COMPARISON OF FATTY ACID PROFILES OF MALE AND FEMALE GIANT RED SHRIMPS (ARISTAEOMORPHA FOLIACEA RISSO, 1827) OBTAINED FROM MEDITERRANEAN SEA

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ABSTRACT

This study was carried out to detect the concentration of fatty acid in female and male specimens of commercially important giant red shrimp (Arístaeomorpha foliacea) obtained from including 20 male shrimps and also 20 female shrimp Mediterranean Sea. In fatty acid composition, the saturated fatty acid fraction was dominant, followed by polyunsaturated fatty acid and monounsaturated fatty acid for both sexes. The analyses indicated that PUFAs, and the MUFAs content were higher in female shrimp than in those of males and they were statistically significant differences in fatty acid profile between females and males (p<0.05).

- Keywords: Arístaeomorpha foliacea, fatty acids, giant red shrimp, Mediterranean Sea -
INTRODUCTION

The giant red shrimp (Aristaeomorpha foliacea RISSO, 1827) belongs to the family Aristidae, which includes other important species such as the blue and red shrimps (Aristeus antennatus RISSO, 1816) and the scarlet shrimp (Plesiope- 
naeus edwardsianus JOHNSON, 1868) (RAGONÈSE et al., 1997). A. foliacea is widely distributed in 
the eastern and western Atlantic, Indian Ocean and western Pacific, in the waters of Japan, Aus-

tralia, New Zealand and in the Mediterranean Sea. In the Mediterranean Sea, the species in-
habits muddy bottoms of the continental slope approximately between 100 and 1200 m depth. 
This species plays an important role in the overall biomass of the Mediterranean Sea and repre-
sent an important commercial resource among the other shrimp species since 1959 (D’ONGHIA 
et al., 1998; DESANTIS et al., 2003; FERNANDEZ et al., 2011). Due to its economic relevance, re-
cently there are many studies on this species from Mediterranean Sea and there has been a 
considerable amount of research on nutritional 
value of various species of shrimp. However 
there is not any data on the nutritional and fatty 
acids composition of A. foliacea.

Seafoods are important source of nutrients in 
the human diet. Crustaceans such as shrimps 
have high nutritive value, are low in fat, espe-
cially saturated fatty acids; contain high amount of 
polyunsaturated fatty acids (omega-3 and omega 
6) (OKSUZ et al., 2009; TAG EL-DIN et al.; 2009; 
TURAN et al., 2011; SHALINI et al., 2013). These 
fatty acids could not be synthesised by the hu-
man body and must be obtained through the 
food, aquatic invertebrates and algae (RICHArD-
son, 2005). The methyl esters of fatty acids of samples were prepared according to 
IUPAC Methods II. D. 19 (1979). The analyses were carried out by using a Perkin Elmer Au-
system. XL Gas Chromotography and Flame Ionization Detector (FID) equipment and a Su-
peco 2330 fused silica capillary column (30 m 
X 0.25 mm x 0.20 μm film thickness) for deter-
mning the fatty acid composition.

RESULTS AND CONCLUSIONS

Table 1 shows mean weights (g) of female and 
male species of shrimp (Aristaeomorpha foliacea) 
obtained from Mediterranean Sea.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (g)</td>
<td>29.96±6.53</td>
<td>12.26±2.07</td>
</tr>
<tr>
<td>Protein (%)</td>
<td>15.72±1.02</td>
<td>18.0±0.80</td>
</tr>
<tr>
<td>Lipid (%)</td>
<td>0.72±0.11</td>
<td>0.51±0.13</td>
</tr>
</tbody>
</table>

Different letters (a,b) in the same row represent significant statistical dif-
fences (p>0.05).

The mean weight for female shrimps was 
found to be higher than the mean weights for 

male shrimps. Similar results were reported by 
YILMAZ and YILMAZ (2007) for Penaeus semisul-
catus collected from Mediterranean Sea of Tur-
key and also by TURKMEN (2012) and CEVIK et 
al. (2008) for Penaeus kerathurus and Parap-
enaeus longirostris respectively. Our findings 
are consistent with prior research. The levels of 
protein and lipid vary depending upon season, 
age, maturity, sex, water temperature, spawning 
cycle and availability of food, types of diet and 

MATERIALS AND METHODS

Collection and preparation of samples

The samples were caught by bottom trawlers 
between 450 and 500 m of depth, during in 2013 
from Mediterranean Sea of Turkey (36° 22’ 707”N-
24° 25’ 941” E /36° 14’ 919” N- 34° 19’ 163” E).

