http://www.pjbs.org

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 7 (7): 1096-1098, 2004
ISSN 1028-8880

Biochemical Composition of Fertilized Dentex (*Dentex dentex*) Eggs

[1]Musa Bulut, [2]Osman Özden, [2]Sahin Saka and [2]M. Kürsat Firat
[1]Department of Aquaculture, Faculty of Fisheries, Çanakkale Onsekiz Mart Üniversity, 17020 Çanakkale, Turkey
[2]Department of Aquaculture, Faculty of Fisheries, Ege Üniversity, 35100 Izmir, Turkey

Abstract: In this study, biochemical composition of fertilized dentex (*Dentex dentex*) eggs were examined and their protein, moisture, lipid and fatty acid contents were analyzed. The results showed that dentex eggs have 74.25±0.61% moisture, 11.57±0.25% protein, 2.57±0.07% ash and 4.97±0.07% lipid. Fatty acid analysis showed that dentex eggs contain 36.37±0.09% saturated fatty acid, 38.57±0.03% monosaturated fatty acids (MUFA) and 24.44±0.04% polyunsaturated fatty acids. The diameter of dentex eggs was 1.05±0.06 mm.

Key words: Dentex, egg, chemical composition, fatty acids

INTRODUCTION

Dentex (*Dentex dentex*), is very common fish throughout the Mediterranean Bauchot and Hureau[1] and eastern parts of Atlantic Ocean however, it is seen rearly in the Sea of Marmara and the Black Sea is rear. Dentex belongs to the family Sparidae and only the young of year forms schools. Since mature *D. dentex* does not form schools, it is hard to catch them in large numbers. They generally live in shallow waters (15-20 m depth). In winter, mature *D. dentex* can be found at 200 m depths. Although, some studies have stated that *D. dentex* can be protandric hermaphrodite like giltehead seabream (*Sparus aurata*) by Glamuzina *et al*.[2]. Others have confirmed that this species is gonokoristic hermaphrodite by Pastor *et al*.[3] and Efthimiou[4]. According to this after 1 year they start to become either male or female. Although, spawning period changes by location, their spawning occurs between March and May in the Mediterranean. Depending on the water temperature, they even spawn in June. Like other members of Sparidae, mature *D. dentex* lays eggs partially.

In this study, *D. dentex* broodstock was provided from a private fish farm. Biochemical composition of *D. dentex* eggs was examined and factors that affect egg quality were determined to provide insight for aquaculture purposes.

MATERIALS AND METHODS

Broodstock and egg collection: Wild *D. dentex* broodstock was captured from the Aegean Sea and were assigned to tanks, each tank containing 2/1 (male/female). The stocking rate was 3 kg m^{-3}. The eggs used in this study were harvested in March from mature broodstock during their spawning period. No stimulant was used during egg collection.

Biochemical Analysis: In this study, protein composition of *D. dentex* eggs was analyzed using the procedures of A.O.A.C.[5]. Ash content of *D. dentex* eggs was analyzed according to A.O. A.C.[5]. Total lipids were extracted by using the procedures of Flynn and Bramblet[6]. Moisture content of *D. dentex* eggs was analyzed according to Ludorf and Meyer[7].

Fatty acid methyl esters were prepared according to IUPAC[8] using cold methylation Method 2.301. The analysis of fatty acid methyl esters was performed using a HP 6890 Gas Chromatograph equipped with a flame ionization detector (FID) and fitted with a 50% cyanopropyl bonded, DB-23 fused silica capillary column (30 m×0.25 mm i.d.×0.250 μm; J and W Scientific, Folsom, CA, USA). In this system, injector and detector temperatures were 250°C. Gas flow speeds were 30 ml min^{-1} for hydrogen, 300 ml min^{-1} for air and 24.5 ml min^{-1} for nitrogen. Injection was split (model 1/100) and injector model was 5 μl Hamilton with an injection volume of 0.25 μl.

