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Influence of Dietary Protein on Growth, Reproduction, Seed Chemical Composition and Larval Survival Rate of Nile Tilapia (*Oreochromis niloticus*) Broodstocks of Different Size Groups under Hapa- in- Pond Hatchery System

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ABSTRACT

Hapa-in-pond system is a hatchery technique, and was being developed for breeding fishes in captivity before the development of induced breeding technique. In spite of several research efforts, very little information is available regarding nutritional requirement of tilapia broostocks under hapa-in-pond system. On the other hand, few reports are available on broostock size and its correlation to both nutritional requirement and reproductive performance. To study broostock size and dietary protein effects on reproductive performance of tilapia and fry survival rate under hapa-in pond-system, three levels of dietary protein (DP) were tried (25%, 30 % and 35 %)on two different size group of Nile tilapia broostocks ,small(S: 100g) and medium (M: 200 g). Growth performance of small female broods was significantly influenced by different dietary protein levels as the highest values were noticed for fish were fed on DP of 35%. The highest total seed production; absolute fecundity, seed female^{-1}; relative fecundity, seed g female^{-1} ; system productivity, seed day^{-1} m^{-2} and fry survival % were recorded for DP of 35% (6679 seeds, 1669 seed female^{-1}, 333 seed female^{-1} spawn$^{-1,}$ 8.65 seed g female^{-1}, 66.80 seed day^{-1} m^{-2} and 95.93%, respectively).Medium broods showed superiority over small in regard to reproductive performance parameters. Seeds from medium broods indicate higher protein and lipid content and the lower moisture percentage. It could be concluded that dietary protein up to 35% induces greater reproductive performance. Different size groups respond differently to varied dietary protein in terms of growth performance and seed chemical composition.

Keywords: Tilapia, Broodstocks, Dietary protein, brood size

INTRODUCTION

Improvement of broodstock productivity performance to cover the seasonal demand for seed is major aim in hatcheries and tilapia farms. Problems encountered in traditional tilapia seed production systems are early maturity, multiple spawning, low fecundity and greater investment in parental care (Tahoun *et al*., 2008). Hapa- in pond hatchery technique is commonly used in many countries like Philippines (Bautista, 1987), Thailand (Little *et al*., 1997.) , China (FAO, 1962; Lin, 1949) Bangladesh and India for a long time (Bardach *et al*., 1972; FAO, 1962). This technology has been commercialized recently and proven to be economically viable (Bhujel, 1997). Species, which are multiple spanners with short vitellogenetic periods, it is possible to improve spawning quality by modification of the nutritional quality of broodstock diets even during the spawning season(Ferna´ndez-Palacios *et al*., 1998 and Tandler *et al*., 1995). Gonadal maturation and fecundity directly dependent on broodstock nutrition (Watanabe, 1985; Bhujel *et al*., 2001). Although eggs can absorb some nutrients directly from water, egg yolk is the main source of nutrition for embryonic development in fish. Exogenous nutrition of brooding females, therefore, plays a crucial role in supplying the essential nutrients required for gonadal development as well as the performance of eggs and larvae (Gunasekera *et al*., 1997). Several workers have reported that the protein requirement for optimum reproductive performance of tilapia broodstock under clear water condition ranged between 30- 40% (Bhujel *et al*., 2001a; El-Sayed *et al*., 2003; El-Sayed, 2006). So far, researches has not been carried out to investigate suitable dietary protein level for intensive management of tilapia brood in hapas installed in fertilized ponds (green water) where natural food provides a considerable proportion of the nutritional requirements.

Till date female size and its correlation to brooders nutritional requirement failed to invite much attention despite that female brooders could be classified to three different size groups such as small (60 up to 150 g) , Medium (150 -200g) and large (above 200g) (Bhujel, 2000). The objective of the study was to investigate the effect of different dietary protein levels on reproductive performance of two size groups of tilapia broodstock (small and medium) under hapa pond system (green water) .

