Effect of Feeding Frequency on the Growth Performance and Feed Utilization of Black Seabass, Dicentrarucheslabrax (Linnaeus)

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Abstract:

A feeding experiments was carried out to investigate the effect of feeding frequency on growth performance and feed utilization of Black seabass, (Dicentrarchuslabrax). Five feeding frequency were employed: once/day (morning); once/day (afternoon); twice/day; 3 times/day and & 4 times/ day.The best growth performance with improved feed utilization was obtained in feeding frequencies once a day in the morning and 4 times a day . Specific growth rate (SGR), food conversion ratio (FCR) and feeding efficiency (FE) was significantly similar ($p < 0.05$) for both these feeding

regimes. From the point of view of feed utilization, feeding once a day in the morning may be considered the optimum feeding frequency.These conclusion could also have very important implication in the feeding management of a fish farm as well as in its economies.

***Keywords**: Feeding frequency. Growth performance .Feed utilization; D. labrax.*

1.Introduction:

The black seabass, *Dicentraruchuslabrax*, (Linnaeus) (Order Perciformes; Family : Serranidae) ,It's a marine aquaculture species which has eurythermal (Coll,1983 : Chervinski, 1994), and euryhaline, and it is resistance to high variation in the environments. *D. labrax* is most commonly found in coastal water and hyper saline lagoon. Spawning occurs during the early winter season (CoLL,1983), considered as a *carnivorous* fish and high market prices in the Mediterranean sea. The most methods of feeding with respect the farm location, time of day and feeding frequency for a given species during optimum growing and according to the size of stage of life cycle from up to 12 times/day for larvae to 3 or 4 times/day for grow out production fish and one time/day for brood stock (Pioer,1982). Multiple daily feeding, will usually increase growth rate especially for fish that do not have a stomach. Grass carp, *Cyprinuscarpio* (Linnaeus), but multiple feeding may not improve feed conversion efficiency. Kubaryk (1980), found that *Tilapianilotica* grow faster when fed four times daily than when fed two times , but did not grow when fed eight times . The feeding frequency is gradually recorded as the fish increase in size (Lovell, 1989). In general, a number of basic rules suggested by Piper (1982) for optimum feeding. Feed costs can range 40-

60% of total costs in some fish farm operations and is obviously one area where any improvement can be very important. To this end, proper feeding management in terms of feeding frequency application should be sought, it is known that large fish need to be fed less often than are smaller ones, but this is may be true, it is still leaves unanswered the question of how much and how often. This issues in term of feeding frequency, needs to investigated further. The principle objective of the present study to investigate the most economic feeding management in terms of feeding frequency and its effects on growth performance and feed utilization of *D.labrax*.

2. Materials and Methods :

2.1The growth experiment:

The experiment was conducted over 16 weeks between 10^{th} May 2007 and 10^{th} September 2007. Thiscorresponded to a total of (112) days including an acclimation periods of (4) weeks.

2.2The experimental tanks:

A partial recycling tanks system, consisting of 15 square white fiber glass (1.5 m^3) tanks were used. The tanks were located indoor and received a bore hole water of constant salinity (37%). The water was supplied at a rate of between 20-25 L/min for each tank to keep and adequate dissolved oxygen level an excess of 8.0 mg/L and a constant temperature of ($21c^0$).

2.3The experimental fish:

D. labrax, were supplied by government company of (SediAbdullah Fish Farm), and transported to the experimental tanks of Marine Biology Research Center in Tajura with sufficient oxygenation. A total of 450 fish of an average weight (90) grams, the fishes was distributed randomly in the experimental tanks (30 fish/tank). During the acclimation period the fish were fed to satiation once a day at 10.00 am. At the start and at the end of the experiment a random sample of each tank were weighed, seven days intervals from each tank were also sampled under an anesthetic (2-phenoxy ethanol), weighed and measured in order to monitor the growth performance and feed utilization, the weight of the fish was taken using an electronic balance to an accuracy of (0.10 g).

2.4 Diets and feeding regimes:

A pelleted commercial feed of 3 mm diameters (Coppens International; B.V), was supplied by a General Authority of Marine Wealth. The nutritional composition of the experimental diets used in the experiment is given in (Table.1). Five feeding frequency were employed: once a day in themorning, once a day in the afternoon, twice a day , 3 times a day , and 4 times a day, the feeding rates based according to the size of the fish.

Table 1. Proximate composition (%) of experimental feed (Coppens International; B.V)

Proximate	Crude protein	Crude lipid	Crude fiber	Moisture	Ash
Composition (%)	48.0	10.0	2.0	10.0	10.0

Coppens International; B.V – Holland:

2.5 Assessment of fish performance:

The fish body weight recorded at the start and the intervals during the experiment were used to calculate the mean initial and final body weight for each treatments. The parameters used to assess growth performance and feed utilization were: SGR (%/day)=Log(Fin.BW-Ini.BWX100/days; FCR = Food intake/Increase in biomass; FE = Increase in biomass/Food consumed X100.

