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Nutritional Habits of the Inhabitants of the Island of Vis

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A B S T R A C T

The island of Vis belongs to middle Dalmatian group of islands with caracteristics Mediterranean climate. The assumption was that the dominant diet of the inhabitants is also Mediterranean. Such diet is considered to be one of the best for the prevention of many complex and chronic diseases, as confirmed by numerous studies in different parts of the World. This study showed a shift in dietary habits in the direction of a more globalized diet. Such sudden shift may prove to be an important trigger for the development of complex diseases such as diabetes melitus type 2, cardiovascular diseases, gout, as well as certain types of cancer.

Key words: *nutrition, medterranean diet, island of Vis*

Introduction

Mediterranean diet is nowadays considered as one of the best in the prevention of some complex and chronic diseases. Already in the Ancient Greece and Rome it was considered to be successful in reducing overweight[1]. Although today there are many variants of the Mediterranean diet (Cretan, Sicilian, South Italian, Dalmatian, Lebanese, etc.), they are connected by some main links: high intake of unsaturated fatty acids (mostly from olive oil), sea fish, fruits and vegetables, high intake of complex carbohydrates, moderate intake of red wine (rich in antioxidants), along with the low intake of saturated fatty acids and red meat. Such balance of food stuffs is expected concerning the climate that enables long vegetation seasons and well balanced nourishment throughout the whole year[2,3].

Numerous international studies have confirmed the protective effect of the mentioned nutrition and its various advantages in comparison with continental diet. This is mostly valid for the prevention of some complex diseases like cardiovascular diseases, type II diabetes and colorectal carcinoma[4,5]. Some of the preventive, positive effects of the Mediterranean nutrition are the impact upon the maintenance of the lipid level within normal limits, the prevention of insulin resistance and metabolic syndrome, the increase in the antioxidant capacity of the organism and the decrease in mortality from cardiovascular diseases and carcinoma[6,7]. The protectiveness of such diet lies in its richness of vitamins and phytochemicals that are strong antioxidants: phenols, flavonoids, isoflavonoids, phytosterols and plant acids[8]. We can cite the results of some studies showing that the respondents applying Mediterranean diet have markedly higher serum concentration levels of beta carotene, phenols, C vitamin, alpha tocopherol and HDL cholesterol[9]. Furthermore, the ratio of the intake of unsaturated (vegetable oils) and saturated fatty acids (animal origin acids) is more favorable. This is supported by some studies stating that the 6 percent substitution of energy intake of saturated or trans-fatty acids with unsaturated fatty acids can potentially reduce cardiovascular diseases from 6 to 8%[10]. Mediterranean diet is recommended by WHO (World Health Organization) and is gaining significance, specially in view of the WHO report from 2004, which presents data on 56 million of people with various diseases caused by nutrition and on further 54 million with diseases caused by indirect impact of nourishment. Four million people die annually from cardiovascular diseases. To that result mostly contribute high blood pressure, high serum cholesterol, obesity and too small intake of fruit and vegetables[11]. Some studies have found that the increased intake of fruit and vegetables is connected with the fall in the incidence of cardiovascular diseases[12–16]. In the 50ies, Keys attributed the low incidence of cardiovascular diseases on Crete with the low intake of energy, red

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meat and milk products and with the high intake of fruit, vegetables and complex carbohydrates. This was also shown on the example of the poor Albanian people, where only 41 out of 100000 men were afflicted by this disease[11,17]. The analysis of the impact upon lung carcinoma has shown the 21 percent reduction in women who eat a lot of fruit and vegetables in comparison to those who take them in small quantities (0.79, 95% CI, 0.59 to 1.06). However, statistically significant difference has not been found in men[18].

Besides vitamins, great importance is currently attributed to bioactive components containing phytochemicals. It is believed that there are more than 8000 phenolic structures varying from simple to very structured molecules. Flavonoids are the most represented in vegetable food[19], the most frequent being flavones, flavonols and glycosides[20].

