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PREFERENCES, CONSUMPTION AND CHOICE FACTORS OF FISH AND SEAFOOD AMONG UNIVERSITY STUDENTS

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Key words: students' fish and seafood preferences, choice factors, frequency of consumption, principal component, cluster analysis

Preferences of fish and seafood, criteria of choice and consumption frequency were examined in a group of 200 students of the Medical University of Gdańsk (Poland). They answered a self-administrated questionnaire about preferences of seafood and fish. The study was aimed at clarifying choice factors and consumption frequency of fish and seafood. The results of the study showed that respondents were significantly more familiar with fish than molluscs and crustaceans. The most preferred among fish and seafood were: salmon, cod, tuna and mackerel, and shrimps, respectively.

Data analysis shows that the most significant factors of choice of fish and seafood were taste and freshness. The third significant attribute of the choice of these products by women was their health impact, while the others were as follows: nutritive value, price, availability, appearance, habits, fads and market novelty. Male respondents reported price as a factor determining their choice over both nutritive value and health impact.

INTRODUCTION

Nutrition is one of the major factors affecting human development, health, fitness and well-being. An optimal diet is described as one fulfilling consumers' needs for energy and nutrients [Gawęcki & Hryniewiecki, 2000]. Being particularly valuable and having specific, unique nutritive values fish should occupy a special position in a human diet. Fish contain easily bioavailable proteins, long chain n-3 polyunsaturated fatty acids (n-3 LC-PUFA), vitamins (especially A, D, B_6 and B_{12}) and trace elements (iodine, selenium, fluorine, *etc*.) [Gawęcki, 2000; Gajewska-Meszaros & Meszaros, 2001; Lebiedzińska *et al.*, 2004]. Due to a considerable role of seafood in the prevention of heart and autoimmunological diseases an increase in fish consumption is highly recommended [Sikorski, 1992; Kłosiewicz-Latoszek & Szostak, 2000; Kłosiewicz-Latoszek & Ostrowska, 2000; Kolanowski 2000; He *et al.*, 2002; Thies *et al.*, 2003]. Fish and seafood consumption all over the world tends systematically to increase, whereas in Poland is insufficient with a declining tendency [Kołakowska & Kołakowski, 2001; Statistical Yearbook of the Republic of Poland, 2004]. It is interesting to understand why people in Poland do not eat more fish and seafood as well as what kinds of barriers, *i.e.* consumers' preferences, freshness and taste of fish products, price or skills in the preparation of seafood meals, are crucial. Food choice is influenced by biological, psychological and cultural factors. Humans mainly learn to eat and like certain foods, and dislike the others, with traditions having the main influence. Preferences can be based on the instrumental consequences of eating (*e.g.* nutritive properties of food) or on liking test [Babicz-Zielińska, 2001; Baryłko-Pikielna & Kostyra, 2004]. The knowledge of preferences can be helpful when our intention is to increase the consumption of seafood.

International organizations give high priority for the promotion of healthy diets and physical activity to improve health outcomes and to reduce the risk factors for non-communicable diseases caused by unhealthy diets [WHO, 2004]. In the view of these recommendations, the medical universities' students should be obliged to promote healthy lifestyle among different groups of population. Several authors [Myrland *et al*., 2000; Czarnocińska *et al.*, 2001; 2003; Friedrich, 2005] observed that better educated consumers demand products of a higher quality and that nutritional education was associated with healthy eating habits.

Students are considered as a group characterised with a specific lifestyle that results from a number factors, such as leaving the family home, academic activities, situation of the campus and dormitory and restricted budget [Wądołowska *et al.*, 1998; Babicz-Zielińska, 1999a].

Present study was aimed at the exploration of preferences, choice factors and consumption frequency of fish and seafood among students of the Medical University of Gdańsk.

MATERIALS AND METHODS

A random sample of students (group of 150 women and

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50 men) aged 18-26 were examined. During the study, all subjects were students of the Medical University of Gdańsk (2003/2004). A self-report questionnaire was carried out individually.