MATERIALS AND METHODS

Nile tilapia *O. niloticus* broodstock were collected from a commercial fish farm located in Kafr El-Sheikh Governorate, Egypt. A total number of 108 (72females + 36males) were selected, sexed and transferred to conditioning happas (each measuring 6×3×1 m^3). The experiment was conducted in 18 happas each of 1 m^3 net volume (2×1×0.5 m)installed in an earthen pond (4200 m^2). Both males and females wnith mean body weights of 100.56 and 210.33 g respectively for Small (S) and medium (M) sizes groups, were stocked at a rate of 6 broodstock / $hapa^{-1}$ with a sex ratio of 1:2 (2 males:4 females).

Experimental diets and feeding practices

Three diets with different protein levels (25, 30, and 35 %) were formulated to evaluate the effect of dietary protein levels on reproductive performance and fry survival rate of two size groups of tilapia broods (S and M). The diets (Table 1) were prepared manually by mixing the requisite amount of dry ingredients thoroughly, followed by the addition of water to form thick dough. The experimental diets were pelleted and offered to fish in crumble form after grinding it.

Each experimental diet was allocated to three hapas according to a completely randomized design. Each hapa was considered as an experimental unit. During the experiment period (100 days), all fish were hand-fed at 2.5 % feeding level three times a day on weekdays and once daily on weekends. Weight of fish (females and males) in each hapa were recorded at 2 weeks interval. Five seed clutches were collected during the experimental period and the total number of seeds were recorded for each experimental treatment.

Fry survival

Hatched fry from last clutch of different experimental treatments were examined for tolerance stress. As simulation to transport stress conditions, hatched fry from each treatment are distributed in three plastic bags. Plastic bags were aerated and then comparative survival percentage were estimated after six hours.

Samples and chemical analysis

Fish seeds, from each hapa, were sampled for chemical analyses. The experimental diets and eggs samples were dried and grounded into homogeneous slurry in a food

Table (1): ***Composition and proximate analysis of different boodstock diets.***

Ingredient	Dietary protein level		
	25%	30%	35%
Fish meal	**20**	**28**	**36**
soybean meal	**30**	**30**	**30**
Corn	**41.45**	**33.45**	**25.45**
Soybean oil	**6**	**6**	**6**
Vitamin& mineral premix[1]	**1.96**	**1.96**	**1.96**
Carboxy-methyl cellulose	**0.5**	**0.5**	**0.5**
Ascorbic acid	**0.05**	**0.05**	**0.05**
BHT[2]	**0.04**	**0.04**	**0.04**
Total	**100**	**100**	**100**
Analyzed composition (dry matter basis)			
Dry matter (%)	**98.07**	**98.16**	**98.41**
Crude protein (%)	**26.49**	**30.48**	**35.07**
Lipid (%)	**5.76**	**6.40**	**6.82**
Ash (%)	**8.42**	**10.49**	**11.59**
Gross energy (kcal Kg-1)[3]	**4438.15**	**4445.13**	**4495.31**

1- Vitamins and minerals mixture each 3Kg of mixture contains: 10 000 000 I.U. vit A, 2 500 000 IU vit D3, 10 000 mg vit. E, 1000 mg vit. K, 1000 mg vit. B1, 5000 vit. mg.B2, 1500 mg vit.B6, 10mg vit B12 , 30 000 mg Niacin, 10 000 mg Pantothenic acid,.1000 mg Folic acid, 50 mg Biotin, 300 mg Iodine, 30 000 mg Iron, 60 000 mg Manganese, 4000 mg Copper,100 mg. Coblat , 100 mg Selenium, 50 000 mg Zinc, 3000g Calcium Carbonate.

