Mansoura Veterinary Medical Journal 23:1 (2022) 10-17
DOI: 10.21608/MVMJ.2022.229849

Original Article *Nutrition*

Growth performance parameters of European Sea bass (*Dicentrarchus Labrax*) cultured in marine water farm and fed commercial diets of different protein levels

Basma Sleem, Ola Orma, Amr Abd El-Wahab, Tarek Ibrahim

Department of Nutrition and Nutritional Deficiency Diseases, Faculty of Veterinary Medicine, Mansoura University, 35516 Mansoura, Egypt.

ARTICLE HISTORY

Received: January 29, 2021

Revised: February 12, 2022

Accepted: February 16, 2022

Corresponding author: Amr Abd ElWahab
Email: amrabdelwahab37@yahoo.de

ABSTRACT

Objective: To evaluate the growth performance and whole-body composition of growing E. Sea bass cultured in marine water farm and fed commercial fish diets containing 42.3% to 39.60% crude protein (CP) and 17.4 % to 17.8 % fat.
Design: Randomized controlled study
Samples: Five ponds out of the 8-ponds open marine water farm of 12 Feddans were used.
Procedures: Each pond (120 m length x 40 m width x 1.5 m depth) stocked with 5500 growing E. Sea bass of about 25 g initial mean body weight. Fish feeding and management were followed up for 6 months (June to November 2018). Diets (extruded, pelleted, 3- 4.5 mm size of different protein levels) offered once daily at satiation (at 7:00 AM) until October and twice daily during November. Diets offered daily decreased from 4.6% of relative BW of fish at the start of the feeding trial to 1.02% at the last month. Partial replacement of ponds water was maintained daily. The high protein diet (42.3%) fed during the first 2 months, in the second 2 months a 40.42% CP diet was fed, while diets fed in the last 2 months contained 39.60% CP. Fish samples (n=20 from each pond) were collected at the end of each month to follow up growth parameters. Fish samples collected (4 from each pond) at the end of the fourth and the sixth months of feeding trial for whole body composition and morphometric indices determination.
Results: Body weight gain increased from 47.06 g in the 1st month to 113.80 g at the last month. Feed consumption increased from 68 g/fish/month to 109.08 g/fish/month. Mean body weight of the Sea bass fish was 496.30 g at the end of the follow up feeding periods. Unexpectedly, feed conversion ratio decreased from 1.44 at 1st month to 1.18 at the end of the feeding trial instead of the marked increase in BW of fish. Feed efficiency ratio increased from 69.21% at the 1st month gradually to 87.5% at the end of the 5th month, with a little decrease during last month, (85.0%) parallel to the decrease in water temperature in November. There was a little decrease in moisture percentage of fish body with increase in fish size (67.8 vs 69.10%) with a little increase in protein content (18.55 vs 17.82%) of the Sea bass whole body composition, also fat content increased from 7.94 to 9.25%. Carcass or dressed fish wt. dressed %, fillet yield % and K- factor markedly improved with increasing the fish size at the end of feeding trial.
Conclusion and Clinical relevance: In conclusion, it seems that feeding diets containing about 42 to 40 % protein with 17.6 % fat produced appreciable growth of *E. Sea* bass fish culturing in marine water farm under the semi-intensive feeding system.
Keywords: E. Sea bass, growth, commercial diet, body composition, morphometric indices

1. INTRODUCTION

A positive trend regarding global aquaculture production plays a significant role in contributing to food security and economic development [1]. According to FAO[2], Egypt's fisheries production show that total production from all sources (marine, freshwater and aquaculture) reached 1.5 million tonnes of which: 1.2 million tonnes from aquaculture (78%) and others from capture as marine and inland fisheries (22%). Sea bass is carnivorous fish and it is considered an important aquaculture species cultured in both brackish and freshwater ponds as well as in cages. The Sea bass production has many advantages; it has fast growth and can be fed with artificial feed or low cost fish. Also, it has flavoured white meat for consumers [3]. Several factors affect Sea bass production as growth performance, and survival rate. Improving diet quality can markedly increase farm productivity [4]. Environmental factors play an important role in farm performance as in winter months (<12°C), Sea bass reduce feed intake [5].

Protein is an essential constituent required for maintenance, growth and reproduction because it is the main building unit of all body cells and tissues. In addition, it has indispensable role in the synthesis of body proteins providing tissue repair and source of energy [6]. Dietary protein excess considered detrimental to fish if not well-balanced with optimal lipid level, in addition it increased feed cost. Fish consider very efficient protein converters as they take only 2.1 lb of dietary protein to produce 1 lb of fish protein and fish protein usually represents 65-85% of the dry matter of fish body [7].