In the first stage of the study, choice factors were examined. To evaluate the significant factors influencing fish and seafood choices 10 attributes were determined as multiple choice possibilities: taste, freshness, appearance, health impact, nutritive value, dietary habits, market novelty, fads, price and availability.

In the second part of the questionnaire concerning the fish and seafood preference, a rating scale was introduced. The examination of preferences of six seafood varieties (shrimps, squid, crabs, mussels, oysters and octopus) and fifteen fish species (salmon, mackerel, tuna, cod, herring, sardines, halibut, trout, hake, pollock, flatfish, pike, zander, bass and roach) was carried out with the use of a four-degree scale rated as follows: I do not like (1 p.), I like moderately (2 p.), I like (3 p.), I like very much (4 p.). This hedonic scale was enlarged on an option stating unfamiliarity with the particular product: "I am not familiar with". Mean values of preferences were later analysed as preference ratings.

The next part of the questionnaire evaluated the frequency of fish and seafood consumption. Available answers comprised a set of temporal sections: few times a week, once a week, few times a month, once a month, rarely and never.

The last part of the questionnaire was related to the preferred form of consumption. Students were asked what fish products they purchased: raw fish (requiring a culinary preparation at home) or ready to use fish products. Respondents chose forms of fish dishes consumed from a set of dishes: smoked fish, fried fish, fish jelly (Polish traditional dish), canned fish, fish soup, fish salad and fish paste. Multivariate statistical analysis was applied using STATISTICA for Windows (version 6.0, Copyright© Statsoft, Inc. 2003). Chemometric methods used in the study were as follows: principal component analysis (PCA), hierarchical clustering analysis (HCA), analysis of variance ANOVA and simple Student's t-test [Dobosz, 2004].

RESULTS AND DISCUSSION

Factors of choice of fish and seafood

Data presented in Table 1 show that the most significant factors of choice of fish and seafood, for all students (n=200), were taste and freshness ($p<0.0001$). Taste was chosen by 89% of women and 92% of men. Freshness was chosen by 66% of women and 70% of men. Likewise, taste and freshness have been found to be important predictors for fish choice factors in a study of Babicz-Zielińska & Rybowska [2001]. These food-choice factors have also been demonstrated to be important in other food products [Babicz-Zielińska, 1999b; Czarnocińska *et al.*, 2003]. Our data suggest that women appreciated the health impact and nutritive value over the price of the products ($t=2.64$, $p<0.001$), whereas male respondents demonstrated an opposite attitude than that of being health-conscious. The men reported the price and appearance as factors determining their choice over both nutritive value and health impact (Table 1). As the third significant attribute, women selected health impact and other attributes such as: nutritive value, price, availability, appearance, habits, fads and market novelty. The significant difference between male and female students was found with respect to health impact as the choice factor ($F=7.93$, $p<0.01$), (Table 2). It corresponds to the data reported by Czarnocińska *et al.* [2003] who observed that a health factor was associated with higher choice of vegetables in the group of girls compared to that of boys. This result is similar to a Norwegian finding that the major determinants of frequent fish consumption among Norwegians are the health impact and nutritional awareness [Olsen, 2003; Trondsen, *et al.*, 2004a, b].

TABLE 1. The importance of fish and seafood choice factors depending on sex of students.

Choice factors	Female-students N = 150 Mean ± SD	Male-students N = 50 Mean ± SD	Total population N = 200 Mean ± SD
Market novelty	0.12±0.21	0.10±0.19	0.10±0.20
Fads	0.15±0.26	0.14±0.19	0.15±0.24
Habits	0.30±0.45	0.28±0.45	0.29±0.45
Appearance	0.32±0.47	0.44±0.50	0.35±0.47
Availability	0.37±0.48	0.40±0.49	0.38±0.48
Price	0.40±0.49	0.46±0.50	0.42±0.49
Nutritive value	0.49±0.50	0.42±0.49	0.47±0.50
Health impact	0.56±0.49	0.34±0.47	0.51±0.50
Freshness	0.66±0.47	0.72±0.45	0.68±0.46
Taste	0.90±0.30	0.94±0.23	0.91±0.28

N – number of respondents; SD – standard deviation

TABLE 2. ANOVA results for choice factors for fish and seafood depending on sex of students.