An important nutritive element in Mediterranean diet is red wine, which contains more than 200 phenolic components[21]. Here should be specially mentioned flavonols, resveratrol, monomeric catechins and polymeric anthocyanidins[22]. Consequently, red wine is considered to be a potent antioxidant that protects the DNA molecules from oxidative stress[23], inhibits the LDL cholesterol oxidation[24,25], substantially increases the antioxidative capacity of plasma ($p<0.03$)[26] and the concentrations of HDL cholesterol, Apo A1, TGFbeta 1 and r-PA[27]. Some of current investigations examine the possible effect of guercetin, the most represented flavonoid in vegetable food, on the carcinoma prevention. It is believed that this phytochemical could participate in blocking its progression[28]. Olive oil is also one of highly significant victuals of this diet. It is associated with strong antioxidative activities and through that with the prevention of many complex diseases[29]. Olive oil (unsaturated fatty acids) is typical for Mediterranean diet and is very frequently used in many Mediterranean countries like Greece, Italy, Spain, France, Albania, etc. The Greek paradox is one of the most important proofs of the impact of this diet upon the prevention of some complex diseases. To it pointed investigations performed in the 60ies. According to them, the observed intake of fats was higher than the recommended one, but the nutrition of Greek people was despite that associated with good health and longevity. The inhabitants of Crete consumed 40% of fats, mostly unsaturated oleic fatty acids, while the lowest was the intake of saturated fatty acids. The incidence of cardiac diseases was 90% lower than in the USA, the incidence of breast cancer 4 times lower than in Japan, and lifespan of the Greek women was the longest in the world[30].

Subjects and Methods

The investigation is based on scientifically accepted research methods of anthropometric isolates of the Eastern Adriatic[31–33]. The recruitment of examinees and the applied methods were conducted according to the protocol of the Institute for Anthropology, Zagreb, as well as according to the propositions of the International Biological Program[34].

The Island of Vis belongs to the group of Middle Dalmatian islands, with the Mediterranean climate and with presupposed Mediterranean diet of its inhabitants. On the island are two towns, Vis and Komiža, and several villages that constitute the group of Vis Villages, lying in the interior of the island.

The research was performed on the sample of 307 examinees (Komiža, Vis Town and Vis Villages), comprising 135 men and 172 women, aged between 17 and 85 years. The sample was chosen from electoral rolls, while the consent of each respondent was obtained before the onset of investigation. The site of the settlements of the island of Vis (Komiža, Vis Town and Vis Villages) from where the sample of examinees was taken is shown in Figure 1.

Komiža is represented within the sample with 137 examinees (44.6%), Vis Town with 75 (24.4%) and Vis Villages with 95 (30.9%). The ratio of men and women is almost equal in all groups, amounting to approximately 44% to 56%. The results of the examinees' distribution in groups are shown in Figure 1.

The total mean value of life age of the examinees on the whole island is 57 years (Komiža 55.7 yrs, Vis Town 58 yrs, Vis Villages 58 yrs). Samples, i.e. the particular

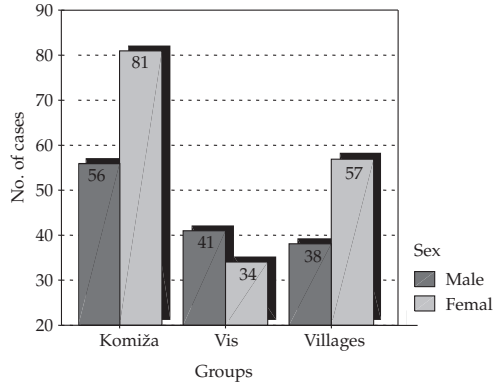

Fig 1. Group distribution of examinees.

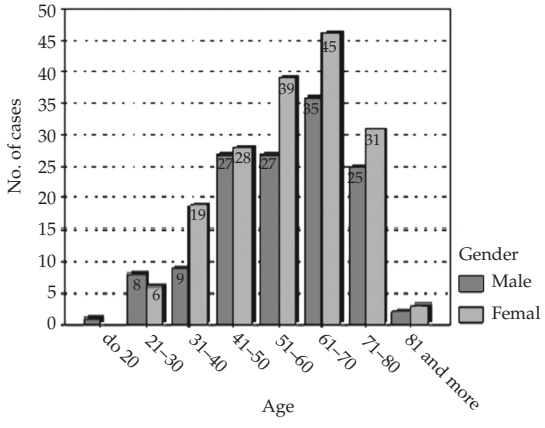

Fig 2. The age-associated distribution of examinees (N=307).