Lipids are important components of fish diets as lipid provide concentrated source of energy and supply of essential fatty acids. It is well known that the lipids could give about twice the energy of protein and carbohydrates [8].

Therefore, the objectives of the study were to evaluate the growth performance, body composition and morphometric indices of growing E. Sea bass cultured in marine water farm and fed commercial fish diets containing high protein and fat content.

2. MATERIALS AND METHODS

2.1. Fish farm follow up

The study was carried out with E. Sea bass (Dicentrarchus Labrax) in a private marine water fish farm at Damietta-Port Said Road (near to Damietta Province). The farm is about 12 Fadden (acres) with 8-ponds (120 m length x 40 m width x 1.25 m depth). Initial mean body weight (BW) of E. Sea bass is about 25 g (22.5-27.1 g). Fish feeding and management were followed for 6 months. Daily feed intake (on air-dry basis) was introduced to fish at 4.6% to 1.02% of relative BW/fish/pond. Fish were fed once daily (at 7:00 AM) during the period from June to October 2018 and twice daily (at 7:00 AM and 14:00 PM) at winter, during November 2018 to minimize over feeding and waste of feed in the pond as the feeding system followed was the semi-intensive system.

European Sea bass fish were stocked at rate of 5500 fish/pond (0.92 fish/m3 water). The ponds were filled with sea water. Part of farm water was changed daily using water raising machine in order to initiate oxygen (aeration) and to prevent rapid pollution of water by waste products and rejuvenate clean water with natural zooplankton and phytoplankton (natural fish feeds as a semi-intensive system). Water depth nearly was maintained at about 1.25 m in summer months and at about one meter during winter month (November).

The survey was conducted from July to December 2018. Every month, feed allowance was estimated and adjusted after fish weighing and calculated as a percentage of fish relative BW (w1+w¬2)/2. Ponds were watched daily for any mortalities and any dead fish was weighed and discarded (pond records were followed each month to estimate dead fish number and average weight).

2.2. Practical commercial E. Sea bass diets

The diets fed to E. Sea bass were commercially prepared (name of company: Zoocontrol for Industrialization and Trade) with more than 40% crude protein (CP) and 18% total fat (on as feed bases). These commercial diets were formulated according to NRC [9] and their main chemical composition percentages as follow: 40-42% CP, 18% `fat, 2.40% crude fiber and 4088 to 4180 kcal DE/kg diet. The diets composed of fishmeal (65% CP), SBM (46% CP), wheat bran (14% CP), corn gluten (60% CP), oil (soya and fish oils), extruded full fat soya (31% CP), wheat middlings (17% CP) and vitamins and minerals mixture (specialized for fish) as declared from ingredients list on the pamphlet of the diets producing company. The proximate chemical composition of the main feed ingredients used for culture E. Sea bass fish diets according to NRC [9] were as in Table (1).

Table 1. The proximate chemical composition and digestible energy (DE) of feed ingredients used for manifacturing E. Sea bass fish diets according to NRC (2011).

	DM %	DE kcal/kg	CP %	CF %	Ca %	P %
Ingredient						
Corn yellow	88	2200	8.5	2.3	0.03	0.28
Wheat bran	89	2790	14	9.9	0.13	1.16
Soya bean meal	90	2934	47	3.4	0.26	0.64
Fish meal (Herring)	92	4060	65	0.7	5.19	2.88
Corn gluten meal	91	4260	60	1.5	0.07	0.44
Wheat middlings	89	2850	17	8.5	.012	1.10
Fish oil	-	8000	-	-	-	-
Soya oil	-	8000	-	-	-	-

Feeds were offered at about 4.6% and 2.39% of the relative BW (w1+w¬2)/2 of fish per pond during the 1st and the 2nd month (June to July 2018) and contained 46-43% CP and 19.1% fats on dry matter basis. During the period from August to November, feed diets offered at 1.98% during August then at 1.41% to 1.02% of relative BW until end of November 2018. Feed intake appeared to be regulated depending on fish relative BW and degree of water temperature.

2.3. Water temperature and pH

Water temperature was measured and recorded daily through fixed water thermometers; it was mostly fluctuated between 28 to 18ºC during the follow up period. Water pH values were measured weekly by using a portable pH meter (June to November). The pH values were ranged from 6.5 to 7.3 during the study period in the different ponds. Water samples were transferred to laboratory and analyzed for dissolved oxygen.