During the analysis, 10 ml hexane was added to 0.2 g of lipid sample and mixed. Then, 0.5 ml, 2 N methanol-KOH was added to the solution and mixed until the solution becomes 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 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

Corresponding Author: Musa Bulut, Department of Aquaculture, Faculty of Fisheries, Çanakkale Onsekiz Mart Üniversity, 17020 Çanakkale, Turkey E-mail: mbulut@comu.edu.tr

known fatty acid methyl esters, available in mixtures of standards. Quantitative results were recorded as fatty acids (%).

RESULTS AND DISCUSSION

Fertilized *D. dentex* eggs were found to be pelagic, spherical and transparent. They contain one oil globule. Table 1 shows the average size of *D. dentex* eggs used in this study.

Fatty acid analysis of *D. dentex* eggs showed that dentex eggs contain more saturated fatty acids than MUFAs and PUFAs. In general, unsaturated fatty acid content was less than saturated fatty acid content. Dominant saturated fatty acids in the egg were 14:0, 16:0 and 18:0. Dominant MUFAs were 16:1, 18:1 and 20:1. Dominant PUFAs were 18:2, 20:4, 22:5 and 22:6. Results showed that total saturated fatty acids in the fertilized eggs were 36.37±0.09%, MUFA was 38.57±0.03% and PUFA was 24.44±0.04% (Table 2). In addition, essential fatty acids that affect egg quality in *D. dentex* such as EPA, DHA, AA, MUFA and PUFA were recorded as 4.07±0.006, 15.17±0.006, 0.91±0.005, 38.57±0.009 and 24.44±0.04%, respectively (Table 2).

Chemical composition of fish eggs varies by physiological, geographical, genetic factors, dietary requirements, water temperature, body length, species and sex by Kinsella *et al.*[9], Lahti[10], Ringo and Nilsen[11]. As in many marine fish, these parameters are used to evaluate egg quality in *D. dentex*. Additionally, both egg size and percentage of hatching depends on dry yolk weight which in turn affects egg quality. Similarly, we are still some way from fully understanding the complex interactions between protein and total lipid contents.

Ash ratio show eggs mineral high components by Rana[12]. Carik and Harvey[13] revealed that wet weight, dry weight, lipid and protein component of fish larvae correlated with survival ratios positively. It was determined that total lipid component was 6.6% in hake roe (*Merlangius merlangius*) by Mendez *et al.*[14]. It was 8.6% in domesticated valleye by Czesny and Dabrowski[15]. The percent lipid component was determined between these intervals.

Vourela *et al.*[16] indicated that ash amounts of fish eggs changed between 1.8-4.8% as dry weight and there was a considerable differences in lipid and protein contents among species. From the results of the present study, it was though that environmental conditions, genetic and species characteristics and the most important broodstock feeding regimes effected on protein contents of *D. dentex* eggs (Table 3).

Fatty acid analysis of dentex eggs, it was determined that saturated fatty acid ratio was more than monounsaturated fatty acid and polyunsaturated fatty acid ratios. Generally, it was determined that unsaturated fatty acid ratio is less in comparison with saturated fatty acid. Saturated fatty acids 14:0, 16:0 and 18:0, monounsaturated fatty acid 16:1, 18:1 and 20:1 it was dominant that pollyunsaturated fatty acids 18:2, 20:4, 20:5 and 22:6 were the most observed fatty acids. Gooch *et al.*[17] revealed that 16:0, 16:1, 18:1, 20:1, 22:1, 18:2, 20:4, 20:5, 22:5 and 22:6 fatty acids were encountered at most in fish. These fatty acid contents similar to those found by Gooch *et al.*[17], Aggelousis and Ratnayabe[18] indicated that the most encountered fatty acid in fresh water fish species were 16:0, 18:0, 16:1, 18:1, 20:5, 22:6. It was found that ratio of total saturated fatty acid of fertilizated eggs was 36.37±0.09%, monounsaturated, was 38.57±0.03% and polyunsaturated was 24.44±0.04%. Furuita *et al.*[19] explained egg quality and production for Japanese flounder (*Paralichthys olivaceus*) by HUFA level in egg directly. *D. dentex* egg is 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. AA 20:4 level, one of the ω-6 fatty acids iare the other important was effect egg quality. This study, EPA, DHA and AA are 4.07±0.006, 15.17±0.006 and 0.91±0.005%, respectively. Rodriguez *et al.*[20] explained that EPA and DHA were necessary to be found in egg content for developing seabream larvae sufficiently. Furuita *et al.*[21] revealed AA level was effective on egg quality of *P. olivaceus*.