2-Butylated hydroxyl toluene

3-Gross energy was calculated using conversion factors of 9.5, 5.6 and 4.2 and Kcal g^{-1} ***for fat, protein, and carbohydrate, respectively (Young et al. 2005).***

processor, and stored at −20 °C until analyzed. All chemical analyses of the samples were conducted according to A.O.A.C. (1990) methods for dry matter (oven drying at 105 ^{o}C for 24 h), Crude protein (N-Kjeldahl × 6.25), fat (solvent extraction with petroleum ether, bpt 40-60 ^{o}C for 10-12 h), and ash (oven incineration at 550 ^{o}C). Energy was calculated using conversion factors of 9.5, 5.6 and 4.2 and Kcal g^{-1} for fat, protein, and carbohydrate, respectively (Young *et al*. 2005).

Growth performance parameters

The growth performance parameters were calculated according to the following equations:-

Average weight gain (AWG) = Average final weight (g) – Average initial weight (g)

Average daily gain (ADG) = [Average final weight (g) – Average initial weight (g)] / time (days).

Specific growth rate (SGR) = 100 [Ln Wt_1 – Ln Wt_0 / T]

Where:

Ln= normal logb

Wt_0: initial weight (g).

$Wt_{1=}$ final weight (g), -T = time of days.

Feed utilization parameters

Feed utilization was calculated according to the following equation:

Feed Conversion Ratio (FCR) = Total feed consumption / weight gain (male + female).

Reproductive performance parameters

Variables were estimated (according to Mair *et al*., 2004) from the data included:-

Absolute fecundity: - the number of egg per spawning per female.

Relative fecundity: - the number of egg per unit weight of female (average female weight).

Statistical analysis

All experimental data were statistically analyzed using SPSS software Version (11). Data were statistically analysed in a factorial design procedure. Mean of treatments were compared by Tukey test ($p<0.05$). As for growth performance data, they were analyzed using the previous procedure to detect the effect of dietary protein level depending on broods growth performance. Meanwhile, data relating to growth performance of small and medium broods were separately analyze in one way design procedure using SPSS statistical package ,mean of treatments were compared by Tukey test ($p<0.05$) to

Table (2): ***Growth performance of small tilapia broodstock fed different dietary protein levels for 100 days.***

Broodstok	Protein level (%)	Female final weight (g)	Male final weight (g)	Female weight gain (g)	Male weight gain (g)
	25	172.67^{b}	194.33^{b}	64.00^{b}	93.00^{b}
Small	**30**	175.00^{b}	197.33^{b}	70.00^{b}	95.67^{b}
	35	185.67^{a}	206.00^{a}	82.67^{a}	106.00^{a}
SE±		2.11	1.93	3.05	2.22

SE ± standard error .calculated from residual mean square in the analysis of variance.
Values in each column followed by a common letter are not significantly (P≤0.05) different

detect the influence of different dietary protein levels on growth performance of each brood size separately.

RESULTS

The two-factorial analysis of variance indicates overall significant effects of dietary protein level and broodstock size (p<0.05). No interaction, however, was found between the parameters (p<0.05). Growth performance of females and males of two size groups (small or medium) are recorded in Table (2 and 3), while Table (3) represent the factorial analysed data for broodstocks growth performance. Different dietary protein levels (25, 30,and 35%) influenced the growth of small female. The highest final weight (FW),weight

Table (3): ***Growth performance of medium tilapia broodstock fed different dietary protein levels for 100 days***

Broodstok	Protein level (%)	Female final weight (g)	Male final weight (g)	Female weight gain (g)	Male weight gain (g)	Average hapa weight gain (g)
	25	307.00	321.33^{b}	95.67	117.33^{b}	106.50^{b}
Medium	**30**	313.00	332.00^{ab}	101.00	129.00^{ab}	115.00^{ab}
	35	317.33	337.33^{a}	109.67	138.00^{a}	123.83^{a}
SE±		2.34	2.84	3.00	3.37	3.11

SE ± standard error .calculated from residual mean square in the analysis of variance.
Values in each column followed by a common letter are not significantly (P≤0.05) different

Table (2): ***Growth performance of small tilapia broodstock fed different dietary protein levels for 100 days.*** **(Continued)**