2.4. Weighing process

During the survey, fish samples were collected and weighed to follow up fish growth and other parameters from five ponds of the farm. Twenty fish were weighed monthly per pond. Initial mean BW was 25.04 g (22.5-27.1 g) and number of fish were about 5000 fish/pond (6000 m3). At weighing fish, a plastic container full of aerated water was prepared; the 20 fish were caught by a net, put in the aerated water container and weighed. For obtaining individual wet

weight, fish were raised one by one from the container and net balance recorded. Finally, water volume in the container was readjusted to calculate accurate weight of fish. Immediately after weighing, fish were returned to its pond.

2.5. Growth performance measurement

From each pond, fish samples (n=20) were collected at the end of each month of rearing period. The fish samples weight was calculated for determination of the following parameters by using the formulae of Biswas et al. [10] to express the weight of feed required to produce a unit weight of fish.

Mean weight of fish in pond = Total weight of fish in pond/no. of fish in the same pond

FCR = Feed intake (g)/Weight gain (g)

Survival (%) = [Number of dead fish harvested/Number of fish stocked] x 100

Body weight gain (g/fish) = Final mean body weight - Initial mean body weight

2.6. Chemical analysis of experimental diets

Samples of the diets offered for fish were collected, pooled for each two successive months and analyzed for moisture, crude protein, crude fat and crude ash by standard methods [11].

2.7. Chemical analysis of whole-body composition and morphometric indices of fish

Random fish samples (4 fish/pond) were collected at the end of September 2018 (the 4th month) and November (the 6th month) of the follow up period for determination of whole-body chemical composition. These fish samples were minced and dried at 70ºC for 72 h to be analyzed for whole body chemical composition (moisture, crude protein, crude fat and crude ash) [11].

2.8. Morphometric indices

Fish samples (4 fish from each of the 5 ponds) were randomly collected at the end of the 4th and 6th month of the follow up feeding period at time of weighing and kept in ice-boxes till time for determination of the morphometric indices (MI) of growing E. sea bass. The fish sampled were individually weighed, total length measured, then dissected and viscera weighed, and carcass yield determined. Visceral fat and liver were accurately sampled, weighed (0.01 digital balance) and their weight percentages to whole fish weight determined. Then after, fish skin and heads removed, and fillets weighed to measure muscle ratio (MR). The following MI were determined:

Conditional Factor= = Bwt (g)/Total Length (cm)^{3}X100
(K Factor)

Carcass Yield % = Carcass Wt / Whole fish Wt X 100

Muscle ratio % (Fillet Yield %) = Fillet Wt / Whole fish Wt X100

Visceral Fat Index (VFI) = Viscera fat Wt / Whole fish Wt X 100

2.9. Statistical Analysis

The data were subjected to statistical analysis of variance (ANOVA) using one way test to evaluate the commercial diets of different protein levels on growth performance parameters of European Sea bass (*Dicentrarchus Labrax*) cultured in marine water farm. Data were analyzed using statistical SPSS v20 (SPSS Inc., Chicago, IL, USA). Differences among dietary treatments were compared using Duncan's test and significant was declared at ($p< 0.05$)

3. RESULTS

The most common feed ingredients in the diets that used for feeding Sea bass are shown in Table (1). The yellow corn, soya bean meal, full fat soy, fish meal, fish oil and wheat middlings are usually the main ingredients for feeding of fish. Feed intake appeared to be regulated depending on fish relative Bwt and degree of water temperature as shown in Table 2. Daily average feed intake per fish (g) gradually increased from 2.23 g in the 1st month to 3.27g at the 3rd month and to 4.47g at the 6th month, feed intake as percentage of relative Bwt was 4.6, 1.98 and 1.02% of RBW of fish. Data analysis (Table 3) show that dietary crude protein (DCP) percentage is 42.3% with 17.40% total fats in the diets fed during the 1st two months of the follow up feeding periods. While DCP was 40.42% with 17.50% fat in the diets fed during the 2nd feeding period (August and September months). At the last feeding period (last two months), dietary CP content decreased to 39.60% with 17.80% fat on as feed basis. Crude fiber level in the diets was ranged from 2.81% to 3.27% respectively, also nitrogen free extract content was 20.49% to 21.75%, respectively. The data in Table (4) revealed the BW development measured at monthly intervals during the follow up period. There was no significant differences between the BW development along with the follow up feeding period (6 months) between fish BW in each pond and that of pooled mean for all fish growth development. The monthly increase in BW is significantly clear, as the BW increased from 25.04 g (initial BW) to 203.7 g at the 3rd month (during June, July and August) and to 496.3 g as final BW (at end of November).

