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Investigation of Proximate Value, Sensorial Evaluation, Flesh Yield of Shrimp (*Parapenaus longirostris*) (Lucas, 1846) between Populations in the Marmara and Northern Aegean Sea

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***Abstract*—**The differences on proximate composition, sensorial analysis (for raw and cooked samples) and flesh productivity of the samples of *Parapenaus longirostris* that were caught in the North Aegean Sea and Marmara Sea were investigated. Moisture, protein, lipid, ash, carbohydrate, energy content of the North Aegean Sea shrimp were found 74.92 ± 0.1, 20.32 ± 0.16, 2.55 ± 0.1, 2.13 ± 0.08, 0.08%, 110.1 kcal/100 g, respectively. On the other hand, the Marmara Sea shrimp was found 76.9 ± 0.02, 19.06 ± 0.03, 2.22 ± 0.08, 1.51 ± 0.04, 0.33, 102.77 kcal/100g, respectively. Protein, lipid, ash and energy values of the Northern Aegean Sea shrimp were higher than the Marmara Sea shrimp. On the other hand, moisture, carbohydrate values of the Northern Aegean Sea shrimp were lower than the Marmara samples. Sensorial analyses were carried on for raw and cooked samples. Among all properties for raw samples, flesh color, shrimp connective tissue, shrimp body parameters were different from each other according to the result of the panel. According to the result of the cooked shrimp samples among all properties, cooked odour, flavor and texture were different from each other as well. Especially, flavor and textural properties of cooked shrimps of the Northern Aegean Sea were higher than the Marmara Sea shrimp. The flesh yield of the Northern Aegean Sea shrimp was found 46.42%, while Marmara Sea shrimp was found 47.74%.

***Keywords*—**Proximate value, sensorial evaluation, *Parapenaus longirostris* flesh yield.

I. Introduction

SEAFOOD is very good nourishment for human nutrition. Scientists have known for many years that seafood is a low-fat source of high-quality protein and that the health benefits of eating seafood is unignorable for people [1]. Especially, the health benefits of eating seafood make it one of the best opportunities for children. Seafood products possess high levels of EPA and DHA as well as of vitamin D. Moreover, replacement of foods rich in saturated fat (SFA) by seafood products can help to reduce SFA intake [2]. Eskimos native to Greenland have a low of heart diseases in spite of having a diet in oil [3]. The people who live in these regions consume more seafood and their products such as; fish oil, shrimp. Also, these prevent heart diseases, sort of cancers and diabetes. Especially, in developed countries consuming shrimp is mostly preferred and the most consumed seafood in America was recorded as shrimp in 2010 [1]. The underlying reason is that shrimps have highly glamorous source of protein, since not only they are low in fat but also in their calorie level. Therefore, shrimp has an important place on human diet due to its many diverse benefits on human health [4].

This study focuses on the differences on their nutritional values and consumers' preferences with sensorial analysis of shrimps found in different regions (Marmara Sea and North Aegean Sea) but the same species that is called *Parapenaus longrirostris.*

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II. Material and Methods

The first group of shrimp (*Parapenaus longirostris),* with an average length and weight of 4.31 ± 0.41 cm and 3.77 ± 0.44 g were obtained from the Marmara Sea. The second group of shrimp (*P. longrirostrist),* with an average length and weight of 3.87 ± 0.4 cm and 2.87 ± 0.85 g were obtained from the North Aegean Sea. The first group was bought from Istanbul Wholesale Market Hall while the second group was obtained from Gökçeada Island. All groups were kept on ice and transported to the seafood processing technology laboratory at the Faculty of Fisheries, Istanbul University. Length, weight and flesh productivity of two groups were measured.

Both of shrimp groups were homogenized in Waring 8011 blender about 50 s at low speed to obtain a uniform sample and analyzed to determine moisture, protein, lipid and ash. All analyses were done in triplicate.