Broodstok	Protein level (%)	Average hapa weight gain (g)	Total feed intake(g)	Feed conversion ratio ($g\ g^{-1}$)	Female specific growth rate (%)	Male specific growth rate (%)
Small	**25**	78.50^{b}	165.33^{a}	2.11^{a}	0.46^{b}	0.65^{b}
	30	82.83^{b}	150.67^{a}	1.82^{b}	0.51^{ab}	0.66^{ab}
	35	94.33^{a}	161.67^{a}	1.71^{b}	0.59^{a}	0.72^{a}
SE±		2.59	2.79	0.06	0.02	0.01

SE ± standard error .calculated from residual mean square in the analysis of variance. Values in each column followed by a common letter are not significantly (P≤0.05) different

gain (WG) and specific growth rate(SGR) were recorded for fish fed on 35% dietary protein (DP) (185.67, 82.67and 0.59) respectively. Results

indicate that (FW) and (WG) of medium sized females were not significantly influenced with the increase of DP. For male broods (FW), (WG) and (SGR), for both (S and M) groups significantly responded to different DP levels, and the highest values were recorded for fish fed on 35% DP level. Feed conversion ratio improved with increasing DP up to 35% for broods of small size while, no significant (P ≤ 0.05) differences was

Table (3): ***Growth performance of medium tilapia broodstock fed different dietary protein levels for 100 days*** **(Continued)**

Broodstok	Protein level (%)	Total feed intake(g)	Feed conversion ratio ($g\ g^{-1}$)	Female specific growth rate (%)	Male specific growth rate (%)
Medium	**25**	178.00^{b}	1.68	0.37	0.45^{b}
	30	185.00^{ab}	1.62	0.39	0.49^{ab}
	35	194.33^{a}	1.57	0.42	0.53^{a}
SE±		2.67	0.04	0.01	0.01

SE ± standard error .calculated from residual mean square in the analysis of variance. Values in each column followed by a common letter are not significantly (P≤0.05) different

Table (4): ***Growth performance of small and medium tilapia broodstock fed different dietary protein levels for 100 days***

Factors		Female final weight (g)	Male final weight (g)	Female weight gain (g)	Male weight gain (g)	Average hapa weight gain (g)
Dietary protein level(%)	**25**	239.83^{b}	257.83^{c}	79.83^{b}	105.17^{c}	92.42^{b}
	30	244.00^{b}	264.67^{b}	85.50^{b}	112.33^{b}	98.92^{b}
	35	251.50^{a}	271.67^{a}	96.17^{a}	122.00^{a}	109.08^{a}
SE±		1.922	1.78	2.57	1.84	2.14
Size	**S**	177.78^{b}	199.22^{b}	72.22^{b}	98.22^{b}	85.22^{b}
	M	312.45^{a}	330.22^{a}	102.11^{a}	128.11^{a}	115.06^{a}
SE±		1.57	1.55	2.10	1.50	1.75
ANOVA	**DP**	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Size	0.003	0.001	0.002	<0.0001	0.001
	DP*Size	0.523	0.345	0.789	0.216	0.788

SE ± standard error .calculated from residual mean square in the analysis of variance.
Values in each column followed by a common letter are not significantly (P≤0.05) different

Table (5): ***Reproductive performance of small and medium tilapia broodstocks fed different dietary protein levels for 100 days***

Factors		**Total seed production**	**Seed female^{-1}**	**Absolute fecundity** (Seed female^{-1} spawn^{-1})	**Relative fecundity** (Seed g female^{-1})
Dietary protein level(%)	**25**	5975^{b}	1493^{b}	298^{b}	7.88^{b}
	30	6406^{a}	1601^{a}	320^{a}	8.45^{a}
	35	6679^{a}	1669^{a}	333^{a}	8.65^{a}
SE±		79.74	19.93	3.99	0.09
Size	**S**	5568^{b}	1392^{b}	278^{b}	9.82^{a}
	M	7139^{a}	1784^{a}	356^{a}	6.83^{b}
SE±		65.11	16.28	3.26	0.08
ANOVA	**DP**	<0.0001	<0.0001	<0.0001	<0.0001
	Size	<0.0001	<0.0001	<0.0001	<0.0001
	DP*Size	0.939	0.939	0.939	0.213