Choice factors	F-ratio	p-value
Market novelty	0.038	ni
Fads	0.681	ni
Habits	0.071	ni
Appearance	2.105	ni
Availability	0.112	ni
Price	0.434	ni
Nutritive value	0.804	ni
Health impact	7.939	p<0.01
Freshness	0.486	ni
Taste	0.728	ni

ni – statistically insignificant

Preferences of seafood and fish

Shrimps were the most preferred of all the seafood at a significance level of $p<0.001$ (Table 3). Advanced statistical methods provide opportunities to find hidden relationships, if any exists, between large amounts of data and to illustrate the results in a legible graphic form. Therefore the data obtained were processed by multivariate statistical analysis, *i.e.* hierarchical cluster analysis (HCA) and principal component analysis (PCA).

TABLE 3. Preferences for seafood in pairs in view of Student's t-test.

Choice factors	t-test values	t-test significance level
Shrimps-Squids	9.587	p<0.001
Shrimps-Mussels	6.309	p<0.001
Shrimps-Crabs	6.920	p<0.001
Shrimps-Octopus	8.786	p<0.001
Shrimps-Oysters	11.270	p<0.001
Squids-Mussels	-4.339	p<0.001
Squids-Crabs	-3.015	p<0.001
Squids-Octopus	-0.923	ni
Squids-Oysters	1.760	ni
Mussels-Crabs	0.690	ni
Mussels-Octopus	3.528	p<0.01
Mussels-Oysters	5.476	p<0.001
Crabs-Octopus	2.071	ni
Crabs-Oysters	4.587	p<0.001
Octopus-Oysters	2.394	ni

ni – statistically insignificant

The HCA analysis enables the separation of seafood species according to students' preferences at a distance of 19. The cluster function has successfully clustered five species of seafood (mussels, crabs, oysters, octopus and squids), at a linkage distance of shrimps (Figure 1).

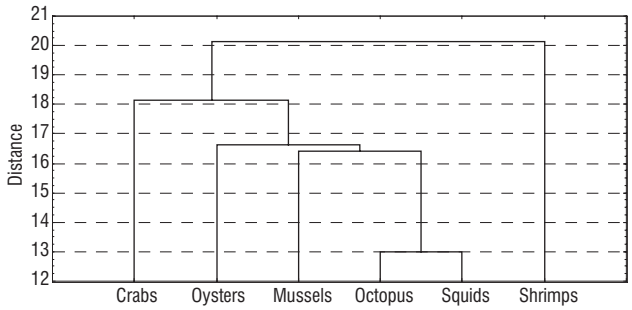

FIGURE 1. Hierarchical dendrogram for six species of seafood based on the students preferences.

The results regarding fish preferences indicate that the most preferred sea fish were: salmon, mackerel, tuna, cod, trout and herring, and that there were no significant differences between male and female students in this respect (Table 4).

A PCA was carried out for 15 species of fish considering 10 factors of choice, *i.e.* market novelty, fads, habits, appearance, availability, price, nutritive value, health impact, freshness and taste. The first three cumulative principal components, *i.e.* PC1, PC2 and PC3, accounted for 45.9% of the total variance. Eigenvalues (EVs) for these factors were greater than unity. It can be seen (Figure 2) that PC1 is responsible for distinguishing the tuna fish and herring from other species. This is probably due to low prices of tuna and herring and their high availability, especially as a canned, ready-to-use products. PC2 differentiates fresh water fish from the sea water ones. Higher values of PC2 are generally associated with fresh water fish (except herring), whereas their lower values are attributable to the sea water fish. PC3 is responsible for distinguishing

TABLE 4. Degree of liking of different fish by students.