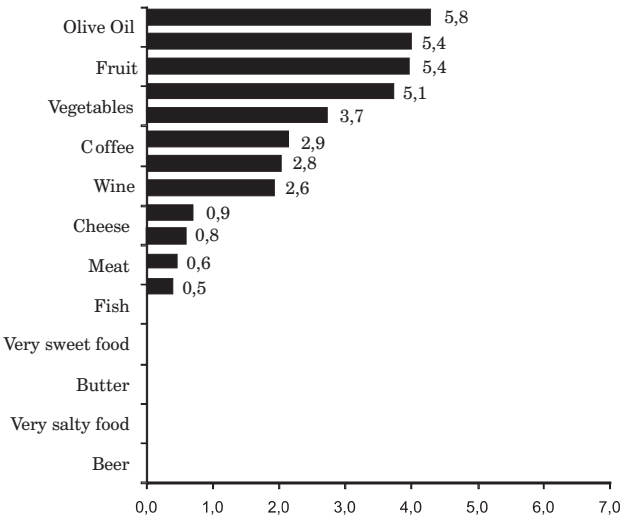

Fig 3. The average number of days in which examinees consume particular victuals during one week.

groups of examinees, do not statistically differ regarding age. The mean age of men is 56.5 years and of women 57.3 years, also not presenting statistically significant difference. Mean values of age associated with groups and gender are graphically presented in Figure 3. As seen in Figure 3, the number of examinees does not significantly differ in age cohorts either.

The complex anthropogenetic characteristic analyzed in this investigation were selected according to the guidelines of the International Biological Program[34], which has been worldwide accepted for the investigations with similar aims.

Measures were performed with the standard techniques of the Institute for Anthropology, following the guidelines of the »Practicum of Biological Anthropology«, including »Anthropometry«[35], »Physiological Methods-1«[36] and »Physiological methods in anthropological investigations«[37]. Biochemical blood tests were done at the Polyclinic for Medical Laboratory Diagnostics »Laborcentar«, Bukovčev trg 4, 10000 Zagreb.

Nutritional habits of the inhabitants were obtained from the nutritional habits index, which is contained in the standard questionnaire for fieldwork. The food frequency questionnaire is designed to show how many times a week people eat certain foods.

Results

By applying Pearson's χ^2-test, we found no statistically significant relation of the intake of fish and the groups (χ^2=1.422; df=2, p=0.491) (Table 1).

The average number of days in which the examinees eat fish during one week is 2.60. Its distribution within groups is: 2.81 in Komiža, 2.35 in Vis Town and 2.51 in Vis Villages.

TABLE 1
THE CONSUMMATION OF FISH REGARDING GROUPS

		Group					
		Komiža		Vis Town		Vis Villages	
		n	(%)	n	(%)	n	(%)
Fish	no	2	(1.5)	3	(4.0)	2	(2.1)
	yes	135	(98.5)	72	(96.0)	93	(97.9)
Total		137	(100.0)	75	(100.0)	95	(100.0)

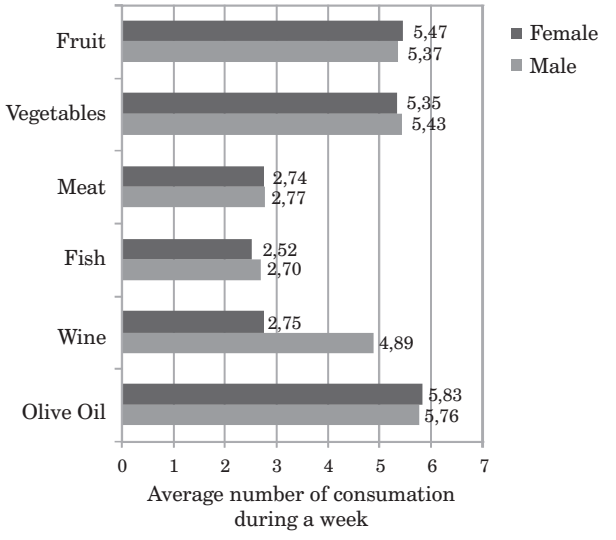

Fig 4. The frequency of intake associated with gender.