Moisture was measured by oven-drying at 105°C to stable weight [5]. Crude protein was determined by the Kjeldahl procedure [6]. Crude lipid was determined by the method described by AOAC [7] using a soxhlet glass set. Ash was determined gravimetrically in a muffle furnace at 550°C to constant weight [8]. Carbohydrate contents were determined according to [9]. The Atwater method was used for the calculation of total calories (kcal/100 g) [10].

Sensorial analyses were done according to Torry method [19]. In this study, raw and cooked shrimps were investigated. Sensorial analyses were evaluated by twelve educated panelists. For raw shrimps of two groups flesh colour, head, connective tissue, shrimp body and odour properties were evaluated by trained panelists. Cooked shrimp samples for two groups had been boiled in different jars at the same time for thirteen minutes before the panel started. Panelists investigated all cooked samples as odour, flavours and texture for two groups. The panelists scored all shrimp samples among 5 and 0 for two groups, separately. Used tables for sensorial analyses are given in Tables II and III.

III. Result and Discussion

The proximate composition of shrimp (in raw) is given in Figs. 1-4. The North Aegean Sea shrimp had 20.32% protein value, when protein value of the Marmara Sea shrimp was found 19.06%.

Shrimp is the best protein source within crustaceans. The nutritional quality of shrimp depends on several factors such as environmental nutrition, sex, season and habitats. According to [11], protein value of Antarctic krill, a species of Antartic water of the Southern Ocean, was found 17.22%. Another study indicated that protein value of *Metapenaus stebbingi* was determined as 16.29% [12]. Protein values of *Metapenaeus affinis* for male and female were 19.68% and 20.32%, respectively [13]. Although it was same species of shrimp (*Parapenaus longirostrist*), our results showed that the protein value of shrimp from obtained different habitat was varied each other.

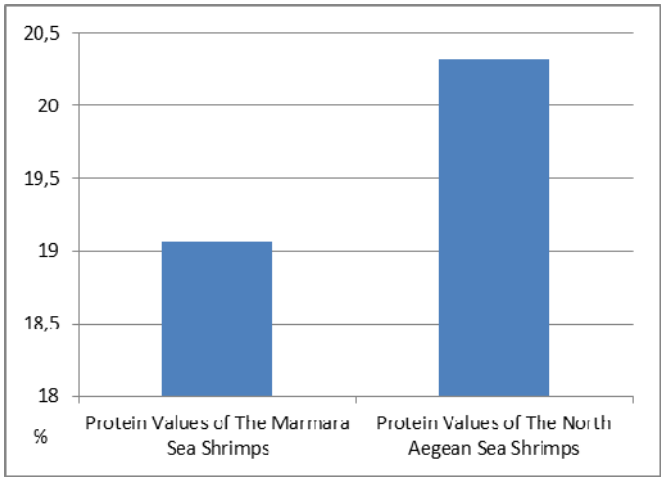

Fig. 1 Protein values of Shrimp (%)

Many studies have been conducted on the lipid composition of different fish species in different parts of the world [14]. There is a remarkable difference in the chemical composition among fish species. This differentiation depends on several factors including the region and the season of fishery, the sex and age of the fish [15], [16].

Crude lipid values of shrimp were found different that was caught in the Marmara Sea and the North Aegean Sea at the end of the study, crude lipid value of Marmara Sea shrimp was found 2.22%, once crude lipid value of the North Aegean Sea shrimp was found 2.55% (Fig 2).

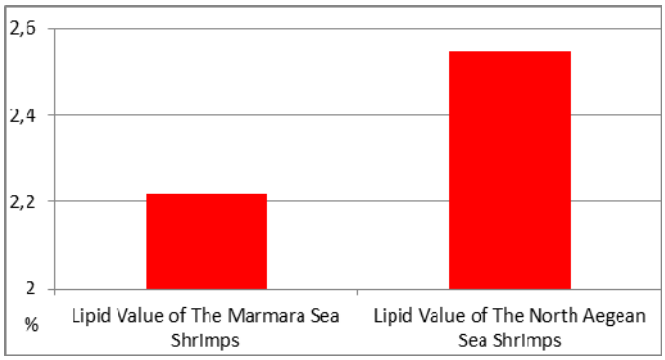

Fig. 2 Lipids values of shrimp (%)

In another study, Antarctic krill (*Euphausia superb*) meat contained 2.66% of crude lipids [11]. On the other hand, crude lipid of *Parapenaus longirostrist* was found 1.1% of [17]. Fat values of *Metapenaeus affinis* for male and female were found as 1.65% and 1.69%, respectively [13]. Although, shrimps belong to the same species, the results indicated that shrimps in two habitats can have different lipid values.