2.6 Statistical analysis:

Using the individual data for the three replicates of each treatment. Statistical analysis was carried out to discover whether there were any significance differences between different treatments for each of the performance parameters. The Student-Newman-Keuls Multiple Range Test (Zar,1996). Was employed at a level of significance of <0.005. The analysis was performed on a personal computer using(BMDP).Statistical Software Package (Version PC 90).

3.Results:

3.1 Assessment of growth performance:

The results show no significant differences ($p < 0.05$) in final body weight between different treatments. The best growth response, in terms of body weight was observed in feeding frequency of 2 times/day 3 times/day and 4 times/day. Feeding frequency of once/day (afternoon) showed the lowest final body weight. The mean values of final weight ranged between

165.4 g (once/day (pm) to 18.8 g (4 times/day). A similar response was also observed on the basis of specific growth rate (%/day), the maximum values always being found in feeding frequency 2 - 4 times/day, with no significant differences, and lowest values in feeding frequency once/day (pm). (Table.2).

3.2 Assessments of feed utilization:

Feeding frequency of once/day (am), 3 times/day, and 4 times/day showed the best food conversion ratio (FCR), followed respectively by feeding frequency of 2 times/day, that also did not differ significantly. These treatments all gave significantly lower FCRs than the fish fed once/day (pm). The mean values of FCR ranged between 1.4 (once/day (am), 3 times/day, 4 times/day and 1.8 (once/day (pm). (Table.2).

Feeding efficiency of feeding frequency once/day (am), showed a comparable result to 4 times/day, with higher values than these on the other treatments once/day (pm), 2 times /day and 3 times /day respectively. Feeding efficiency of feeding frequency once/ day (pm) was significantly lower. The mean values of FE ranged between 55.3 (once/day (pm)),and 72.4(times/day).

3.3 Mortality:

Low mortality was recorded during the experimental period one fish (2.22% mortality) died in the tanks fed 2 times/day and 3 fishes (3.33% mortality), died in tanks fed once/day (pm). These values are considered as normal for this species.

Table 2. Growth performance and feed utilization of *D*icentrarchus*labrax* fed different feeding frequency.

Feeding frequency (times/day)	1(am)	1(pm)	2	3	4
Initial.BW	90.2[a] (2.2)	90.1[a] (0.1)	90.0[a] (1.4)	90.1[a] (1.0)	90.3[a] (1.4)
Final.BW	184.3[a] (3.0)	165.2[nd] (3.7)	179.5[a] (5.6)	183.4[a] (9.6)	185.8[a] (3.0)
SGR (%/day)	0.7[a] (0.0)	0.6[nd] (0.0)	0.8[a] (0.0)	0.8[a] (0.1)	0.8[a]
FCR	1.4[a] (0.0)	1.8[nd] (0.0)	1.5[a] (0.1)	1.4[a] (0.1)	1.4[a]
FE (%)	71.2[a] (2.3)	55.3 [nd] (4.0)	67.4[a] (6.4)	70.5[a] (6.9)	72.4[a] (3.1)
M (%)	0.00	3.33	2.22	0.00	0.00

BW=Body weight, SGR=Specific growth rate, FCR=Food conversion ratio, FE=Feeding efficiency, M=Mortality. Mean in a row followed by the same superscript are not significantly different ($p<0.05$). Number between parentheses refer to standard deviation.nd=not determined.

4. Discussion:

The final results show that the best growth performance was observed in the fish fed once a day in the morning; 3 times/day and 4 times a day. Fish fed all feeding frequencies showed differences ($p < 0.05$) in terms of specific growth rate (%BW/day) .(Table.2). Fish fed once a day in the afternoon, showed the significantly ($P<0.05$) slowest growth