Table 2. Feed intake regulated depending on fish relative Bwt and degree of water temperature

Average water temp.	Period/month	Relative Bwt/g	Average F. intake f/d/g	F. intake as % relative Bwt
26-28	June	48.5	2.23	4.6
27-29	July	99.2	2.37	2.39
26-28	August	165	3.27	1.98
25-27	September	241.5	3.4	1.41
24-26	October	330.9	3.93	1.19
18-20	November	439.4	4.47	1.02

Table 3. Chemical composition analysis (%) of commercial fish diet samples collected during follow up feeding period of growing Sea bass fish cultured in marine water farm (as on fed basis)

Ch. Comp. (%)	Commercial diet samples 1	2	3
Dry matter	91.10	90.80	90.31
Crude protein	42.30	40.42	39.60
Crude fat	17.40	17.50	17.80
Nitrogen free extract	20.49	21.75	21.22
Crude fiber	2.81	3.22	3.27
Ash	8.10	7.91	8.42

1-diet samples collected during May, June and July feeding period.
2-diet samples collected during August and September feeding period.
3-diet samples collected during October and November feeding period.

Absolute body gain of Sea bass fish at monthly intervals was markedly obvious and at high rate of relative BW. At the beginning of the follow up period (at June) the BW gain was 47.06 g to 75.6 and 103.22 g at September and October, respectively and still of high body gain (109.08 g/month) at November, in spite of the decrease in water temperature (20-18ºC) in last month (Table 5). Body weight gain (gram/day/fish) increased from 1.56 to 3.63g at November (Table 6).

Unexpectedly, FCR decreased from 1.44 at 1st month to 1.18 at the end of the feeding trial instead of the marked increase in BW of fish (Table 7). Feed efficiency ratio increased from 69.21% at the 1st month gradually to 87.5 at the end of the 5th month, with a little decrease during last month parallel to the decrease in water temperature in November. Whole body chemical composition and MI of fish are shown in Table (8). There was a little decrease in moisture percentage of fish body with increase in BW (67.8 vs 69.10%) with a little increase in protein content (18.55 vs 17.82%) of the Sea bass, also fat content increased from 7.94 to 9.25%. Dressed fish Wt, dressed%, fillet yield% and K-factor are markedly improved with increasing the fish size at the end of the feeding trial.

Table 4. Monthly body weight development of growing Sea bass cultured in marine water farm and fed commercial fish diets during the period from July to November 2018

Period/month	Ponds 1	2	3	4	5	Mean ±SD
Initial	22.5 ± 2.79	26.5± 2.82	25.4± 2.93	27.1± 2.18	23.7± 2.84	25.04 ± 2.43
1	73.4 ± 5.15	75.2± 4.67	68.8± 5.76	70.6± 4.11	72.5± 5.82	72.10 ± 4.88
2	114.2 ± 7.70	132± 7.15	121.9± 8.94	125± 8.77	138.2± 8.82	126.3 ± 8.11
3	195.7 ± 12.75	210± 10.50	192.4± 10.14	203.8± 10.88	± 206.512.79	203.7 ± 10.85
4	275.4± 20.85	± 271.818.46	268.0± 18.40	284.0± 17.63	± 297.218.98	279.3 ± 13.90
5	385.0± 20.74	± 366.821.35	372.0± 19.31	387.2± 19.70	± 401.520.50	382.5 ± 20.85
6	497± 28.96	± 481.931.85	475.5± 30.88	489.5± 26.43	± 514.028.85	496.3 ± 28.80

Mean in the same row with different superscripts significantly different at p<0.05. 1,2,3,4 and 5 represent fishponds at the farm.
* Pooled values for 5 means ± mean SE

4. DISCUSSION

In this part of the study, we will discuss and review the growth performance, whole body composition and morphometric indices of growing E. Sea bass considering the feeding practices followed and the effects of using commercial fish diets containing fish meal and fish oil, soybean meal and full oil soybean with others feed materials prepared with high technical properties. As diet ingredients were extruded and pelletized at suitable sizes (3-4 mm) and formulated according to the advice of NRC [9] affect growth performance parameters of Sea bass cultured in marine water farm during the summer period (at 28ºC to 18ºC temperature).