SE ± standard error .calculated from residual mean square in the analysis of variance.
Values in each column followed by a common letter are not significantly (P≤0.05) different

Table (4): ***Growth performance of small and medium tilapia broodstock fed different dietary protein levels for 100 days*** **(Continued).**

Factors		Total feed intake(g)	Feed conversion ratio (g g^{-1})	Female specific growth rate (%)	Male specific growth rate (%)
Dietary protein level(%)	**25**	171.67a^{b}	1.89^{a}	0.42^{b}	0.55^{b}
	30	167.83^{b}	1.72^{b}	0.45^{b}	0.58^{b}
	35	178.00^{a}	1.64^{b}	0.51^{a}	0.63^{a}
SE±		2.10	0.04	0.01	0.01
Size	**S**	159.22^{b}	1.88^{a}	0.52^{a}	0.68^{a}
	M	185.78^{a}	1.62^{b}	0.40^{b}	0.49^{b}
SE±		1.72	0.03	0.01	0.01
ANOVA	**DP**	<0.0001	<0.0001	<0.0001	<0.0001
	Size	0.016	0.002	0.002	0.001
	DP*Size	0.006	0.054	0.177	0.564

SE ± standard error .calculated from residual mean square in the analysis of variance.
Values in each column followed by a common letter are not significantly (P≤0.05) different

Table (5): ***Reproductive performance of small and medium tilapia broodstocks fed different dietary protein levels for 100 days*** **(Continued).**

Factors		System productivity (Seed day^{-1} m^{-2})	Seed weight (g)	Fry survival (%)
Dietary protein level(%)	**25**	59.75^{b}	0.016^{a}	93.10^{b}
	30	64.07^{a}	0.016^{a}	95.00^{a}
	35	66.80^{a}	0.015^{a}	95.93^{a}
SE±		0.80	0.00	0.47
Size	**S**	55.68^{b}	0.015^{a}	94.96^{a}
	M	71.39^{a}	0.016^{a}	94.40^{a}
SE±		0.65	0.00	0.38
ANOVA	**DP**	<0.0001	0.087	0.323
	Size	<0.0001	0.647	0.003
	DP*Size	0.939	0.113	0.557

SE ± standard error .calculated from residual mean square in the analysis of variance.
Values in each column followed by a common letter are not significantly (P≤0.05) different

Table (6*): Chemical composition of seeds from small and medium broods size fed different dietary protein levels for100 days*

Factors		Moisture (%)	Crude protein (%)	Ether extract (%)	Ash (%)
Dietary protein level(%)	**25**	80.46^{ab}	11.50^{ab}	2.87^{b}	3.27^{a}
	30	82.53^{a}	10.46^{b}	2.46^{c}	2.69^{a}
	35	79.68^{b}	12.56^{a}	3.27^{a}	2.70^{a}
SE±		0.73	0.34	0.10	0.25
Size	**S**	82.65^{a}	10.06^{b}	2.52^{b}	2.89^{a}
	M	79.13^{b}	12.95^{a}	3.21^{a}	2.88^{a}
SE±		1.72	0.60	0.28	0.08
ANOVA	**DP**	0.001	<0.0001	<0.0001	0.997
	Size	0.044	0.003	<0.0001	0.225
	DP*Size	0.027	0.145	0.271	0.110

SE ± standard error .calculated from residual mean square in the analysis of variance. Values in each column followed by a common letter are not significantly (P≤0.05) different

reported for medium sized broods broostock. Generally (table 4.) dietary protein level affect tilapia broods performance significantly(table 4.).