Moisture values of shrimps were found different between Marmara and the North Aegean Sea with 76.9%, in the Marmara Sea and 74.92% in the North Aegean Sea (Fig 3).

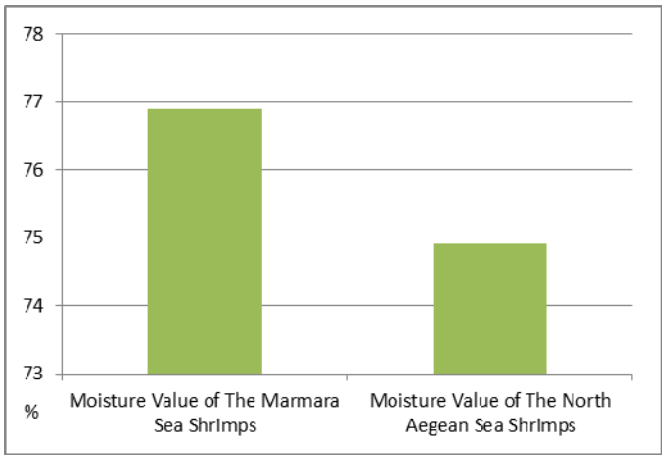

Fig. 3 Moisture values of shrimp (%)

Moisture value of Antarctic krill (*Euphausia superb*) was found as 76.39% [11]. Especially, this was found similar with shrimp that was caught from the Marmara Sea. Moisture analyses indicated that there were differences among shrimps which were caught at the same season but different regions.

Ash value of shrimp caught from the Marmara Sea was lower than from that of the North Aegean Sea. The Marmara Sea shrimp had 1.51% ashes, once the North Aegean Sea shrimp had 2.55% of ashes.

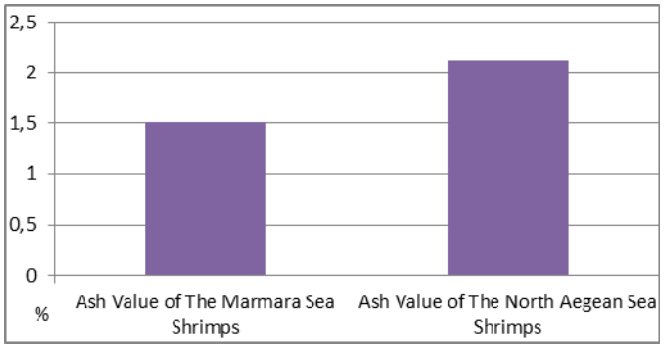

Fig. 4 Ash values of shrimp (%)

Antarctic krill (*Euphausia superb*) contained 1.43% of ash [11]. Ash values of individual with both male and female (*Metapenaeus affinis*) were referred as 1.67%, 1.62%, respectively [13]. To sum up, ash value of shrimp from the North Aegean Sea shrimp was found more than the Marmara shrimp.

Seafood has lower carbohydrate value than most food. According to the results of the study, carbohydrate value of Marmara Sea was found more than the North Aegean Sea shrimp. When carbohydrate value of the North Aegean Sea shrimp was 0.08%, the Marmara Sea shrimp was found 0.33%.

Carbohydrate values of samples were lower than many consumed food. Carbohydrate values of *Metapenaeus affinis* for male and female were found 0.86% and 0.57%, respectively [13]. Once the results were compared with this study, carbohydrate values of two groups were found lower than that of *Metapenaeus affinis*.