The water quality is very important to determine the growth and survival of the Sea bass. For example, at low water temperature increases the dissolved oxygen hence increases the metabolic rates of fish [12]. The very high-water temperature reduced the fish growth and increased the mortalities of cultured fish [13]. Generally, the good survival rate values may be attributed to the quality of both feed and water, besides the best management. This agrees with Berillis et al. [14] who stated that good environmental and management conditions (as suitable water exchange rate) could led to a high survival rate up to 100%. In Egypt, survival rate is considered a perfect measure to evaluate the efficiency of fish production. In the present study the recorded levels of dissolved oxygen and pH values were within the optimal range for the fish growth according to [12]. The water quality parameters are important tools to detect the growth and survival of the E. Sea bass. The very high-water temperature reduced the fish growth and increased the mortalities of cultured fish [13, 15]. The perfect water temperature for best growth for Sea bass is 26-32°C. In the present study, recorded water temperature ranged from 28 to 18ºC and pH value 6.5 to 7.3 during the period from June to November. Mortalities are increased and growth is slowed down at cooler water conditions (below 20°C) over prolonged periods [16]. Among the various factors controls fish life in pond, the dissolved oxygen is of primary importance for their respiration [17]. The water pH is used as an indicator of water condition as the acidic pH decrease appetite and growth rate of fish [17]. The perfect water pH suitable for the rearing of Sea bass as stated by Kungvankij et al. [16] and Hargreaves and Semra, 2001, is pH 7.5-8.5 and for dissolved oxygen is 4-9 ppm.

Table 5. Monthly absolute body weight gain (BWG) of growing Sea bass cultured in marine water farm and fed commercial fish diets during the period from July to November 2018

	Ponds					SDMean±
Month/N	1	2	3	4	5	
1	50.90	48.70	43.40	43.50	48.80	47.06 ±3.41
2	40.80	56.80	53.10	54.40	65.70	54.16±8.94
3	81.50	78.00	70.5	78.80	78.30	77.42±4.11
4	79.70	61.80	75.600	80.20	80.70	75.60±7.98
5	109.60	95.00	104.00	103.20	104.30	103.22±5.25
6	112.00	115.10	103.50	102.30	112.50	109.08±5.78
Total	474.50	455.40	450.10	462.40	490.30	466.54±16.12

Table 6. Body weight gain per gram/day/fish (g/d/f) of growing Sea bass cultured in marine water farm and fed commercial fish diets during the period from July to November 2018.

	Ponds					Total / 5 ponds
Month/N	1	2	3	4	5	
1	1.69	1.62	1.44	1.45	1.62	1.56
2	1.36	1.89	1.77	1.81	2.19	1.81
3	2.71	2.6	2.35	2.62	2.61	2.58
4	2.65	2.06	2.52	2.67	2.69	2.52
5	3.65	3.16	3.46	3.44	3.47	3.44
15.41	16.34	15.033	3.45	3.41	3.75	3.63

In our study, subjecting the collected diet samples for chemical analysis showed that diets fed during June and July (1st two months of the trial) were containing 42.30% CP and 17.40% fat. In the next following periods, the CP content was 40.42% and 39.60% and the levels of fat were 17.50% and 17.80%, respectively. Levels of dietary CP and fat are in good comparable to the protein and fat content recorded in the NRC [9] and that recommended by Kousolaki et al. [18] in their review. Nutrient requirement of the fish are provided by the commercial feeds. The existence of life food is also allowed in the refreshable marine water in the fish farm.

growth of Sea bass is achieved when dietary CP is around 42.5-48%, with a dietary lipid concentration of 10-14% [20]. In the experimental units (laboratory) the maximum growth was obtained by feeding the fish a diet containing 45% CP and

6-9% fat [29]. Whereas Boonyaratpahin [30] reported that the growth of Sea bass was not affected by reducing the protein content from 50% to 45% and increasing the lipid level from 15% to 18%. While Catacutan and Coloso [31] found that a dietary lipid content of 9.3% was optimum for Sea bass if a 43% CP level was used. In a subsequent study [32], the growth rate of fish was the highest with a diet of 45% protein and 18% lipid. In the

Table 7. Allover growth performance parameters of growing Sea bass cultured in marine water farm and fed commercial diets during 6 months period (June to November 2018)

Performance indices					
Period/ month	BW, g	BWG, g	Feed intake/Fish, g	FCR	Feed efficiency ratio, %
Initial	25.04	-	-	-	-
1	72.10	47.06	68.00	1.44	69.21
2	126.30	53.90	71.00	1.32	75.92
3	203.70	77.40	98.00	1.27	78.98
4	279.30	75.60	102.00	1.35	74.12
5	382.50	103.20	118.00	1.14	87.50
6	496.30	113.80	134.00	1.18	85.00

Dietary energy was managed by using oil. Moreover, consistent increase in growth of Sea bass fed diets containing higher utilizable dietary energy levels, regardless of oil source, indicated that dietary energy has a marked effect on growth of Sea bass fish [33]. present study the level of protein was 42.4 to 39.60% and the fat content was from 17.4 to 17.8%.