Results of reproductive performances are summarized in table - 5. Parameters relating to reproductive performances (total seed production; absolute fecundity, seed female^{-1}; relative fecundity, seed g female^{-1} ; system productivity, seed day^{-1} m^{-2} and fry survival, %) increased significantly at 35% DP (6679 seeds, 1669 seed female^{-1}, 333 seed female^{-1} spawn$^{-1,}$ 8.65 seed g female^{-1}, 66.80 seed day^{-1} m^{-2} and 95.93%, respectively) except for seeds weight, which showed no significant differences.

As regards size, medium broods showed superiority over small in all reproductive parameters except for relative fecundity, seeds weight and survival rate .The highest relative fecundity was recorded for small broods (9.82 seed g femal^{-1}), while no significant differences observed for seeds weight and survival rate.

Seeds chemical composition is shown in Table (6). It is assumed DP not only affects composition but considerable increase in the protein and lipid content was noticed at 35% level. On the other hand the highest lipid and protein content and the lowest moisture content were noticed for Medium broods seeds in comparison with small broods.

DISCUSSION

Results of growth performance indicate that brooders belonging to different size and sex groups did not respond uniformly to different DP levels. It is derived that dietary protein directly related to brooders size (small, medium or large) and sex. According to this study, growth performance of small females improved with increased dietary protein while Medium females showed no response .As reported tilapia protein requirement ranged between 30-40%, as also it depends on species and sex (Santiago *et al*., 1985; De Silva and Radampola, 1990; Bhujel *et al*., 2001a; El-Sayed *et al*., 2003 and El-Sayed, 2006). Gunasekera *et al*. (1996) reported that early matured Females (25-50g) fed with 10 % DP diet were significantly smaller ($P \leq 0.05$) when compared to those fed 20 and 35% DP diets.

In our study dietary protein significantly enhanced reproductive performance. Seeds production increased with increasing dietary protein level up to 35% DP. AL Hafedh *et al*, 1999 observed the same results for tilapia. Red tilapia broods registered higher seed production when fed 44% protein diet (Chang *et al*., 1988). Wee and Tuan (1988) increased DP from 20% to 50% the optimum DP level for spawning *O. niloticus* was 35%. Study conducted by Gunasekera *et al*. (1995),on Nile tilapia fingerlings fed a low protein diet 17% indicated no oocyte maturation, females fed 25% protein showed slow oocyte growth, whereas females fed 32% protein level had early oocyte growth and maturation and no significant difference was noticed between 32% and 40% protein diets groups. Moreover the absolute and relative fecundities were found to be significantly higher at 27.6 and 35% DP levels than those of 42.6 and 50.1%. High protein diets helped produce heavier and larger eggs (Wee and Tuan, 1988). Santiago *et al*. (1991) established that higher dietary protein level enhanced reproductive performance in bighead carp *(Aristichthys nobilis)* in terms of total eggs weight per female and number of eggs per spawn.

Medium broods exhibited significant superiority over small in terms of total seed production, absolute fecundity and system productivity, while higher relative fecundity reported for small broods. It is reported (Hughes and Behrends, 1983; Rana, 1988) that tilapia females that matures earlier at smaller size produces smaller eggs but comparatively more eggs than larger fish per unit body weight. Rana, 1986 suggested that relative fecundity decreases with maternal age, weight and length.

Fry survival percentage recorded significantly higher when brood fed on

30 and 35% DP. Same results was suggested by Gunasekeru *et al*.(1996) they reported confirmed the same.

As it is known egg necessarily contains all nutrients needed to ensure the embryonic growth and development,so biochemical composition of an egg is a potential way to assess egg quality (Izquierdo e*t al.*, 2001). Proteins and lipids are the major components stored in egg yolk and would be expected to play a major role in reproduction. In our study , though seeds derived from both small and medium broods were of same weight class ,but protein and lipid content of smaller one were lower compared to medium group and highest moisture content recorded in smaller one. Elevation of DP initiates weight gain in smaller size groups, while medium females did not respond similarly. It seems that a portion of dietary protein and lipids directed to growth in small broods while, in medium broods most dietary protein and lipid directed to seeds composition. It could conclude that seed chemical composition depend greatly on female size. This could explain the conflict around effect of dietary protein levels on egg composition.