performance. Taking into consideration that fish of this feeding regime were fed late at 5.00 pm; it could be that there is a disturbance in their biorhythm which affects the total metabolism. It is clear that. *D. labrax* appear to show different responses to feeding frequencies. Andrews and Page (1975), automatic feeder that continuously dispersed the food from once to twenty four times a day , also reported similar findings in *I. punctatus* . Jobling (1983) reported better growth in the fish fed frequently than fed periodically. These differences in the response of the fish to the various feeding frequency can be attributed to the differences in the stomach capacity of the fish (Kondo and Nose,1971) with the fish having smaller stomach needing more frequent feeding. According to Brett (1979), the feeding frequency is related to the capacity of the stomach and rate of digestion. Increasing the feeding frequency has been reported to improve the growth of the fish. In *S. aurata* and *S. gairdneri*, the daily food ratio changed directly with the frequency of feeding (Ishiwata, 1969). Similar results have been reported in other species of fish (Kondo and Nose 197). The fish appear to have the same growth when fed either once/day (am); twice/day ; 3 times/day or 4 times/day, with no significant differences in terms of growth performance being observed between them. From this point of view and for economic observation, feeding once a day in the morning may be considered the best feeding regime for *D. labrax* when applied in a large – scale fish farming. However, feeding 3 times and 4 times daily is also important and should be taken in consideration in the other aspects. Sampath (1983) mentioned that feeding once a day is economical for *Channastriatus* (Block). Joblig (1983) and Marian et al (1982) found that feeding once a day is the optimum schedule for *Salvelinusalpinus* (L.). It has been reported that the optimum feeding

frequency may vary with species and many factors influencing the return of appetite (Gwyther and Grove, 1981). The optimum feeding frequency is once every 2 days for the grouper *Epinephelustauvina* (Forskal) (Chus and Teng, 1978), Twice a day for *I. punctatus* (Andrews and Page, 1975), and 3 times a day for *D. labrax* (Tsevis et al , 1992). In *S. quinqueradiata*, when fed to satiation, better growth was observed with a feeding regime twice a day (Harada, 1965). In striped bass ,*Moronesaxatilis* (Walbaum), the growth rate and food conversion ratio, were greatly enhanced when the fish were fed to satiation 4 times a day (Powell, 1972). Optimum growth and feeding efficiency were obtained in both catfish species, *I. punctatus* and *Heteropneutesfossilis* (Bloch) when fed to satiation twice a day (Sing and Srivastava, 1984), found better food conversion ratio in *S. gairdneri* fed once a day in the morning than in these fed twice and 4 times per day.

In this experiment fish that fed at all feeding frequencies , except fish fed only in the afternoon, showed similar feed utilization, in terms of food conversion ratio and feeding efficiency, with no significant differences between them. The final values of above parameters were the same, especially in fish fed at a frequency of once a day (am.) and 4 times daily (Table.2).

This variation in utilization probably depends on change of the metabolism due to the different feeding patterns or it could be due to more physiological activity and higher endocrine function . However as no report seems to exist for *D. labrax*, further investigation are required. Hickling,C.F. (1962), stated that in fish given an unlimited food supply , food may pass through the gut faster than in fish given limited food .The results obtained in this experiment compare with the results obtained by other workers using *D . labrax* as well as other fish species. Marais and

Kissil (1979) working with 50 g *D. labrax* obtained a maximum feed efficiency using a feeding regime of twice a day ; Kissil (1991), using *S.urata*, fed to satiation at a feeding frequency of twice a day , obtained a maximum specific growth rate 0.67%/day. The best food conversion ratio 2.09 , Vergara (1992) grew 60g *S. aurata* at 22c^{o} at a feeding rate of 2.0%Bw/day and feeding frequency ranging from 2 to 5 times a day .Maximum values of specific growth rate , feeding efficiency were 0.63%/day and 45% respectively.

From the above, it is evident the determination of optimum feeding frequency has to be studied from two different points of view. The first one is that economy, which is determined according to the aquaculture unit program , and the other is related to the physiological requirements and responses. From the point of view of economies it is difficult to determine accuracy the optimum feeding frequency, as the production plan differs among fish farms and there are a number of marketing factors that affect it . In order to investigate the optimum feeding frequency from the physiological point of view, the fish utilization of food as a whole taking in consideration all factors which affect it, including fish size , stomach capacity, digestion of time , biorhythm and quality of food. Although, according to the results reported by a number of authors , the best feeding frequency varies with species and different feeding regimes, feeding once a day in the morning may be considered the optimum feeding frequency for *D. labrax* taking into consideration the economic point of view due to many consideration during the fish farm operation, in order to decrease the production costs.

5. Conclusion:

These studies provide evidence that feeding frequency can influence the growth performance and food utilization of *D. labrax*. The best growth performance was obtained when fish were fed once a day in the morning, and 4 times a day. The result of the present investigation indicate that the optimum feeding frequency for *D. labrax* is once a day in the morning, and 4 times a day, where maximum growth is obtained. However, feeding once in the morning is more appealing from the viewpoint of economic and feeding management than other regimes. It appears that when fish are fed in the morning, they have a more active protein metabolism and higher food efficiency than when fed in the afternoon. So the time of feeding appears to offer a means of improving growth performance and feed utilization. These conclusions could also have very important implications in the management of a fish farm, as well as its economic.

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