Table 8. Whole body composition (%) and morphometric indices of E. sea bass fish reared in marine water farm and fed commercial diets (at 280 and 500 g BW)

Body Comp. (%)	BW (280 g)[1]	BW(500 g)[2]
Moisture	69.10	67.80
Crude protein	17.82	18.55
Crude fat	7.94	9.25
Ash	3.10	2.85
Morphometric indices	**BW (280 g)[1]**	**BW(500 g)[2]**
Dressed fish Wt /g	222	426
Dressed fish %*	80.73	84.92
Fillet yield %**	52.64	58.69
Visceral fat index (%)	0.89	1.24
Condition Factor (K)	1.28	1.07

*Dressed percentage of fish wt.
**Fillet percentage = fish muscle as % of dressed wt.
[1] samples collected at the end of the 4th month of feeding trial.
[2] samples collected at the end of the 6th month of feeding trial

For barramundi, the efficiency of that energy conversion has been estimated to be about 68% [34]. It is well known that increasing energy level in diet is associated with decreased feed consumption as was mentioned previously.

According to Lanari et al. [35] the growth of Sea bass increased markedly when fed a diet containing 19% fat compared to diets with 11% and 15% fat content. However, according to the different fish developmental stages the effect of dietary lipid level is varied. Boujard et al. [36] showed that increasing the dietary lipid content resulted in a significant decrease in feed intake without any affect growth rate.

The body composition of Sea bass seems to be affected by different factors as fish size and the diet composition. According to Peres and Oliva-Teles [20] it has been found that increasing the dietary fat level up to 24% led to an increase in lipid content of liver and digestive tract (primary sites), with no variation in muscle lipid content. In addition, the present results, showed thas final whole body

lipid content was affected by the increasing in BW (7.94% and 9.25% fat for BW 280 g and 500 g, respectively). In our study the whole-body protein content was a 17-18% as found by Lupatsch et al. [37] for the same species. Lanari et al. [35] suggested that protein and ash contents in body of Sea bass are depended on fish size, while the concentration of fat in fish positively correlated with energy intake and fish size.

In the present work, regarding to the effect of feeding the growing E. Sea bass fish on commercial, technically prepared, diets containing high protein (42.3 to 39.6%) and high fat (17.57%) in marine water farm under the semi-intensive system on morphometric indices (table 8). the results showed that dressed fish and dressed % values were improved at the end of the feeding trial compared with these recorded for the Sea bass samples collected at the end of the 4th month of the follow up feeding period. Also, the increase in the visceral fat index was not marked (0.89 vs 1.24%). Even more, the fillet percentage (the muscle ratio %) improved from 52.64% at the end of the 4th month to 58.69% at the end of the follow up feeding period. In addition, the K factor

value of the Sea bass collected at the end of the 4th month, 1.28 decreased to 1.07 at the end of the feeding trial. The K factors measures the state of fish well-being, fitness, changes in nutritional statues, environmental effects and body shape. Condition factor mostly used to confirm visual inspection as to whether the fish have atypical conformation, too fat or too thin [38]. However, each species has characteristic range of condition factors, which reflects their body conformation. For Sea bass fish cultured in brackish water nearly for one year K factor value ranged from 0.88 to 1.27 with an average of 1.05 [39]. Also, Sharaf [40] reported that the K factor average 1.43 for Sea bass cultured at Suez Canal region and the K value decreased with increase of fish size.

In general, the results indicate that feeding diets containing about 42 to 40% protein with 17.6% fat produced good remarkable growth performance parameters in

growing. E.Sea bass cultured in marine water farm under the supplementary feeding system. There was a little decrease in moisture percentage with an increase in fish size (67.8 vs 69.10%) with a little increase in protein content (18.55 vs 17.82%) of the sea bass whole body composition, also fat content increased from 7.94 to 9.25%. Carcass or dressed fish weight, dressed % fillet yield % and K- Factor were markedly improved with increasing the fish size at the end of the feeding trial.

Conclusion

In conclusion, it seems that feeding diets containing about 42% protein associated with dietary fat level of 17.4% is suitable for growth of Sea bass cultured in marine water farm. Moreover, with high body weight and/or with increasing in size of the fish the body composition is markedly improved regarding high contents of protein and fat in the body, with a higher fillet yield and desirable K-factor.

Acknowledgement: NA

Conflict of interest: Authors declare that there is no conflict of interest.