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[11], Lahti[10], Aggelousis and Ratnayabe[18], the cause of these differences originated from fish feeding, water temperature, seasonal migration, ovulating period, fish

Table 1: Egg and oil globule size of *D. dentex* eggs used in this study

Dentex (*Dentex dentex*)	N	Mean±SE (mm)	Max	Min
Egg diameter (mm)	30	1.05±0.06	1.15	0.96
Oil globule diameter (mm)	30	0.27±0.03	0.33	0.20

Table 2: Fatty acid composition of *D. dentex* eggs

Fatty acid	∑ SFAs		∑ MUFA		∑ PUFA
12:0		14:1 ω-7	0.39±0.006	18:2 ω-6	2.13±0.016
14:0	5.38±0.02	16:1 ω-9	1.16±0.006	18:3 ω-3	0.45±0.014
15:0	0.74±0.01	16:1 ω-7	2.05±0.015	18:4 ω-3	0.69±0.005
16:0	23.17±0.05	16:1 ω-5	9.42±0.025	20:4 ω-6	0.91±0.005
17:0	0.69±0.01	17:1 ω-10	1.02±0.025	20:5 ω-3	4.07±0.006
18:0	4.91±0.04	18:1 ω-9	19.18±0.02	22:5 ω-3	1.02±0.006
20:0	0.91±0.02	18:1 ω-7	3.33±0.031	22:6 ω-3	15.17±0.006
22:0	0.28±0.006	20:1 ω-9	0.16±0.025		
23:0	0.08±0.006	20:1 ω-7	1.65±0.060		
23:0	0.15±0.006				
24:0	0.06±0.01				
Total	36.37±0.09		38.57±0.03		24.44±0.04

Table 3: Chemical composition of *D. dentex* eggs

Dentex	N	Min	Max	Mean±Sx
Moisture	3	83.50	85.30	84.58±0.65
Crude protein	3	11.11	12.56	12.06±0.52
Crude lipid	3	4.68	4.91	4.80±0.10
Crude ash	3	1.85	2.05	1.94±0.07

age, water pollution and etc. Lipids are necessary for development of body construction and consists of fatty acids must be taken from outside. As some fatty acids consist of linoleic, linolenic and arachidonicacid which cannot synthesis in body, they are very valuable for feeding. These fatty acids have to taken from outside into body otherwise, their shortage subject to defeats in body functions and furthermore death. EPA, DHA, AA, PUFA, HUFA, MUFA, ω-3 and ω-6 fatty acid is necessary in egg composition. Otherwise, larvae survival ratio decrease at the further stages Desvilettes *et al.*[22]. Therefore, egg fatty acid composition is required adequate quality in egg content.