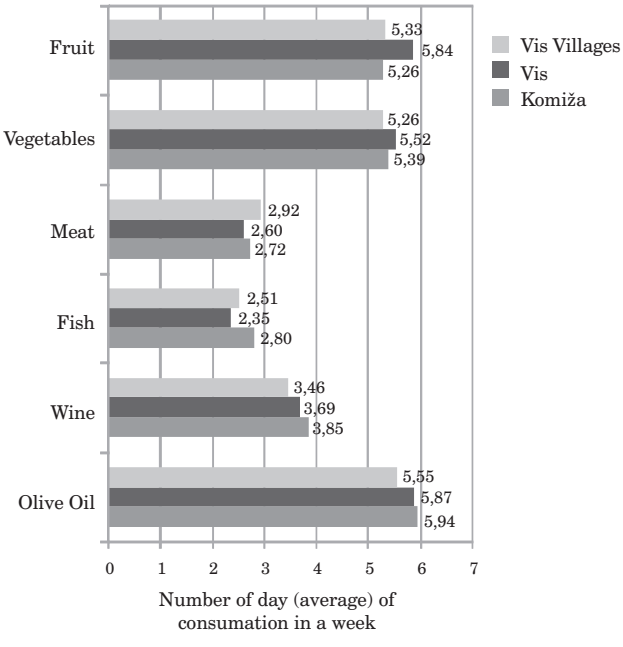

Fig 5. The frequency of intake in groups.

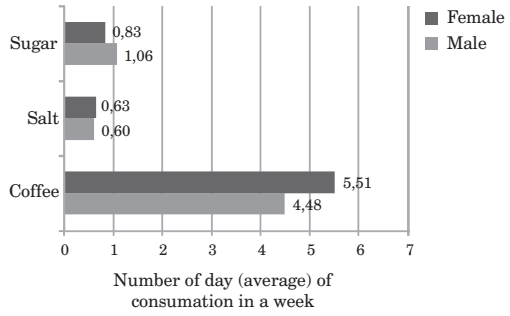

Fig 6. The frequency of intake associated with gender.

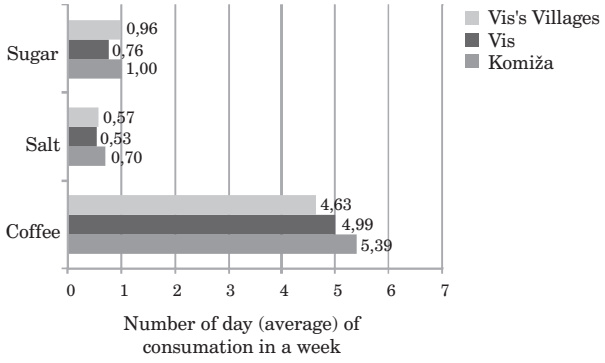

Fig 7. The frequency of intake within groups.

After checking the normality of the distribution by the Kolmogorov-Smirnoff test, which had showed that this variable was not distributed on the normal (Gauss) curve ($p<0.001$), we performed the non-parametric Kruskal Wallis test, which revealed no statistically significant difference in the average number of days when the examinees consume fish during one week ($p=0.071$). (But, if we raise the acceptable risk level of conclusion to 10%, we can conclude that there is statistically significant difference between Komiža and Vis Town: the inhabitants of Komiža eat fish more frequently than the citizens of Vis (the post-hoc Mann-Whitney U-test, $p=0.048$) (Table 2).

In Pearson's χ^2-test we did not find statistically significant relation between the intake of meat and groups ($\chi^2=1.596$; df=2, p=450) (Table 3).

The average number of days in which the examinees eat meat within one week is 2.75, while in groups it amounts to: 2.72 in Komiža, 2.60 in Vis Town and 2.92 in Vis Villages.