Authors contribution: Authors contributed equally

5. REFERENCES

[1] FAO. Fisheries and aquaculture information and statistics branch. 2017.
[2] FAO. Achieving Blue Growth through implantation of the code of conduct for Responsible Fisheries. Policy Brief. Rome, FAO. 2015.
[3] Singh R. Growth, survival and production of Lates calcarifer in a seasonal rain fed coastal pond of the Konkan region. Aquac. 2000;8:55-60.
[4] Grigorakis K, Fountoulaki E, Giogios I, Alexis M. Volatile compounds and organoleptic qualities of gilthead sea bream (Sparus aurata) fed commercial diets containing different lipid sources. Aquac. 2009;290:116-21. https://doi.org/10.1016/j.aquaculture.2009.02.006
[5] Moreira I, Peres H, Couto A, Enes P, Oliva-Teles A. Temperature and dietary carbohydrate level effects on performance and metabolic utilisation of diets in European sea bass (*Dicentrarchus labrax*) juveniles. Aquac. 2008; 274:1 53-60. https://doi.org/10.1016/j.aquaculture.2007.11.016
[6] Jauncey K, Ross B. A guide to tilapia feeds and feeding. [sn]; 1982.
[7] Jauncey K. Tilapia feeds and feeding. 1998.
[8] Glencross B, Michael R, Austen K, Hauler R. Productivity, carcass composition, waste output and sensory characteristics of large barramundi Lates calcarifer fed high-nutrient density diets. Aquac. 2008;284:167-73. https://doi.org/10.1016/j.aquaculture.2008.07.031
[9] Council NR. Nutrient requirements of fish and shrimp: National academies press; 2011.
[10] Biswas G, Thirunavukkarasu A, Sundaray J, Kailasam M. Culture of Asian seabass Lates calcarifer (Bloch) in brackishwater tide-fed ponds: growth and condition factor based on length and weight under two feeding systems. 2011.
[11] Cunniff P. Official methods of analysis. Association of Official Analytical Chemists (AOAC) 16th ed Arlington, Virginia, USA. 1995.
[12] Ntengwe FW, Edema MO. Physico-chemical and microbiological characteristics of water for fish production using small ponds. Physics and chemistry of the Earth, Parts A/B/C. 2008;33:701-7. https://doi.org/10.1016/j.pce.2008.06.032
[13] Ngoh SY, Tan D, Shen X, Kathiresan P, Jiang J, Liew WC, et al. Nutrigenomic and nutritional analyses reveal the effects of pelleted feeds on Asian seabass (Lates calcarifer). PloS one. 2015;10:e0145456. https://doi.org/10.1371/journal.pone.0145456
[14] Berillis P, Mente E, Nikouli E, Makridis P, Grundvig H, Bergheim A, et al. Improving aeration for efficient oxygenation in sea bass sea cages. Blood, brain and gill histology. Open Life Sciences. 2016;11:270-9. https://doi.org/10.1515/biol-2016-0028
[15] Buttner J, Soderberg R, Terlizzi D. An introduction to water chemistry in freshwater aquaculture (NRAC Fact Sheet No. 170-1993). Northeastern Regional Aquaculture Center, University of Dartmouth, North Dartmouth, MA. 1993.
[16] Kungvankijp. BJJP, L.B. Tiro and I.O. Potestas. Biology and Culture of sea bass (lates calcarifer). NACA Training Manual Series 1984:67.
[17] Biswas KP. A Text Book of Fish, Fisheries & Technology: Narendra Publishing House; 1990.
[18] Kousoulaki K, Østbye T-KK, Krasnov A, Torgersen JS, Mørkøre T, Sweetman J. Metabolism, health and fillet nutritional quality in Atlantic salmon (Salmo salar) fed diets containing n-3-rich microalgae. Journal of nutritional science. 2015;4. https://doi.org/10.1017/jns.2015.14
[19] El-Dahhar A, El-Zaeem S, Khalifa G. Effect of Dietary Protein Level on Survival, Growth Performance and Body Composition of European Sea Bass (Dicentrarchus Labrax) Fingerlings under Sea Water Flow Conditions. Journal of the Arabian Aquaculture Society. 2016;374:1-18. https://doi.org/10.12816/0050314
[20] Peres H, Oliva-Teles A. Effect of dietary lipid level on growth performance and feed utilization by European sea bass juveniles (Dicentrarchus labrax). Aqua. 1999; 179:325-34. https://doi.org/10.1016/S0044-8486(99)00168-4
[21] El-Dahhar A, Lovell R. Effect of protein to energy ratio in purified diets on growth performance, feed utilization and body composition of Mozambique tilapia, Oreochromis mossambicus (Peters). Aquac. Res. 1995;26:451-7. https://doi.org/10.1111/j.1365-2109.1995.tb00935.x
[22] Company R, Calduch-Giner J, Kaushik S, Pérez-Sánchez J. Growth performance and adiposity in gilthead sea bream (Sparus aurata): risks and benefits of high energy diets. Aqua. 1999;171:279-92. https://doi.org/10.1016/S0044-8486(98)00495-5
[23] Lim C. Nutrient requirements of European sea bass (Dicentrarchus labrax) and Gilthead sea bream (Sparus aurata). United States Department of Agriculture (USDA) Technical Bulletin (www ars usda gov/research/publications htm. 2003.
[24] Volpatti D, Chiara B, Francesca T, Marco G. Growth parameters, innate immune response and resistance to L istonella (V ibrio) anguillarum of D icentrarchus labrax fed carvacrol supplemented diets. Aquac. Res. 2013;45:31-44. https://doi.org/10.1111/j.1365-2109.2012.03202.x
[25] Wilson R. Amino acids and proteins. In "Fish Nutrition". Academic press, San Diego, California, USA; 2002. https://doi.org/10.1016/B978-012319652-1/50004-5
[26] Dias J, Alvarez M, Diez A, Arzel J, Corraze G, Bautista J, et al. Regulation of hepatic lipogenesis by dietary protein/energy in juvenile European seabass (Dicentrarchus labrax). Aqua. 1998;161:169-86. https://doi.org/10.1016/S0044-8486(97)00268-8
[27] Helland S, Grisdale-Helland B. The influence of replacing fish meal in the diet with fish oil on growth, feed utilization and body composition of

