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Dietary Patterns in Adults from an Adriatic Island of Croatia and Their Associations with Metabolic Syndrome and Its Components

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A B S T R A C T

Adriatic islanders have a high prevalence of metabolic syndrome (MetS) although they have traditionally practiced an active lifestyle and adhered to a Mediterranean diet. We performed a cross-sectional study to identify dietary patterns in a sample of 1442 adults from the island of Hvar, and determined whether MetS and its components: waist-circumference, serum triglycerides, fasting plasma glucose, HDL-cholesterol, and blood pressure, were related to an altered pattern of the traditional Mediterranean diet. Dietary intake was assessed by a food frequency questionnaire. MetS was defined using the International Diabetes Federation criteria. Our study showed that dietary patterns in this population have diversified from the traditional diet. Principal component analysis identified three major patterns. The meat, alcohol, and fish pattern (MAFp), sweets, grains, and fats pattern (SGFp), and an olive-oil, vegetables, and fruits pattern (OVFp) explained 30.6% of total dietary variance. The MAFp associated significantly with MetS (p=0.027) and high plasma glucose (p=0.006).

***Key words**: dietary patterns, Adriatic population, principal component analysis, metabolic syndrome, Mediterranean diet*

Introduction

Obesity has reached epidemic proportions worldwide and metabolic disturbances associated with obesity are on the rise. This trend is more evident in developing societies that are experiencing recent economic growth and modernization[1]. The interactive effects of genetics, lifestyle and diet are influential in development of obesity and related disorders. Among dietary patterns, numerous studies have suggested that a traditional Mediterranean diet[2] has considerable beneficial health effects including reduced rates of obesity and metabolic syndrome (MetS)[3–5].

This study is part of a larger genetic epidemiology study of MetS and related traits in an isolated island population from the eastern Adriatic coast of Croatia; inhabited by a unique group of populations who emigrated from the Balkan peninsula at two time points. The first influx occurred during the 6th and 8th century AD and the second between the 15th and 18th century during the Turkish wars[6]. The present-day Adriatic islanders share a common population history, demographics, environmental factors, and lifestyle patterns. Prior studies show a high prevalence of obesity, hypertension, and MetS among the islanders[7–9]. This study was performed in the middle Dalmatian island of Hvar, where the prevalence of MetS is as high as 25.0% based on the Adult Treatment Panel III report and 38.5% based on International Diabetes Federation criteria[10]. This is intriguing given that the Adriatic islanders have traditionally practiced

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an active lifestyle, including fishing and farming in a rural coastal setting, and adherence to a traditional Mediterranean diet[6,11]. We examined whether the high prevalence of MetS among Adriatic islanders is due to an alteration in their traditional Mediterranean diet. Specifically, we investigated dietary patterns of adults from the island of Hvar and examined whether the identified patterns associate with MetS and its components, namely, high waist circumference, high triglycerides, high fasting plasma glucose, low HDL-cholesterol, and elevated blood pressure. We hypothesize that the traditional Mediterranean diet is the predominant dietary pattern in this population, and that this pattern is inversely related to metabolic risk factors among the adults.

Materials and Methods

Study population

Study participants were part of two population-based cross-sectional field surveys conducted in eight different villages in May 2007 and May 2008 on the island of Hvar on the eastern Adriatic coast of Croatia[10]. The combined data included 1442 adults between 20–94 years of age. One hundred and ten adults were excluded due to missing dietary information (N=11), implausible total calories (≥7500 kcal per day) and food servings (N=58), and missing metabolic measurements (N=41). Participation was voluntary and recruitment was done through general advertisement, public notices and announcements at community meetings. This study was approved by the Ethics Committee of the Institute for Anthropological Research in Zagreb, Croatia and the Institutional Review Board of the University of Cincinnati.

Dietary assessment

Dietary intake was assessed by an interviewer-administered, quantitative food frequency questionnaire (FFQ) supplemented by photographs of each food item on the food list as small, medium, and large portion-size to assist in portion size estimation[12]. This questionnaire was a modification of FFQ that had been used in several nutritional surveys among other Croatian island populations[13,14] and had been tested for reproducibility and validity[15]. The frequency of consumption for 74 food items and beverages common to the region was determined based on the reported weekly frequency of intake (5–7 times, 3–4 times, and 1–2 times per week, or never). To identify dietary patterns, the 74 food items were collapsed into 22 food groups (Table 1) based on food groupings common to the Croatian food system[16], and that were similar in macronutrient content[17]. Portion sizes obtained were converted to gram weights and were used to derive energy and nutrient values using USDA National Nutrient Database for Standard Reference, Release 24, 2011. The Croatian food composition tables were not used in this study because they had not been updated to the current dietary practices of the region in over a decade[18].