Fish	Female-students N = 150 Mean ± SD	Male-students N = 50 Mean ± SD	Total population N = 200 Mean ± SD
Salmon	3.14±1.10	3.07±1.12	3.11±1.10
Mackerel	3.05±1.23	2.98±1.34	3.04±1.09
Tuna	3.07±1.10	2.93±1.08	3.02±1.06
Cod	2.93±1.20	2.52±1.05	2.81±1.27
Trout	2.62±1.46	3.00±1.42	2.75±1.39
Herring	2.59±1.17	3.00±1.33	2.73±1.17
Flatfish	2.07±1.33	2.39±1.18	1.65±1.45
Pollack	2.19±1.51	1.91±1.47	2.12±1.55
Sardines	1.92±1.54	2.11±1.57	1.97±1.22
Zander	1.75±1.63	1.84±1.70	1.78±1.60
Bass	1.55±1.60	2.23±1.61	1.71±1.40
Hake	1.69±1.45	1.82±1.17	1.73±1.50
Roach	1.58±1.54	2.07±1.45	1.71±1.30
Pike	1.63±1.33	1.70±1.01	1.65±1.52
Halibut	1.59±1.36	1.64±1.42	1.62±1.65

N – number of respondents; SD – standard deviation

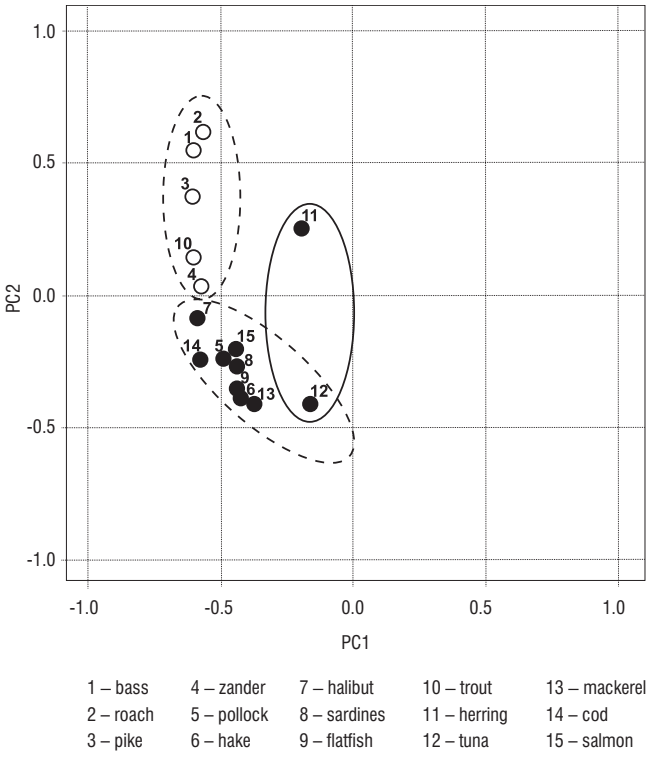

FIGURE 2. Biplot of object scores for the two first factors of 15 species of fish (● – fresh water fish, ○ – sea water fish) considering the following 10 factors of choice: market novelty, fads, habits, appearance, availability, price, nutritive value, health impact, freshness and taste. PC1 is a weighted linear combination of the original variables, describing 24.3% of the total variance for EV = 3.6. PC2 is a weighted linear combination of the original variables, describing 11.5% of the total variance for EV = 1.7.

one group of sea water fish with higher values of PC3 (pollock, hake and halibut) from another one with lower values of PC3 (salmon, herring, tuna and cod) (Figure 3). The next cluster, consisting mainly of freshwater fish, is located in the middle part of the scatterplot (near 0 value of PC3).

