weight significantly increased SGR of Nile tilapia.

Brader *et al.,* (1993) and Lutzhoft *et al.,* (1999) who found that, addition of flumequine to diets can be improved (SGR). Results of the present study are in agreement with those of **Azab *et al.* (2003)** who found that, the addition of 10 mg flumequine /kg of body weight per day caused non significant increase in SGR compared with control group.

On the other hand **Moutou *et al.,* (2001)** who reported that, using flumequine as medicated diet in rainbow trout caused decrease in (SGR).

4.2.4. Daily Weight Gain (DWG):

Results of daily weight gain (DWG) as affected by flumequine doses are illustrated in Table (24). Averages of DWG during the period 2-15 days for fish fed the experimental diets were relatively constant and equal to 0.005 g with non significant differences between averages. During the period 15-30 days DWG averages were 0.013, 0.030, 0.024 and 0.018g for the four treatments, respectively. Analysis of variance indicate that, the differences among DWG affected by the different four treatments were significant ($p<0.001$) and the same results were also observed during the experimental periods, 30-45 and 45-60 days. During the period 60-75 days the averages DWG among the different treatments were 0.24, 0.33, 0.36 and 0.25 g for the four treatments, respectively, with highly significant ($p<0.01$) differences between averages. DWG during the whole experimental period 2-75 days were 0.07, 0.105, 0.104 and 0.08 g for the four treatments, respectively. Analysis of variance between averages for whole experimental period were significant ($p<0.001$).

Generally, results of DWG indicate that, the levels of flumequine (FLU) 10 mg and 14 mg/kg of body weight increased daily weight gain (DWG) during all experimental period.

Results of the present study are in agreement with those of **Azab *et al.* (2003)** who found that, the addition of 10 mg flumequine /kg of body weight /day for 5 successive days caused a significant ($p<0.05$) increase in DWG at the experimental periods 3, 6 and 9 weeks, while 12 mg flumequine /kg of body weight /day caused a non significant increase in DWG after 3 and 6 weeks from the experimental start, whereas after 9 weeks there was a non significant decrease compared with control group.

4.2.6. Feed Conversion Ratio (FCR):

Table (26) showed that, the averages of feed Conversion Ratio FCR for fish fed the different doses of flumequine. Averages of FCR during the period 2-15 days were 0.8 for the four treatments, respectively, with non significant differences between averages.

Averages of FCR for the period 15-30 days were 0.95, 0.73, 0.61 and 0.72 for the four treatments, respectively. Analysis of variance (Table 27) indicated that, the differences between FCR values of the different treatments were significant ($p<0.001$). Results of Table (26) also indicate that, FCR during the period 30-45 days were 1.96, 1.45, 1.92, and 2.19 for the four treatments, respectively, and averages of FCR for the period 45-60 days were 1.79, 1.79, 1.71 and 1.82 for the four treatments. Also, averages of FCR for the period 60-75 days were 1.10, 1.52, 1.26, and 1.03 for the four treatments, respectively. Analysis of variance (Table 27) indicate that, the differences among values of FCR through the periods 30-45, 45-60 and 60-75 days were non significant.

Averages FCR during the whole experimental period (2-75 days) for the four treatments were 1.16, 1.22, 1.28 and 1.11, respectively. Table (27) shows that, there were non significant differences between values of FCR due to the different FLU doses. These results indicate that, the addition of flumequine in tilapia diets may improve the feed conversion ratio FCR during the experimental period. These results are in agreement with **Brader *et al.*, (1993)** who found that, addition of flumequine to diets can be improved (FCR). **Azab *et al.* (2003)** who reported that, 10mg flumequine /kg of body weight/day caused are improvement in feed conversion ratio (FCR).

4.2.5. Protein Efficiency Ratio (PER):

Results of Protein Efficiency Ratio (PER) as affected by flumequine (FLU) are illustrated in Table (28). Averages of PER during the period 2-15 days for fish fed the four experimental diets, were 2.97, 2.88, 2.97 and 3.03, respectively. Analysis of variance Table (29) showed that, the differences between averages due to the effect of the different treatments were non significant.

During the experimental period 15-30 days averages of PER were, 2.65, 2.11, 3.94 and 3.82 for the four treatments, respectively (Table 28). Table (29) indicated that, the differences between PER values due to the effect of the treatments were significant ($p<0.001$).

Results of PER Table (28) indicated that, the PER during the period 30-45 days were 1.09, 1.20, 1.15 and 1.04, respectively, for the four treatments. Averages of PER for the period 45-60 days 1.06, 1.04, 1.16 and 1.03, respectively, and averages of PER for the period 60.-75 days were 1.92, 1.90, 1.53 and 1.99 for the four treatments, respectively.

Table (29) indicated that, the differences between PER values due to the effect of the four treatments through the periods 30-45, 45-60 and 60-75 days were non significant.

Averages of PER during the whole experimental period (2-75 days) for the four treatments, were 1.55, 1.67, 1.64 and 1.45, respectively. The differences between PER values due to the effect of the different treatments were significant.

These results are in agreement with **Azab *et al.* (2003)** who reported that, flumequine at dose 10 mg/kg of body weight /day caused an insignificant improvement in protein efficiency ratio (PER).