Defining metabolic syndrome

MetS was defined according to the Joint Scientific Statement of the International Diabetes Federation[19]; accordingly, in addition to abdominal obesity, which was defined based on the European waist circumference (WC) cut-off of ≥94 cm in men and ≥80 cm in women, participants had to have at least 2 of the following risk factors: triglyceride (TG) levels of ≥1.7 mmol/L or treatment for hypertriglyceridemia; HDL-cholesterol (HDL) levels of <1.0 mmol/L in males and <1.3 mmol/L in females or treatment for low HDL levels; fasting plasma glucose (FPG) of ≥5.5 mmol/L or treatment for Type 2 diabetes mellitus (T2DM); and blood pressure of ≥130 mm Hg systolic (SBP) and ≥85 mm Hg diastolic (DBP) or treatment for hypertension.

Anthropometric measurements of height, weight and WC were obtained using standard techniques[10]. BMI was calculated by dividing weight in kilograms by height in meters squared. Arterial blood pressure was measured three times by a mercury sphygmomanometer after the participants had rested for 5 minutes in a sitting position; the second and the third measurements were used to calculate mean SBP and DBP. Blood samples were drawn by venipuncture for serum TG, HDL-cholesterol, and FPG after 12 hours of fasting; serum was separated and kept frozen until shipped for biochemical tests performed at the clinically accredited biochemical laboratory, Labor Centar, in Zagreb. Methods used for biochemical assessments included the enzymatic hexokinase assay CHOD-PAP for FPG, the homogeneous enzyme inhibition assay for HDL-cholesterol, and the photometric color test GPO-PAP for measuring TG.

Measurement of covariates

The information on socio-demographics, material lifestyle and other covariates was collected during the interviews. Educational status was determined based on the highest level of education attained and was categorized into elementary, high-school, and college. The socioeconomic status was categorized into low, medium and high group based on socioeconomic index calculated by the presence or absence of material lifestyle variables. Smoking status was grouped into non-smokers, current, and ex-smokers. Physical activity was determined by the type, duration, and frequency of activity performed per day in the past week and was categorized into sitting, light, moderate, and heavy activity based on the International Physical Activity Questionnaire that had been validated for the Croatian population[20].

Statistical analysis

The Principal component factor analysis was conducted to identify dietary patterns using PROC FACTOR command in SAS (version 9.2, 2011, SAS Institute Inc., Cary, North Carolina). The gram weight measures based on intake of 22 food group variables were not normally distributed; therefore a square root transformation of this measure was used. Based on eigenvalues >1, inspection of the Scree plot, and interpretability of factors,

TABLE 1
STANDARDIZED SCORING COEFFICIENTS DERIVED FROM FACTOR ANALYSIS

Food/ Food groups	Food items included*	Factor 1	Factor 2	Factor 3
		Meat, alcohol and fish pattern	Sweets, grains and fats pattern	Olive oil, vegetables and fruits pattern
		(MAFp)	(SGFp)	(OVFp)
Dairy foods	Whole milk, goat milk, yogurt, cream, cottage cheese, mozzarella cheese, goat cheese		0.26	
Fresh meat	Pork, beef, veal, lamb	0.24		
Processed meat	Bacon, sausage, salami			–0.24
Poultry	Chicken, turkey			
Fish and seafood	Haddock, salmon, sardines, shrimp, squid, octopus	0.21		
Vegetables	Leafy, roots, cruciferous, onion, garlic, tomato, egg plant, squash, mushroom			0.25
Potatoes	Potatoes			
Fruits	fresh citrus, fresh non-citrus, and dried fruits			0.24
Nuts	Mixed nuts			
Bread	Pita bread and mixed grain bread			
Cereals and grains	Muesli, rice, and pasta		0.21	
Legumes	Beans and peas			
Eggs	Eggs			-0.24
Baked goods	Cake, pastry, and rolls		0.27	
Sweets	Sugar cookie, compotes, chocolate, candy, and jam and jelly		0.30	
Juices	Fruit juice and orange drink		0.22	
Beverages	Coffee and tea			
Alcohol	Beer, red wine, white wine, and spirit	0.22		
Olive oil	Olive oil			0.41
Plant oil	Canola and vegetable oil			–0.33
Solid fats	Margarine and butter		0.20	
Spices	Pepper, allspice, paprika, rosemary, bay leaf, parsley, sage, caper, oregano, menta and basil			