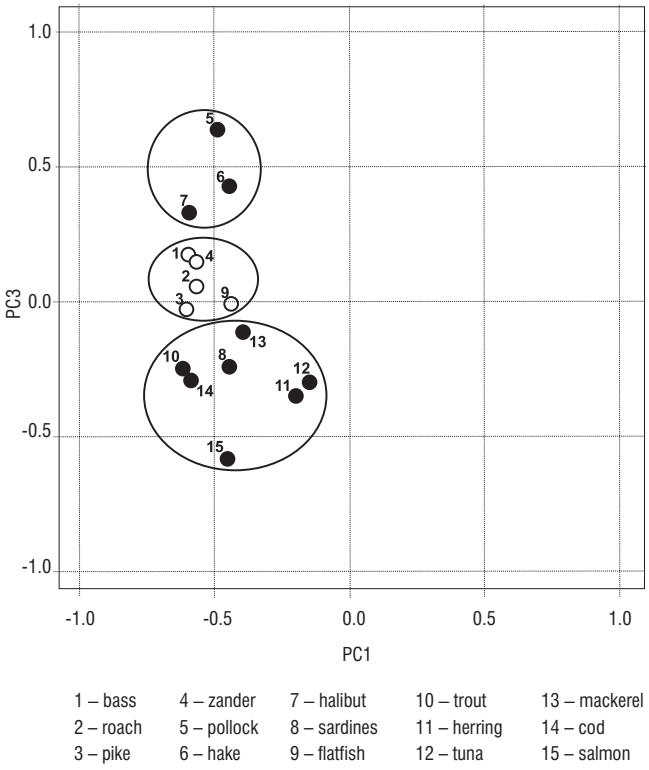

FIGURE 3. Biplot of object scores for the PC1 and PC3 of 15 species of fish (● – fresh water fish, ○ – sea water fish) considering the following 10 factors of choice: market novelty, fads, habits, appearance, availability, price, nutritive value, health impact, freshness and taste. PC1 is a weighted linear combination of the original variables, describing 24.3% of the total variance for EV = 3.6. PC3 is a weighted linear combination of the original variables, describing 10.1% of the total variance for EV = 1.5.

The HCA results were obtained after the application of the cluster analysis at a distance of 26 (Figure 4). The dendrogram is built up of two main clusters. The first one contains three subclusters with the objects of fresh water fish (F), the adjacent area (S2; pollock, hake) and sea fish (S2; halibut, sardines and flatfish). The second main cluster contains two subclusters of the most preferred sea fish (S1); one cluster is composed of the most preferred fish (salmon, cod, mackerel and tuna) and the second contains trout and herring.

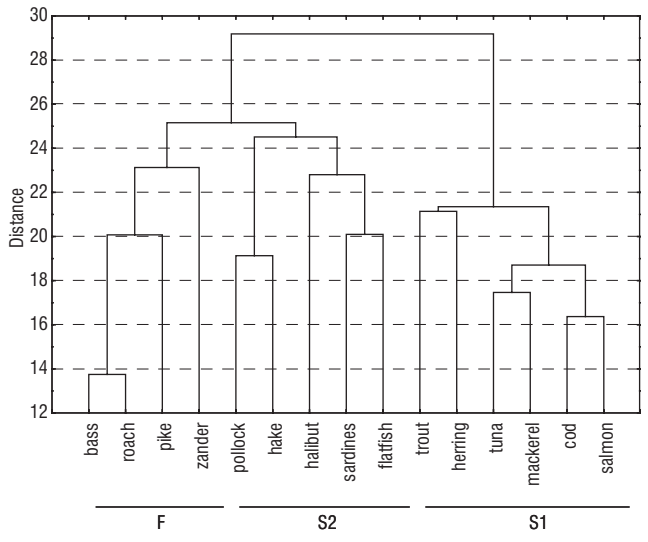

FIGURE 4. Hierarchical dendrogram for 15 species of fish based on the students preferences. S1 and S2 – objects of sea fish (pollock, hake, halibut, sardines, flatfish, trout, herring, tuna, mackerel, cod and salmon); F – object of fresh-water fish (bass, roach, zander and pike).

The applied statistical analysis is useful for obtaining information about consumer's preferences and may be used for the differentiation of nutritional habits of people.