Energy values of shrimps are generally lower than most food products due to their highly low fat ratio. Therefore energy which comes from fat is quietly low. Energy values of two groups were calculated by protein, fat and carbohydrate values. In this study, energy value of the North Aegean Sea shrimps that came from protein were more than the Marmara Sea shrimps.

TABLE I
ENERGY VALUE

	The North Aegean Sea Shrimp	The Marmara Sea Shrimp
Protein (kcal)	86.766	81.386
Fat (kcal)	23.001	20.024
Carbohydrate (kcal)	0.328	1.353
Total (kcal)	110.095	102.763

The same situation was seen for lipid value. The highest energy value was determined in the North Aegean Sea shrimp samples (110.09 kcal/100g wet). Once energy value of the North Aegean Sea shrimp was found 110.09 kcal, it was 102.76 kcal for the Marmara Sea. On account of these results, energy value of the North Aegean Sea shrimp was more than the other one. Over all, although all shrimp samples were in the same species, energy values were found different. Another study indicated that energy values of *M. affinis* for male and female were found 130.31 cal/g and 133.11 cal/g, respectively [13]. When energy value of *Parapenaus longirostrist* was compared to *Metapenaeus affinis*, energy value of *Parapenaus longirostrist* was lower than *Metapenaeus affinis*. Results of energy values are shown in detailed in Table I.

In this study, sensorial analyses were done for raw and cooked samples. According to the results of sensorial evaluation, flesh color and connective tissue, shrimp body parameters were found different from each other. The North Aegean Sea shrimp received the highest score with 4.5 for flesh color. The Marmara Sea Shrimp received the highest score with 4.27 in odor. As a result almost all properties of raw samples of the North Aegean Sea shrimp received the highest score. Moreover, once all parameters were evaluated for each group altogether, the North Aegean Sea shrimp received 4.36 average score in raw samples, the Marmara Sea shrimp received 4.16 average score for raw samples. All sensorial scores for raw material are shown in detailed in Table II.

TABLE II
THE SENSORY CHARACTERISTICS (RAW)

	The North Aegean Sea Shrimp	The Marmara Sea Shrimp
Flesh color	4.5	4.09
Head	3.88	3.9
Connective tissue	4.5	4.18
Shrimp body	4.6	4.36
Odor	4.3	4.27
Average score	4.36	4.16

According to the result of the cooked shrimp samples, all properties; odor, flavors and texture were found different between two sites. Especially, flavors and textural properties of cooked shrimps were highly different in two sites. The North Aegean Sea shrimp received the highest score with 4.8 for texture. Texture parameter of the Marmara Sea shrimp was found the highest score with 4.4. In spite of the fact that cooked odor for two groups were similar, important differences were shown on flavors and texture parameters. Furthermore, once average scores of cooked samples were investigated, the North Aegean Sea shrimp was more preferred than the Marmara Sea shrimp according to panelists' score. The North Aegean Sea shrimp received 4.59 score, the Marmara Sea Shrimp received 4.33 for cooked samples. Sensorial acceptability of two groups was found highly up. Another study on sensorial analysis reported that acceptability of fresh shrimp was 83.3% [18]. Furthermore, samples of our two groups were higher than 86%.

TABLE III
THE SENSORY CHARACTERISTICS (COOKED)

	The North Aegean Sea Shrimp	The Marmara Sea Shrimp
Cooked odor	4.33	4.27
Flavors	4.64	4.33
Texture	4.8	4.4
Average score	4.59	4.33

At the end of the study it was clear that the shrimps from the North Aegean Sea are the most preferred ones by the panelists. Raw and cooked samples of the North Aegean Sea shrimp had the highest score in flavor, texture and odor. Shrimps were caught in different habitats, flesh yield was found similar to each other. Flesh yield of the Northern Aegean Sea shrimp and the Marmara Sea shrimp was found 46.42%, 47.74%, respectively.

IV. Conclusion

There are clear differences in the proximate composition of shrimps. This differentiation may reflect the different habitats of shrimps. On the other hand, the sensory evaluation of panelists show that the North Aegean Sea shrimp most preferred by means of sensorial characteristics than the Marmara Sea samples.

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