TABLE 2
THE AVERAGE NUMBER OF DAYS IN WHICH THE EXAMINEES CONSUME FISH DURING ONE WEEK WITHIN GROUPS

Group	$\overline{X}$	N	SD
Komiža	2.80	137	1.5380
Vis Town	2.35	75	1.2892
Vis Villages	2.51	95	1.5635
Total	2.60	307	1.4970

TABLE 3
INTAKE OF MEAT ASSOCIATED WITH GROUPS

		Group					
		Komiža		Vis Town		Vis Villages	
		n	(%)	N	(%)	n	(%)
Meat	no	8	(5.8)	2	(2.7)	3	(3.2)
	yes	129	(94.2)	73	(97.3)	92	(96.8)
Total		137	(100.0)	75	(100.0)	95	(100.0)

Following the check of the normality of distribution by the Kolmogorov-Smirnoff test, which had showed that this variable was not distributed on the normal (Gauss) curve ($p<0.001$), we performed the non-parametric Kruskal Wallis test that did not present statistically significant difference in the average number of days in which the examinees consume meat during one week ($p=0.442$) (Table 4).

In Pearson's χ^2-test we did not find statistically significant relation between the intake of vegetables and groups ($\chi^2=1.160$; df=2, p=0.560) (Table 5).

The average number of days in which the examinees eat vegetables during one week is 5.38, while in groups it is as follows: 5.39 in Komiža, 5.52 in Vis Town and 5.26 in Vis Villages.

After checking the normality of distribution by the Kolmogorov-Smirnoff test, which had showed that this variable was not distributed on the normal (Gauss) curve ($p<0.001$), we performed the non-parametric Kruskal Wallis test, which did not yield statistically significant difference in the average number of days in which the examinees consume vegetables during one week ($p=0.716$) (Table 6).

TABLE 4
THE AVERAGE NUMBER OF DAYS IN WHICH THE EXAMINEES CONSUME MEAT DURING ONE WEEK WITHIN GROUPS

Group	$\overline{X}$	N	SD
Komiža	2.72	137	1.4639
Vis Town	2.60	75	1.5334
Vis Villages	2.92	95	1.7300
Total	2.75	307	1.5668

TABLE 5
THE INTAKE OF VEGETABLES IN GROUPS

		Group					
		Komiža		Vis Town		Vis Villages	
		n	(%)	n	(%)	n	(%)
Vegetables	no	5	(3.6)	1	(1.3)	2	(2.1)
	yes	132	(96.4)	74	(98.7)	93	(97.9)
Total		137	(100.0)	75	(100.0)	95	(100.0)

TABLE 6
THE AVERAGE NUMBER OF DAYS IN WHICH THE EXAMINEES CONSUME VEGETABLES DURING ONE WEEK WITHIN GROUPS

Group	$\overline{X}$	N	SD
Komiža	5.39	137	2.1535
Vis Town	5.52	75	2.0557
Vis Villages	5.26	95	2.1299
Total	5.38	307	2.1180

TABLE 7
THE INTAKE OF FRUIT REGARDING GROUPS

		Group					
		Komiža		Vis Town		Vis Villages	
		n	(%)	n	(%)	n	(%)
Fruit	no	10	(7.3)	2	(2.7)	5	(5.3)
	yes	127	(92.7)	73	(97.3)	90	(94.7)
Total		137	(100.0)	75	(100.0)	95	(100.0)

By Pearson's χ^2-test we did not find statistically significant relation between the intake of fruit and groups (χ^2=2.008; df=2, p=0.366) (Table 7).

The average number of days in which the examinees eat fruit during one week is 5.42, while in groups it is: 5.26 in Komiža, 5.84 in Vis Town and 5.33 in Vis Villages.

After estimating the normality of distribution by the Kolmogorov-Smirnoff test, which has showed that this variable is not distributed on the normal (Gauss) curve (p<0.001), we performed the non-parametric Kruskal Wallis test that did not show statistically significant difference in the average number of days in which the examinees consume fruit during one week (p=0.352) (Table 8).

In Pearson's χ^2-test test we did not find statistically significant relation between the intake of olive oil and groups (χ^2=1.309; df=2, p=0.520) (Table 9).