Seafood and fish familiarity and consumption frequency

The results obtained demonstrate that seafood products were relatively less-known than fish by the examined students (Figure 5). Shrimps were the most widely known of all seafood but were consumed rather infrequently. Similar

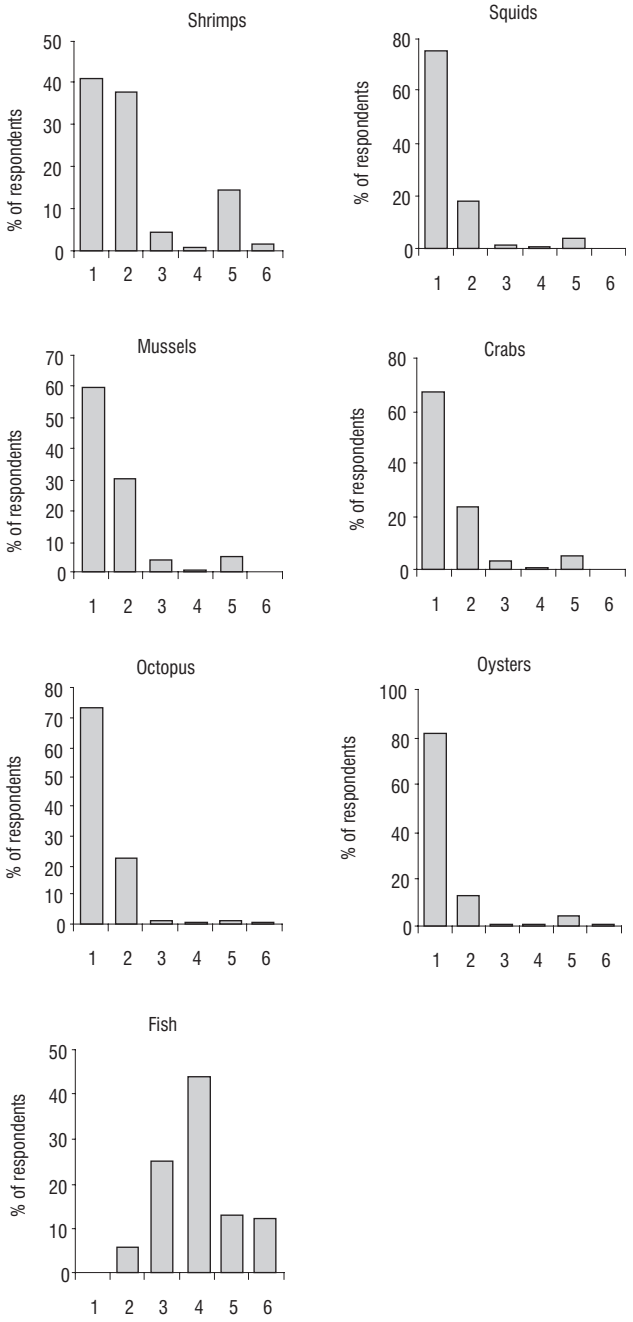

FIGURE 5. Fish and seafood consumption frequency rates (1 – I am not familiar; Frequency of consumption; 2 – rarely, 3 – once a month, 4 – few times a month, 5 – once a week, 6 – few times a week).

data were observed in a study of Babicz-Zielińska & Rybowska [2001].

Fish were consumed few times a month on average (45% of the respondents) in contrast to seafood which was consumed from time to time.

Less than 43% of the examined students (43% of women, 42% of men) consumed fish few times a month. Only 9% of women and 18% of men reported more frequent fish consumption – few times a week.

Students were more familiar with fish than with seafood. This fact is likely to result from high prices of seafood and its low availability on the market. It may be also affected by dietary habits acquired during childhood and Polish habitual diet which does not include seafood.

Seafood has been introduced to the Polish market only recently and because of high prices it is considered as luxurious. Most respondents were not familiar with the analysed products, which resulted in a low mean value of preference ratings. Both sex groups pointed to shrimps as the most frequently chosen seafood species.

New nutritional recommendations are to encourage people to consume vegetables and fruits, whole grain cereals, low fat products and fish (two-three times a week). It was emphasized that making healthy food choices is an integral part of the total risk management [De Backer *et al.*, 2003]. Fish consumption in Poland is still insufficient. In 1997, it amounted to 6.5 kg/per capita, which was the lowest in Europe. An analysis of Statistical Yearbook of the Republic of Poland [2004] shows that the consumption of sea fish, lake fish and frozen fish products tends to decline (5 kg/per capita in 2003). The most significant factor limiting fish consumption is high price, caused by the economic situation of the Polish fishery [Kołakowska & Kołakowski, 2001; Polak-Juszczak, 2001]. The findings concerning fish consumption frequency, obtained in the present study, show a similar tendency.

