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Biochemical Composition of Fertilized Striped Bream *Pagellus erythrinus* (Linnaeus, 1758) Eggs

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Abstract: This research aims to describe the biochemical composition of fertilized eggs of striped bream, *Pagellus erythrinus* (Linnaeus, 1758) and their protein, ash, moisture, lipid and fatty acid % contents. The results showed that striped bream eggs have a value of moisture, protein, ash and lipid; 74.20±0.6, 11.27±1.15, 2.03±0.20 and 4.73±0.15%, respectively. Fatty acid analysis showed that striped bream eggs contain saturated fatty acid of 36.88±0.025%, monounsaturated fatty acids (MUFA) of 32.61±0.240% and polyunsaturated fatty acids (PUFA) of 30.42±0.175%. Moreover, contents Eicosapentaenoic acid (EPA) of 4.60±0.036%, Docosahexaenoic acid (DHA) of 16.66±0.077%, Arachidonic acid (AA) of 1.12±0.033% , w-3 of 23.06% and w-6 of 7.36% were also determined.

Key words: Striped bream, egg, chemical composition

INTRODUCTION

There are some difficulties in culturing the alternative fish species[1]. Egg stage is an important factor for increasing productivity in aquaculture techniques[2]. For that, it is necessary to obtain the eggs which have high quality. Although it isn't known whether egg diameters is a component that determines the quality, both diameter and hatching rate have an important influence in determining the egg quality[3]. Situation is the same for both protein and lipid are also important factors effecting egg quality[4]. Lipids contain fatty acids that are necessary to develop the structure of body. Because of the fact that some lipids include linoleic, linolenic and arachidonic, such as essential fatty acids, it is valuable for feeding and egg productivity[5]. It is necessary that fatty acids are taken from food. Otherwise failures of body functions may occur. Fatty acids such as Eicosapentaenoic acid (EPA), Docosahexaenoic acid (DHA), Arachidonic acid (AA), Polyunsaturated Fatty Acids (PUFA), High Unsaturated Fatty Acids (HUFA), Monounsaturated (MUFA) and ω-3 and ω-6 are sufficient in composition of egg. Otherwise survival rate of juveniles will not be enough[6-9]. Therefore egg have to has fatty acid composition sufficiently[10-13]

Culture of egg and fry is very important on production of marine fish[14,15]. The egg of *Pagellus erythrinus* was pelagic and 0.8 to 1.2 mm diameters[16-19]. In this study, quality of eggs *Pagellus erythrinus* was investigated for aquaculture.

MATERIALS AND METHODS

Striped bream broodstocks, captured at different places of Aegean Sea, were placed to tanks, each containing 3/2 (male/female). The stocking rate was 4 kg m^{-3}. The broodstocks were native and the eggs used in this study were obtained during April. No stimulant was used during egg production. For the analyses purposes the spawning periods were used[20].

Biochemical analysis: In this study, for estimating the chemical composition of fertilizied striped bream eggs, protein, ash[21] lipid[22] and moisture[23] were analyzed. On fatty acid analyses, fatty acid methyl esters were prepared according to IUPAC[24] using method 2.301. The analysis of fatty acid methyl esters were performed using a HP 6890. Gas Chromatograph equipped with a Flame Ionization Detector (FID) and fitted with a 50% cyanopropyl banded, DB-23 fused silica capillary column (30 m x 0.25 mm i.d x 0,0250 μm; J and W Scientific, Falsom, CA, USA). In this system, the working procedures were:

- Detector temperatures: 250°C
- Injector temperatures: 250°C
- Injection: Split-model 1/100
- Gas flow speeds: 30 mL mn^{-1} for hydrogen, 300 mL dmn^{-1} for air, 24,5 mL/mn for nitrogen.

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- Injector model: Hamilton, 5 μL
- Injection Volume: 0.25 μL

During the analysis, 10 mL hexane was added to 0.2 g of lipid sample and mixed until the solution became clear. After the extraction of glycerol, the supernatant was injected to the Gas Chromatograph. The column temperature was programmed to rise from 170°C to a final temperature of 210°C at a rate of 2°C min^{-1} and held at 210°C for a 10 min. Fatty acid methyl esters and total fatty acid contents were identified using HP 3365 Chemistation. The fatty acids were identified by comparing areas of their peaks with the retention times of known fatty acid methyl esters, available in mixtures of standards. Quantitative results were recorded as fatty acids %.