Absolute values <0.20 were not considered and were excluded from the table for simplicity
* Based on food groups common to the Croatian food system and macronutrient content

three factors were retained, orthogonally transformed and rotated by varimax to obtain uncorrelated factors (dietary patterns). By summing the food group intake weighted by their factor loadings food scores were computed; each individual thus received a factor score for each of the retained factors. Multivariable logistic regression examined the association between factor scores and the presence/absence of MetS and each of the metabolic risk factors: high/low WC, high/low TG, high/low FPG, low/high HDL-cholesterol, and high/low SBP and DBP. Regression models were built adjusting age, gender, BMI, physical activity, education, socioeconomic status, smoking status, and total calories in stepwise manner, and model with the lowest Akaike information criterion (AIC) value, representing a good model fit, was selected as a final model. Scores of each dietary pattern were categorized into tertiles, and general characteristics and nutrient intake of the population within each pattern was tested by chi-square statistics and ANOVA. Participants' age was categorized into tertile groups and relationship between age and scores of each dietary pattern was examined by one-way ANOVA with post-hoc Tukey's HSD test. The level of significance for all statistical tests was two-sided with $p<0.05$ and all statistical analyses were performed using SAS.

Results

Factor analysis identified three factors, explaining 30.6% of the total variance in the diet, as primary dietary patterns of adults in the Hvar (Table 1). Factors were labeled based on foods with the highest loadings in that specific dietary pattern. Factor 1 explained 15.6% of variation in the diet and was characterized by high intakes of

TABLE 2
CHARACTERISTICS OF STUDY POPULATION ACCORDING TO TERTILE (T) CATEGORIES OF DIETARY PATTERN SCORES

	N	Meat, alcohol and fish pattern (MAFp)				Sweets, grains and fats pattern (SGFp)				Olive oil, vegetables and fruits (OVFp)			
		T1 (N=444)	T2 (N=444)	T3 (N=444)		T1 (N=444)	T2 (N=444)	T3 (N=444)		T1 (N=444)	T2 (N=444)	T3 (N=444)	
General Characteristics													
Age (years) [a]		55.4±16.4	57.3±15.4	54.6±14.6	*	57.4±14.4	57.5±14.8	52.5±16.8	***	53.6±16.3	57.3±15.2	56.4±14.8	**
BMI (kg/m^2) [a]		27.1±3.9	27.4±4.3	27.6±4.2		27.6±3.6	27.6±4.2	26.9±4.5	*	27.2±3.9	27.6±4.3	27.4±4.2	
Gender					***				***				***
Male	564	69	159	336		255	163	146		267	154	143	
Female	768	375	285	108		189	281	298		177	290	301	
Education					**				**				**
Elementary	417	143	149	125		153	152	112		124	158	135	
High school	696	215	219	262		225	228	243		255	223	218	
College	219	86	76	57		66	64	89		65	63	91	
Smoking					**								*
Yes	309	104	95	110		102	111	96		121	106	82	
No	779	281	265	233		254	262	263		235	260	284	
Ex-smoker	244	59	84	101		88	71	85		88	78	78	
SES					**								
Low	451	178	148	125		162	153	136		155	159	137	
Medium	428	125	153	150		148	138	142		146	138	144	
High	453	141	143	169		134	153	166		143	147	163	
Physical activity					**								
Sitting	241	91	86	64		76	73	92		81	87	73	
Light	817	302	278	237		283	266	268		258	279	280	
Moderate	1320	409	451	460		431	452	437		441	446	433	
Heavy	286	86	73	127		98	97	91		108	76	102	
Dietary intake [a]													
Total calories, kcal/d		2141±657.9	2468±721.4	3294±1093.1	***	2252±826.9	2561±902.0	3090±999.0	***	2445±872.8	2493±873.7	2965±1079.1	***
Carbs, % total kcal		43.8±7.3	40.8±7.1	38.2±8.2	***	39.6±7.8	40.5±7.6	42.7±8.0	***	39.1±7.1	41.1±7.2	42.7±8.9	***
Fat, % total kcal		36.8±6.9	38.0±6.1	39.7±6.5	***	38.9±6.8	38.5±6.5	37.1±6.4	***	40.0±6.2	37.9±6.4	36.5±6.8	***
SFA, % total kcal		12.6±3.1	12.8±3.1	12.7±2.9		12.7±3.2	12.7±3.0	12.7±3.0		13.9±3.1	12.7±2.9	11.5±2.7	***
MUFA, % total kcal		17.4±4.7	17.9±4.0	18.8±4.3	***	18.7±4.8	18.4±4.4	17.1±3.8	***	18.0±4.2	17.9±4.4	18.3±4.6	
PUFA, % total kcal		6.8±1.8	7.3±1.9	8.1±2.0	***	7.5±2.1	7.4±2.1	7.3±1.8		8.2±2.1	7.3±1.9	6.7±1.7	***