Preferred form of consumption

The analysis of the reported consumption of fish dishes demonstrates that the fried fish was consumed by the highest percentage of students (Figure 6). Strictly speaking 85% of women and 73% of men preferred fried fish and to a lesser extent smoked fish, fish fillets, fish salads, canned fish and fish pastes. The results are consistent with data published previously [Babicz-Zielińska & Rybowska, 2001].

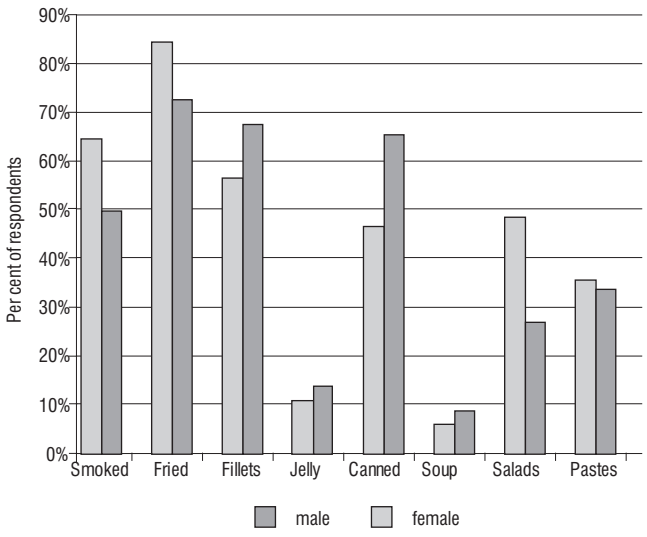

FIGURE 6. Declared consumption of fish dishes by male and female students.

CONCLUSIONS

1. Respondents of both sexes reported taste and freshness as the most significant factors of choice.
2. Women (opposite to men) appreciated health impact and nutritive values over the price.
3. The most preferred fish were salmon, mackerel, cod and tuna, while of all seafood the most preferred were shrimps.
4. Most students reported the consumption of fish few times per month.
5. Of all seafood products examined, the respondents were the most familiar with shrimps.
6. Products' familiarity with fish was significantly higher than with seafood.

The data obtained indicate that it is necessary to undertake actions aimed at increasing the consumption of fish and seafood by students.

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PREFERENCJE, CZYNNIKI WYBORU I CZĘSTOŚĆ SPOŻYCIA RYB I OWOCÓW MORZA WŚRÓD STUDENTÓW

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Ryby i owoce morza ze względu na wysoką wartość odżywczą i szczególne właściwości żywieniowe, powinny zajmować ważne miejsce w jadłospisie człowieka. Konsumpcja ryb i owoców morza na świecie systematycznie wzrasta, natomiast w Polsce jest wciąż niewystarczająca, a nawet wykazuje tendencję malejącą. Celem przeprowadzonych badań było poznanie preferencji w zakresie spożycia ryb i owoców morza wśród studentów Akademii Medycznej w Gdańsku. O wyborze produktu rybnego w większym stopniu decydowały czynniki sensoryczne aniżeli czynniki ekonomiczne. Kobiety, w przeciwieństwie do mężczyzn, w większym stopniu brały pod uwagę walory zdrowotne ryb i owoców morza. Większość mięczaków i skorupiaków była dla respondentów nieznana, co wpłynęło prawdopodobnie na ich niską średnią wartość preferencji (tab. 3, rys. 1). Najbardziej preferowanymi owocami morza były krewetki. Większość studentów spożywała ryby kilka razy w miesiącu. Najczęściej spożywano ryby smażone. Znajomość asortymentu ryb była zdecydowanie większa niż znajomość mięczaków i skorupiaków. Do ryb o wysokiej preferencji studenci zaliczyli: łososia, tuńczyka, szczupaka i makrelę (tab. 4, rys. 4). Konieczne jest podjęcie działań prowadzących do zwiększenia spożycia ryb i owoców morza przez studentów.