Atlantic salmon (Salmo salar) during the smoltification period. Aquaculture. 1998;162:1-10. https://doi.org/10.1016/S0044-8486(98)00206-3
[28] Süzer C, Kamacı HO, Çoban D, Saka Ş, Fırat K, Karacaoğlan A. Early weaning of sea bass (D. labrax) larvae: effects on growth performance and digestive enzyme activities. Turkish J. Fish. Aquat. Sci. 2011;11:491-7.
[29] Watanabe WO, Ellis SC, Chaves J. Effects of dietary lipid and energy to protein ratio on growth and feed utilization of juvenile mutton snapper Lutjanus analis fed isonitrogenous diets at two temperatures. J World Aquac Soc . 2001;32:30-40. https://doi.org/10.1111/j.1749-7345.2001.tb00919.x
[30] Boonyaratpahin M. Asian sea bass, Lates calcarifer. In RP Wilson (Ed) Handbook of Nutrient Requirements of Finfish CRC press, Boca Raton, Florida 1991:5-11.
[31] Catacutan MR, Coloso RM. Effect of dietary protein to energy ratios on growth, survival, and body composition of juvenile Asian seabass, Lates calcarifer. Aquaculture. 1995;131:125-33. https://doi.org/10.1016/0044-8486(94)00358-U
[32] Sakaras W, Boonyaratpalin M, Unpraser N, Kumpang P. Optimum dietary protein energy ratio in seabass feed II. Technical Paper. 1989.
[33] Buchet V, Infante JZ, Cahu C. Effect of lipid level in a compound diet on the development of red drum (Sciaenops ocellatus) larvae. Aqua. 2000;184:339-47. https://doi.org/10.1016/S0044-8486(99)00325-7
[34] Lupatsch I. Israeli study examines feeding regimes for Asian seabass grown at high temperatures. GAA. 2003;12:62-3.
[35] Lanari D, Poli BM, Ballestrazzi R, Lupi P, D'Agaro E, Mecatti M. The effects of dietary fat and NFE levels on growing European sea bass (Dicentrarchus labrax L.). Growth rate, body and fillet composition, carcass traits and nutrient retention efficiency. Aqua. 1999;179:351-64. https://doi.org/10.1016/S0044-8486(99)00170-2
[36] Boujard T, Gélineau A, Covès D, Corraze G, Dutto G, Gasset E, et al. Regulation of feed intake, growth, nutrient and energy utilisation in European sea bass (Dicentrarchus labrax) fed high fat diets. Aqua. 2004;231:529-45. https://doi.org/10.1016/j.aquaculture.2003.11.010
[37] Lupatsch I, Kissil GW, Sklan D. Optimization of feeding regimes for European sea bass Dicentrarchus labrax: a factorial approach. Aqua. 2001;202:289-302. https://doi.org/10.1016/S0044-8486(01)00779-7
[38] Steffens W. Principles of fish nutrition: Ellis Horwood Limited; 1989.
[39] El-Shebly AA. Aquaculture Potential of Sea bass (Dicentrarchus Labrax) in Brackish Water Fish Farms in Egypt. Res. J. Appl. Sci. 2009;5:765-9.
[40] Sharaf M. Biological studies on the fish Dicentrarchus labrax (L.) in Suez Canal region: M. Sc; 1987.