BMI body mass index: SES socioeconomic status; Carbs carbohydrates; SFA saturated fatty acids; MUFA mono-unsaturated fatty acids; PUFA poly-unsaturated fatty acids
[a] Values are X±SD and were examined using ANOVA; all other values are frequency counts and were examined using chi-square test
* significant at p * <0.05; ** ≤0.001; *** ≤0.0001

TABLE 3
RELATIONSHIP BETWEEN TERTILE CATEGORIES OF AGE AND DIETARY PATTERN SCORES

Age-groups = T1 (>20.3 to ≤50.0 years); T2 (>50.0 to ≤63.7 years); T3 (>63.7 to ≤94.3 years)				
	(N=444)	(N=444)	(N=444)	
Age-groups compared	Difference in MAFp scores	LCL	UCL	p
T2 – T1	0.4308	–0.3678	1.2294	0.415
T3 – T1	–0.7492	–1.5478	0.0495	0.071
T3 – T2	–1.1800	–1.9786	–0.3813	0.002
	Difference in SGFp scores	LCL	UCL	p
T2 – T1	–4.4165	–5.9753	–2.8578	<0.001
T3 – T1	–16.0940	–17.6527	–14.5352	<0.001
T3 – T2	–11.6774	–13.2361	–10.1187	<0.001
	Difference in OVFp scores	LCL	UCL	p
T2 – T1	0.7200	–0.0051	1.4450	0.052
T3 – T1	0.5969	–0.1282	1.3219	0.130
T3 – T2	–0.1231	–0.8482	0.6019	0.916

All values are means; Post-hoc Tukey's HSD results, after significant ANOVA test, are presented; MAFp – meat, alcohol and fish pattern; SGFp – sweets, grains and fats pattern; OVFp – olive oil, vegetables and fruits pattern; LCL – lower confidence level; UCL – upper confidence level

TABLE 4
LOGISTIC REGRESSION ANALYSIS EXAMINING RELATIONSHIP BETWEEN DIETARY PATTERNS AND METABOLIC SYNDROME

Metabolic syndrome (yes/no)	Estimate	Std. Error	p
Meat, alcohol and fish pattern (MAFp)	0.0554	0.0251	0.027
Sweets, grains and fats pattern (SGFp)	–0.0023	0.0102	0.820
Olive oil, vegetables and fruits pattern (OVFp)	0.0192	0.0186	0.303
Age in years	0.0587	0.0052	<0.001
Gender (women vs men)	–0.0246	0.1601	0.878
Body Mass Index	0.2605	0.0208	<0.001
Physical activity	–1.4272	0.5917	0.016
Total kilocalories	–0.0003	0.0001	0.030

Model adjusted for age, gender, body mass index, physical activity, and total calories

fresh meat, alcohol, and fish and seafood. This factor was labeled as the meat, alcohol and fish pattern (MAFp). Factor 2 explained 7.8% of variation in the diet and was characterized by high consumption of sweets, baked goods, dairy, juices, cereals and grains, and solid fats and was named the sweets, grains, and fats pattern (SGFp). Factor 3 explained 7.2% of variation in the diet and was defined based on high intakes of olive oil, vegetables and fruits; and low intakes of plant oil, processed meat, and eggs. This factor was labeled as olive oil, vegetables, and fruits pattern (OVFp).

General characteristics and dietary intake of participants across tertiles of dietary pattern scores are presented in Table 2. The participants in the highest tertile of the MAFp score compared to the lower tertile were predominately younger males, had high-school education, belonged to medium and high socioeconomic status group, were smokers and ex-smokers, engaged in moderate and heavy physical activity, and had high total calorie intake; the calories from fats were higher than that from carbohydrates. Those in the highest tertile of the SGFp score compared to the lower tertile were younger, mostly female, and had high-school and college education; the total calorie intake and calories from carbohydrates were high, and calories from fats were low. In the highest tertile of OVFp score, compared to the lowest tertile, the participants were older, mostly female, had an elementary or college education, and were non-smokers; the total calorie intake was lower, and calories from carbohydrates was higher than calories from fats.