The average number of days in which the examinees consume olive oil during one week is 5.80. The distribution in groups is the following: 5.94 in Komiža, 5.87 in Vis Town and 5.55 in Vis Villages.

After the check of normal distribution by the Kolmogorov-Smirnoff test, which had showed that this variable was not distributed on the normal (Gauss) curve (p<0.001), we performed the non-parametric Kruskal Wallis test. No statistically significant difference was found in the average number of days in which the examinees consume olive oil during one week (p=0.352) (Table 10).

Pearson's χ^2-test did not present statistically significant relation between the intake of very salted food and groups (χ^2=0.235; df=2, p=0.889) (Table 11).

TABLE 8
THE AVERAGE NUMBER OF DAYS IN WHICH THE EXAMINEES CONSUME FRUIT DURING ONE WEEK WITHIN GROUPS

Group	Arithmetic mean	N	SD
Komiža	5.26	137	2.444
Vis Town	5.84	75	1.9731
Vis Villages	5.33	95	2.5199
Total	5.42	307	2.3674

TABLE 9
THE INTAKE OF OLIVE OIL REGARDING GROUPS

		Group					
		Komiža		Vis Town		Vis Villages	
		n	(%)	n	(%)	n	(%)
Olive oil	no	6	(4.4)	3	(4.0)	7	(7.4)
	yes	131	(95.6)	72	(96.0)	88	(92.6)
Total	137		(100.0)	75	(100.0)	95	(100.0)

TABLE 10
THE AVERAGE NUMBER OF DAYS IN WHICH THE EXAMINEES CONSUME OLIVE OIL DURING ONE WEEK IN GROUPS

Group	$\overline{X}$	N	SD
Komiža	5.94	137	2.0961
Vis Town	5.87	75	2.0357
Vis Villages	5.55	95	2.4310
Total	5.80	307	2.1901

Discussion

According to the analysis of nutritional habits, fish is consumed 2–3 times a week, what corresponds to the average for the Croatian coast. Although it is very difficult to calculate the intake of fish in grams per day, we could suppose the consummation of approximately 70 g per person per day, what is much more than the Croatian average that amounts to approx. 20 g per person per day. Such average intake of sea fish is similar to that in Greece, Italy, Sweden, Denmark, France, Israel, but still much lower in comparison with Spain, Malta (over 100 g per person per day), Portugal (above 150 g/person/day) or Iceland (250 g/person/day). The intake of other kinds of

TABLE 11
THE INTAKE OF VERY SALTED FOOD REGARDING GROUPS

		Group					
		Komiža		Vis Town		Vis Villages	
		n	(%)	n	(%)	n	(%)
Very salted food	no	99	(72.3)	54	(72.0)	66	(69.5)
	yes	38	(27.7)	21	(28.0)	29	(30.5)
Total		137	(100.0)	75	(100.0)	95	(100.0)

meat was also 2–3 times a week, what does not much differ from the Croatian average, in which leads the County of Požega-Slavonia with 28.9% of examinees who consume meat every day. The recorded intake of red meat certainly points to the changes of nutritional habits, having in mind that Vis is traditionally the fishing island. Daily consummation of fruit and vegetables per person is over 60% for fruit and 55% for vegetables respectively, what is an average in regard to the rest of Croatia. The intake of vegetables is behind the County of Istria and the County of Međimurje (the intake of vegetables over 70%), but within range for the county it belongs to (Split-Dalmatia). Although we cannot establish the exact intake of fruit and vegetables in grams per week, it is estimated to be about 300 g per day per person, what is within the European average. Thus, for example, Great Britain, Austria and Ireland with 200 g/day per person are at the bottom of the scale, while Spain with approx. 600 g/day per person, Greece and Finland with approx. 550 g/day per person are at the top of the same scale. As the vegetation season lasts almost the whole year, the availability of fruit and vegetables is easy, thus we can conclude that the daily intake per person could be higher[38,39].