RESULTS

Fertilized *Pagellus erythrinus* eggs were found to be pelagic, spherical and transparent. They contain one oil globule. Fatty acid analysis of *P. erythrinus* eggs showed that eggs contain more saturated fatty acids than MUFAs and PUFAs. In general, unsaturated fatty acid content was less than saturated fatty acid content (Table 1). Dominant saturated fatty acids in the egg were 16:0, 18:0, 14:0, 17:0, 15:0, 20:0, 22:0 and 23:0. Dominant MUFAs were 18:1, 16:1, 20:1, 17:1 and 14:1. Dominant PUFAs were 22:6, 18:2, 20:5, 20:4, 22:5, 18:4 and 18:3. Results showed that total saturated fatty acids in the fertilized eggs were 36.88±0.025%, MUFA was 32.61±0.240% and PUFA was 30.42±0.175% (Table 1). In addition, essential fatty acids that affect egg quality in *P. erythrinus* such as EPA, DHA, AA, MUFA and PUFA were recorded as 4.60±0.036, 16.66±0.077, 1.12±0.033, 23.06 and 7.36% respectively (Table 1).

It was determinated traces of other fatty acids apart from these fatty acids in egg (Table 1). The traces of fatty acids is important for egg. It must be studied about it. Determinated all of fatty acids in egg is showed in the Table 1.

Table 1: Fatty acid composition of *P. erythrinus* eggs. (Polyunsaturated Fatty Acids (PUFA), High Unsatureted Fatty Acids (HUFA), Monounsaturated (MUFA))

Fatty acid	*P. erythrinus*	∑MUFA	*P. erythrinus*	∑PUFA	*P. erythrinus*
12:0		14:1 n-7	0.24±0.010	18:2 n-6	6.24±0.039
14:0	4.39±0.059	16:1 n-9	0.99±0.030	18:3 n-3	0.25±0.004
15:0	0.75±0.006	16:1 n-7	2.21±0.082	18:4 n-3	0.64±0.026
16:0	23.95±0.065	16:1 n-5	6.94±0.005	20:4 n-6	1.12±0.033
17:0	0.93±0.017	17:1 n-10	0.57±0.02	20:5 n-3	4.60±0.036
18:0	5.65±0.191	18:1 n-9	17.36±0.200	22:5 n-3	0.91±0.011
20:0	0.50±0.005	18:1 n-7	3.21±0.016	22:6 n-3	16.66±0.077
22:0	0.37±0.015	20:1 n-9	0.85±0.008		30.42±0.175
23:0	0.26±0.025		32.61±240		

∑D. Y. A. 36.88±0.025

Percentage of fatty acids which is important for egg is presented in Fig. 1.While palmic acid 16:0 is the highest level (24 %), the level of arachidonic acid 20: 0 (n-6) was determinated 1 %.

Moisture in eggs was found normal levels (74%) (Table 2). Because of the high level of crude protein (11.7%), it can be said that quality of the eggs is high. Furthermore high crude ash level (2%) expresses that mineral content of egg is high.

DISCUSSION

Recently, it has been attach importance to culture of alternative fish in aquaculture sector. Although culture of alternative fish has many advantages, there is some disadvantages. Chemical composition of fish eggs varies by physiological, geographical, genetic factors, dietary requirements, water temperature, body length, species and sex by Kinsella *et al.*[25], Lahti[26], Ringo and Nilsen[27]. Many marine fish, these parameters are used to evaluate egg quality in *P. erythrinus*[6,19,28]. Additionally, both egg size and percentage of hatching depends on dry yolk weight which in turn affects egg quality. Similarly, we are

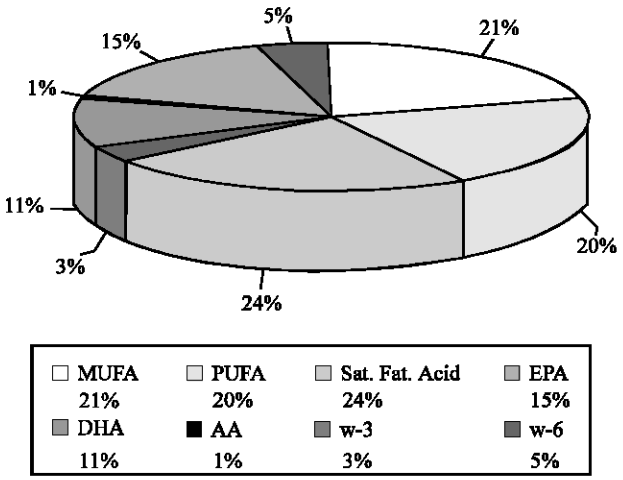

Fig. 1: Fatty acid composition of fertilized eggs of striped bream, *Pagellus erythrinus* [Polyunsaturated Fatty Acids (PUFA), High Unsatureted Fatty Acids (HUFA), Monounsaturated (MUFA), Eicosapentaenoic acid (EPA), Arachidonic Acid (AA)]