Immediately, after collection, shrimps were 
stored in a container, preserved in crushed ice 
and transferred to the laboratory, where the 
heads, shells and intestines were separated and 
placed in labeled polyethylene bags respectiv-
ely and stored at -20°C until processing for anal-
ysis. For each season, 20 female and 20 male 
samples of A. foliacea were obtained by random 
sub-sampling.

Fatty acid analysis

For data analysis independent samples t-test 
was used to identify significant differences in 
fatty acid concentration. Statistical significance 
was defined at p<0.05. The mean values were

obtained from 3 experiments and reported as 
means±SD (DINÇER and AYDIN, 2014).
feeding system of organism (ÖKSÜZ et al., 2009; TURAN et al., 2011; ROŚLI et al., 2012).

In a study on Crangon crangon protein and lipid content were 18.47 and 0.95% respectively (TURAN et al., 2011). ÖKSÜZ et al. (1997) determined total lipid as 0.93% for Parapenaeus longirostris and 0.58% for Penaeus semisulcatus. YANAR et al. (2011) found that protein and lipid of Penaeus semisulcatus ranged between 22.76-23.53% and 0.76-1.44% respectively. FATIMA et al. (2012) reported that lipid in the muscle tissue of Fenneropenaeus penicillatus varied from 0.92 to 1.0% and of F. merguiensis from 0.87 to 0.98%. Protein and lipid were also reported as 20% and 1.1% for Parapenaeus longirostris and 14.2% and 2.6% for Plesionika martia by ÖKSÜZ et al. (2009). DINCER and AYDIN (2014) determined that protein and lipid of Metapenaeus affinis ranged between 18.4-19.1% and 1.07-1.30% respectively. In the present study the content of protein and lipid were identified as slightly lower than those reported previously for some shrimp species. The main reason for this is thought to be related to variation in seasonal feeding habits (different types of diet and feeding system) and habitats. In the study, the protein content for male shrimps was found to be higher than the protein content for female shrimps whereas the lipid content was found to be lower in male shrimp (p<0.05). Similar results were reported by DINCER and AYDIN (2014) for female and male species of Metapenaeus affinis.

The ratios of PUFA/SFA and n-6/n-3 and the fatty acid compositions of the investigated shrimp are presented in Table 2.

The fatty acids analyzed were grouped as saturated fatty acids (SFAs), monounsaturated fatty acids (MUFAs) and polyunsaturated fatty acids (PUFAs). In the present study, in both groups, SFA was the highest followed by PUFA and MUFA. These results were in agreement with that obtained by TURAN et al. (2011) who reported highest levels of SFA followed by PUFA and MUFA for brown shrimp (Crangon crangon) from Sinop Region, Black Sea. Similar results were also reported by OURAJI et al. (2011) for wild Indian white shrimps (Fenneropenaeus indicus); by ÖKSÜZ et al. (2009) for rose shrimp (Parapenaeus longirostris) and red shrimp (Plesionika martia); by YANAR et al. (2011) for Penaeus semisulcatus; by FATIMA et al. (2012) for Fenneropenaeus merguiensis and F. penicillatus and by DINCER and AYDIN (2014) for Metapenaeus affinis. According to the results, C16:0 (Palmitic acid) and C18:0 (Stearic acid) were the main saturated fatty acids in both shrimp species. In both sexes, the predominant monounsaturated fatty acids were found as C18:1 (Oleic acid). The principal acids in PUFA group were eicosapentaenoic acid (C20:5, EPA), docosahexaenoic acid (C22:6, DHA) and linoleic acid (C18:2) for female and male shrimp species. These results agree with studies on fatty acids found in other shrimp species (ÖKSÜZ et al., 2009; TURAN et al., 2011; ROŚLI et al., 2012).