The intake of fats is based on unsaturated fatty acids, precisely olive oil, that corresponds to previously established consummation for the coastal parts of Croatia[40]. The small intake of saturated fatty acids, mostly originating from milk and milk products, is also expected for this climate and Mediterranean diet. Comparing the representation of the unsaturated fatty acids intake of approx. 80% with the rest of Croatia, we conclude that on Vis the intake is high and in accordance with that in the Dubrovnik-Neretva, Split-Dalmatia, Šibenik-Knin, Zadar and Istria counties, where the consummation of vegetable oils of 80% has been recorded as well. This data differ from the Krapina-Zagorje, Vukovar-Srijem and Koprivnica-Križevci counties, where the recorded intakes of saturated fatty acids (fats of animal origin) were approx 45% *per* person *per* day Such vast differences in nutritional habits within the Croatian population are an ideal model for investigating the impacts of nutrition as the external environmental factor upon the incidence of some complex characteristics and diseases[38,41,42]. The intake of alcohol beverages was also expected because of the established Mediterranean diet. The intake of beer is markedly low, while the consummation of wine among men follows the trends of other Mediterranean countries. Particularly the consummation of red wine could be of protective significance for the islanders[43,44].

In these investigations were not found some foods which we could consider as more significantly bound with increased body mass. The connection of fruit with increased BMI could be explained by the fact that obese people eat more fruit due to the prescribed diet. In the same way could be commented the relation of nutrition and waist circumference, where the weak relation is established with salt, cheese, meat and coffee. Statistically more frequent consummation of olive oil in relation of cardiac diseases can be again explained by the prescribed diet that follows the results of many international investigations stating that olive oil containing unsaturated fatty acids is the protective factor in the occurrence of cardiac diseases. Somewhat more important finding was the confirmed relation of olive oil consummation with the lower level of triglycerides, what confirms the preventive properties of this oil that replaces the intake of saturated fatty acids and cholesterol, and also has an extreme quantity of phytochemicals, today described as very protective for many complex diseases. Negative correlations of hypertension with salt, coffee and beer were again possibly connected with the prescribed nutritional habits.

It should be stressed that in the cited investigations the analysis of nutritional habits was done as well, what gave us only a partial answer about the diet of the inhabitants of Vis. Consequently, we could conclude that the nutrition on the island, although it has the contours of the Mediterranean one, unfortunately changes towards continental, that is the global one. This can absolutely be imputed to the current good island – mainland connection, and along that with high availability of all food stuffs in supermarkets.

Thus, these results on the nutrition should in the future be completed and the more accurate insight into diet should be obtained. The most precise nutritional research consists of the 24-hour follow-up of diet, what requires long-lasting investigations in order to encompass all seasons. However, more acceptable standardized questionnaires on nutrition (FFQ – food frequency questionnaire) are much more complete and adjusted, and should be by all means used in further investigations on our islands.

Conclusion

Although basin Meditteranean diet is clearly dominant, through the analysis of nutritional habits questionnaires, the changes in nutritional habits of the inhabitants have been found in the direction of globalization of nutrition, what includes considerably higher intake of red meat, saturated fatty acids, milk, dairies and monosaccharids.

Such relatively abrupt change of nutritional habits could be a strong initiator for the expression of genes responsible for the occurrence of complex diseases, what could, in regard to evolutional forces, become even more expressed in this isolated population.

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PREHRAMBENE NAVIKE STANOVNIKA OTOKA VISA

SAŽETAK

Otok Vis pripada srednjodalmatinskom otočnom arhipelagu za koji je karakteristična mediteranska klima. Obzirom na to možemo pretpostaviti kako je prehrana populacije na otoku bazično mediteranska. Danas se mediteranska prehrana smatra kao jedna od najboljih u prevenciji mnogih kompleksnih i kroničnih bolesti. Brojne svjetske studije utvrdile su mnoge prednosti u odnosu na kontinentalnu prehranu. Studijom su utvrđene promjene prehrambenih navika koje vode u smjeru globalne prehrane. Ovakva nagla promjena prehrambenih navika mogla bi biti snažan pokretač za nastajanje mnogih kompleksnih bolesti kao što su npr. dijabetes melitus tipa 2, kardiovaskularne bolesti, giht i neki karcinomi.