Table 2: Chemical composition of *Pagellus erythrinus* eggs

	N	Min.	Max.	Sx	X±Sx
Moisture	3	73.6	74.8	0.6	74.20±0.6
Crude protein	3	10.1	12.4	1.15	11.27±1.15
Crude lipid	3	4.6	4.9	0.15	4.73±0.15
Crude ash	3	1.8	2.2	0.20	2.03±0.20

still some way from fully understanding the complex interactions between protein and total lipid contents[29,30]. Ash ratio show eggs mineral high components by Rana[3]. Carik and Harvey[28] revealed that wet weight, dry weight, lipid and protein component of fish larvae correlated with survival ratios positively.

Positive correlation exist between larval survival rate and wet weight, dry weight, lipid, and protein contents[28]. Results of study showed crude lipid ratio was estimated to be 5.25±0.16%. It was determined that total lipid component was 6.60% in the *Merlangius merlangius*[31], 8.6% in domesticated valleye[2], 2.29% in striped bream and 4.97% in sea bass[30] and 4.80% in *Dentex dentex*[29]. Total lipid of fish eggs varies not only between ordos but also between.

Generally, it was determined that unsaturated fatty acid ratio is less in comparison with saturated fatty acid. Saturated fatty acids 14:0, 15:0, 16:0, 17:0 and 18:0, monounsaturated fatty acids 14:1, 16:1, 17:1, 18:1 and 20:1. It was dominant that polyunsaturated fatty acids 18:2, 18:3, 18:4 20:4, 20:5, 22:5 and 22:6 were the most observed fatty acids (Table 1). These fatty acid contents similar to those found by Gooch *et al.*[5], Aggelousis[32], Mendez *et al.*[31], Pickova *et al.*[33], Lavens *et al.*[13] and Agius *et al.*[34].

In the end of study, it was found that ratio of total saturated fatty acid of fertilizated eggs was 36.88±0.025%, monounsaturated was 32.61±0.240% and polyunsaturated was 30.42±0.175% (Table 1). It was determined that polyunsaturated fatty acids (PUFA) was 45%, MUFA 31% and saturated fatty acids was 22.9% in eggs of hake roe (*Merlangius merlangius*) by Mendez *et al.*[35]. Bulut[30] found saturated fatty acid 40%, PUFA 31%, MUFA 34% in eggs of *Sparus aurata* and saturated fatty acid 28%, PUFA 31%, MUFA 39% in eggs of *Dicentrarchus labrax*. Besides, it was found saturated fatty acid 36%, PUFA 24%, MUFA 38% in eggs of *Dentex dentex* by Bulut *et al.*[29].

P. erythrinus eggs are rich in ω-3 fatty acid EPA (20:5) and DHA (22:6). The percent of these fatty acids is important criteria for egg quality. In this study, EPA and DHA are 4.60±0.036% and 16.66±0.077% was determined, respectively. Rodriguez *et al.*[10] explained that EPA and DHA were necessary to be found in egg content for developing seabream larvae sufficiently. Mendez[35], Pickova *et al.*[33] and Agius *et al.*[34] reported that DHA% is higher than EPA%.

AA (20:4) level, one of the ω-6 fatty acids are the other important was effect egg quality. Agius *et al.*[34] found 0.6% AA in egg of *Pseudocaranx dentex*. Bulut[30] found 1.7% AA in *Dicentrarchus labrax* and 1.2% AA in *Sparus aurata*. Furthermore, it was reported 0.9% AA level in egg of *Dentex dentex* by Bulut *et al.*[29].

Fatty acids determined in fish eggs showed similarity to the other studies but they were different in terms of amount. According to Ringo and Nilsen[27], Lahti[26] and Aggelousis[32], the cause of these differences originated from fish feeding, water temperature, seasonal migration, ovulating period, fish age, water pollution and etc.

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