Table 2 - Fatty acid composition of female (F) and male (M) shrimps.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Female (%)</th>
<th>Male (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>∑SFA</td>
<td>43.69a</td>
<td>47.15b</td>
</tr>
<tr>
<td>∑PUFA</td>
<td>29.33a</td>
<td>25.41b</td>
</tr>
<tr>
<td>PUFAs/FSA</td>
<td>0.67</td>
<td>0.54</td>
</tr>
<tr>
<td>∑n6</td>
<td>23.07</td>
<td>21.00</td>
</tr>
<tr>
<td>∑n3</td>
<td>6.26</td>
<td>4.41</td>
</tr>
<tr>
<td>n6/n3</td>
<td>0.27</td>
<td>0.21</td>
</tr>
<tr>
<td>Unidentified</td>
<td>2.61</td>
<td>10.1</td>
</tr>
</tbody>
</table>

n.d.: below detection limit; Data are expressed as means±SD of triplicate measurements. Different letters (a,b) in the same row represent significant statistical differences (p<0.05).

Table 2 - Fatty acid composition of female (F) and male (M) shrimps.

might be associated with the different characteristics of the shrimp species (KARUPPASAMY et al., 2013). In a study, TURAN et al. (2011) reported SFA, MUFA and PUFA rates in brown-color shrimp at 33.04, 22.17 and 29% respectively. ÖKSÜZ et al. (2009) reported the MUFA rate in P. longirostris and P. martia at 26.09% and 34.47% respectively. OURAJI (2011) reported the rate of SFA in wild white Indian shrimp and its cultured specimen at 32.88 and 33.79% respectively. EMAMI et al. (2014) reported that the rate of SFA in Penaeus vannamei at 37.26%, in Penaeus semisulcatus at 49.12% and the rate of MUFA in P. vannamei at 24.9%, in P. semisulcatus at 33.76% and the PUFA in P. Vannamei at 37.84%, in P. semisulcatus at 16.9% respec-
Comparison of fatty acid composition between two sexes

The fatty acid compositions of female shrimp species found to be 43.69% saturated (SFAs), 29.33% polyunsaturated acids (PUFAs) and 24.37% monounsaturated (MUFAs) whereas the fatty acid compositions of male shrimp consist of 47.15% saturated (SFAs), 25.41% polyunsaturated acids (PUFAs) and 17.34% mono-unsaturated (MUFAs). Among these the highest concentrations of SFAs (47.15%) were detected in male shrimp species while the highest concentrations of PUFAs (29.33%) and MUFAs (24.37%) were detected in female shrimp. There is a significant difference between the SFA, PUFA and MUFA profiles in both sexes (p<0.05). Similar results were reported for female and male species of *Metapenaeus affinis* by DINCER and AYDIN (2014) and by ESKANDARI et al. (2014) for female and male species of *M. affinis*. Based on results, the amount of palmitic acid (C16:0) for female shrimp (27.59%) was almost the same as in male shrimp species (27.29%) (p>0.05), while the amount of oleic acid (C18:1) (21.68%) was higher than those in male shrimp (15.68%) (p<0.05). The present study also showed that the amount of docosahexaenoic acid (C22:6, DHA) of female shrimp (9.60%) are almost the same as in male shrimp species (9.53%) (p>0.05) whereas the levels of eicosapentaenoic acid (C20:5, EPA) and linoleic acid (C18:2) were higher than those in male shrimp (p<0.05). In a study, DINCER and AYDIN (2014) reported that the EPA content of male *Metapenaeus affinis* was lower than female *M. affinis*. The ratio of PUFA to SFA (0.54) and n-6 to n-3 (0.21) for the male shrimp was found to be lower than those in female shrimp. Although both shrimps were subjected to the same sea water and climate conditions, there were naturally some differences between them, in terms of their size, sex and quantity of lipid.

In conclusion, from a nutritional point of view, both male and female giant red shrimps demonstrated acceptable quality; in particular, the female giant red shrimps had the highest levels of PUFAs, and the MUFA content. Both sexes are low in fat and are considered to belong to a low fat class group. Further investigations are required to obtain more information about this species.

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