Gunasekera *et al*. (1995) did not find any significant influence of the dietary protein on the composition of mature egg of Nile tilapia. Watanabe *et al*. (1985) reported that in red sea bream, different dietary protein levels (from 35 to 55%) and protein sources did not markedly alter the moisture and protein content of eggs. Sam was noticed by Cerdá *et al*. (1994) where diets did not influence egg moisture and protein content in European sea bass, as was in the case of rainbow trout (Washburn *et al*., 1990). On the other hand, there was a significant increase ($P \leq 0.05$) in the amount of protein in the eggs of tilapia broods (*Oreochromis niloticus*) maintained on the 35% protein diet compared with those on 10 and 20% protein diets, but the moisture content of the eggs did not show any significant variation with increasing dietary protein level (Gunasekera *et al*., 1996).

CONCLUSION

Dietary protein levels influenced reproductive performance of tilapia brooders but different brood sizes respond differently to varied dietary protein levels in terms of growth performance and egg composition. Results indicate that a feeding schedule is needed to be adopted by the hatcheries to build up a broodfish .Thus, it is expected that further research is needed to detect the relationsship between different brooders size, dietary nutrient, reproductive performance and seed chemical composition and help in devising feeding schedules which will boost seed production in tilapia hatcheries.

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تأثير المستويات المختلفه لبروتين علائق قطعان تفريخ أسماك البلطي النيلي الصغيره و المتوسطة الحجم على النمو و التكاثر و التحليل الكيماوى للبيض و معدلات نجاة الزريعه تحت نظام الهابات.

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تفريخ الأسماك تحت نظام الهابات اصبح شائعا و ادخل عليه كثير من التطورات و بالرغم من ذلك فان هناك افتقار للمعلومات المتعلقه بالأحتياجات الغذائيه لقطعان التفريخ تحت هذا النظام. على الناحيه الأخرى قليل من الباحثين تناولوا بالدراسه ارتباط الأحتياجات الغذائيه لقطعان التفريخ و علاقتها بحجم الأمهات المفرخه و تاثير ذلك على كم وجودة عملية انتاج البيض. لدراسة مدى ارتباط معدلات انتاج البيض و معدلات بقاء الزريعه بمستويات بروتين علائق قطعان تفرخ اسماك البلطى النيلى و مدى ارتباطه بحجم الأمهات المستخدمه فى التفريخ تم تكوين ثلاث علائق مختلفه فى مستويات البروتين (25% ، 30% ، 35%) لتغذيه مجموعتان مختلفتين فى الحجم (صغير: 100جم)و (متوسط: 200جم) من امهات البلطى النيلى. تم تسكين المهات بمعدل 6 اسماك للهابه و باستخدام نسبه جنسيه (1 :2) . اوضحت نتائج التجربه ان معدلات نمو اناث البلطى الصغيره استجابة ايجابيا لمستويات بروتين العليقه حيث تحسن اداء النمو بزيادة بروتين العلائق و افضل قيمه لوحظت فى الأسماك التى تغذت على 35% بروتين. امهات البلطى التى تغذت على 35% بروتين اعطت افضل اداء انتاجى للبيض من حيث العدد الكلى للبيض و الخصوبه الكليه و الخصوبه النسبيه و معدلات نجاة الزريعه . الأمهات المتوسطه اظهرت اداء انتاجى للبيض اعلى من الأداء الأنتاجى للأمهات الصغيره.و كذلك لوحظ ان محتوى بيض الأمهات المتوسطه من البروتين و الدهون اعلى مقارنة بالبيض الناتج من الأمهات الصغيره و كذلك اقل فى محتواه من الرطوبه. و هكذا يمكن استنتاج

ان افضل اداء لأنتاج البيض ظهر عند مستوى بروتين 35%. الأمهات الصغيره و المتوسطه استجابت لمستوى البروتين فى علائقها على نحو مختلف من حيث معدلات النمو و التحليل الكيماوى للبيض .