REFERENCES

1. Bauchot, M.L. and J.C. Hureau, 1986. Sparidae. In: Fishes of the North-eastern Atlantic and Mediterranean. P.J.P.Whitehead, M.L. Bauchot., J.C. Hureau., J. Nielsen and E. Tortonese (Eds). Paris. UNESCO, 2: 1659- 1722.
2. Glamuzina, B., J. Jug Dujakoviç and I. Kataviç, 1989. Preliminary studies on reproduction and larval rearing of common dentex (*Dentex dentex*). Aquaculture, 77:75-84.
3. Pastor, E., F. Riera, S. Pou, A. Grau, K. Pittman, R. Batty and J. Verreth, 1995. Summary of investigations on reproduction and larval rearing of common dentex (*Dentex dentex*). ICES Mar. Sci. Symp., 201: 148-152.
4. Efthimiou, S., 1996. Performance of Juvenil and on Growing Common dentex (*Dentex dentex*, L. 1758), Sparidae in Relation to Nutrution Under Culture. Christian- Albrechts- Üniversitat. Kiel, No. 286: 123.
5. A.O.A.C., 1984. Offical Methods of Analysis 14th Ed. Association of Official Anolytical Chemists, Washington, DC, USA.
6. Flynn, A.W. and V.D. Bramblet, 1975. Effect of frozen storage, cooking method and muscle quality on attributes of pork lions, J. Food Sci., 40: 55-57.
7. Ludorf, W. und V. Meyer, 1973. Fische und Fischerzeugnisse. Paul Parey Verlag. Berlin und Hamburg, pp: 309.
8. IUPAC, 1987. Standarts Methods for Analysis of oils, Fats and Derivatives In: International Union of Pure and Applied Chemistry, 7th. Edn., Blackwell Scientific Publications, IUPAC Method 2.301.
9. Kinsella, J.E., J.L. Shimp and J. MAI, 1978. The proximate and lipid composition of several species of fresh water fishes. Food Sci., No:1-20.
10. Lahti, E., 1987. Total lipid and chollesterol of liver and muscle in some fish species, especially vendace (*Coregonus albula*) in Finland, Arch., Hydrobiol., 110:142-149
11. Ringo, E. and B. Nilsen, 1987. Hatchery-reared landlocked arctic charr (*Salverinus alpinus* L.) from lake Takwatn, reared in fresh and sea water. 1. Biochemical composition of food and lipid composition of fish reared in fresh water, Aquaculture, 67: 343-356.
12. Rana, K.J., 1987. Influence of egg size on the growth, onset of feeding, point of no return and survival of unfed Oreochromis mosambicus fry. Aquaculture, 46: 119-131.
13. Carik, J.C.A. and S.M. Harvey, 1984. Egg quality in rainbow trout: the relation between egg viability, selected aspects of egg composition and time of stripping. Aquaculture, 40: 115-143.
14. Mendez, E., M. Fernandy, G. Pazo and A.M. Grampone, 1992. Hake roe lipids: composition and changes following cooking. Food Chem., 45: 179-181.
15. Czesny, S. and K. Dabrowski, 1998. The effect of egg fatty acid concentrations on embryo viabilty in wild and domesticated walleye (*Stizostedion viterum*). Aquat Living Resour., 11: 371-378.
16. Vuorela, R., J. Kaiteranta and R.R. Linko, 1979. Proximate composition on fish roe in relation to maturity. Can. Inst. Food Sci. Technol. J., 12: 186-188.
17. Gooch, J.A., M.B. Halle, T. Brown, C.J. Bonnet, C.G. Brand and L.W. Regier, 1987. Proximate and fatty acid camposition of 40 Southeastern U.S. Finfish Species, NOAA Technical repord NMFS 54.
18. Aggelousis, R.H. and W.M.N. Ratnayabe, 1991. Fatty acid composition of the lipids from eight freshwater fish species froom Greece. J. food Composition and Analysis, 4: 68-76.
19. Furuita, H., H. Tanaka, T. Yamamoto, N. Suziki and T. Takeuchi, 2002. Effects of high levels of *n-3* HUFA in broodstock diet on egg quality and egg fatty acid composition of Japanese flounder, *Paralichthys olivaceus*. Aquaculture, 210: 323- 333.
20. Rodriguez, C., J.A. Prez, M. Diaz, M.S. Izquierdo, H.F. Palacios and A. Lorenzo, 1997. Influence of the EPA/DHA ratio in rotifers on gilthead seabream (*Sparus aurata*) larval development. Aquaculture, 150: 77-89.
21. Furuita, H., T. Yamamoto, T.Shima and T. Takeuchi, 2002. Effect af arachidonic acid levels in broodstock diet on larval and egg quality of Japanese flounder *Paralichthys olivaceus*. Aquaculture, (Unpublished).
22. Desvilettes, C., G. Bourdier and J.C. Breton, 1997. Changes in lipid class and fatty acid composition during development in pike (*Esox lucius* L.) eggs and larvae. Fish Physiol. Biochem., 16:381-393.