Table 3 presents the relationship between tertile categories of age and scores of each of the three dietary pat-

TABLE 5
LOGISTIC REGRESSION ANALYSIS EXAMINING RELATIONSHIP BETWEEN DIETARY PATTERNS AND COMPONENTS OF METABOLIC SYNDROME

Outcome variables (yes/no)	Estimate	Std. Error	p
High waist circumference (cms)[a]			
Meat, alcohol and fish pattern (MAFp)	0.0264	0.0344	0.442
Sweets, grains and fats pattern (SGFp)	0.0245	0.0134	0.068
Olive oil, vegetables and fruits pattern (OVFp)	–0.0472	0.0260	0.069
High triglycerides (mmol/L)[a]			
Meat, alcohol and fish pattern (MAFp)	0.0348	0.0227	0.126
Sweets, grains and fats pattern (SGFp)	–0.0082	0.0092	0.376
Olive oil, vegetables and fruits pattern (OVFp)	0.0152	0.0170	0.373
High fasting plasma glucose (mmol/L)[b]			
Meat, alcohol and fish pattern (MAFp)	0.0627	0.0227	0.006
Sweets, grains and fats pattern (SGFp)	0.0071	0.0090	0.430
Olive oil, vegetables and fruits pattern (OVFp)	0.0111	0.0169	0.512
Low HDL cholestrol (mmol/L)[c]			
Meat, alcohol and fish pattern (MAFp)	–0.0495	0.0257	0.054
Sweets, grains and fats pattern (SGFp)	0.0056	0.0097	0.564
Olive oil, vegetables and fruits pattern (OVFp)	–0.0218	0.0190	0.250
Elevated blood-pressure (mmHg)[b]			
Meat, alcohol and fish pattern (MAFp)	0.0230	0.0260	0.377
Sweets, grains and fats pattern (SGFp)	–0.0076	0.0104	0.468
Olive oil, vegetables and fruits pattern (OVFp)	0.0042	0.0193	0.828

[a] Models adjusted for age, gender, body mass index, physical activity, socio-economic status, and total calories
[b] Models adjusted for age, gender, body mass index, and total calories
[c] Model adjusted for age, gender, body mass index, physical activity, and total calories

terns. The MAFp scores were significantly lower in older (tertile 3) versus middle age-group (tertile 2), with a direction for lower scores in older versus younger age-group (tertile 1). The SGFp scores were significantly different between all the three age-groups; the lowest scores being present between older and younger adults. The OVFp scores were higher in middle age versus younger adults.

The result of logistic regression analysis examining the relationship between the three dietary patterns simultaneously and MetS is presented in Table 4. The MAFp showed a positive association with MetS adjusting for age, gender, BMI, physical activity and total calories. Age and BMI associated positively with MetS, physical activity showed a negative association, and gender did not associate significantly with MetS. Examining the independent association of each pattern with MetS, only the MAFp was positively associated with MetS ($\beta=0.054$, $p=0.004$). Table 5 presents the association between the three dietary patterns and individual components of MetS. Based on these analyses, in the final model the MAFp associated positively with high FPG after adjustment for age, gender, BMI, and total calories, and negatively with low HDL-cholesterol after additional adjustment for physical activity. There was a trend toward significance for a positive association between SGFp and WC and for a negative association between OVFp and WC after adjusting age, gender, BMI, physical activity, SES and total calories.

Discussion

The purpose of this study was to identify whether dietary patterns distinct from a traditional Mediterranean diet were evident in the island population living off the Adriatic cost of Croatia, and, if so, to determine which of the specific dietary patterns, if any, were related to an increased risk of MetS. Using principal component factor analysis on food frequency data collected from adults in the region, three dietary patterns were identified: a meat, alcohol, and fish pattern (MAFp); a sweets, grains, and fats pattern (SGFp); and an olive oil, vegetables, and fruits pattern (OVFp).

The MAFp was the predominant dietary pattern among younger and middle age adult males who smoked and had a lower level of education; and it associated positively with MetS and high FPG. Among the various factors studied in relation to MetS, age, BMI, total calories and physical activity showed significant association. Total calories although did not associate positively with MetS, an inverse association was observed between physical activity and MetS. This finding suggests that energy expenditure is an important consideration in understanding the relationship between diet and adverse metabolic changes that may lead to MetS. The MAFp in addition associated negatively with low HDL-cholesterol. Consuming diet high in fats, being physically active, and drinking alcohol in moderation have been shown to be related to increasing the HDL-cholesterol levels[21]; our findings confirm these associations.

Meat consumption, with alcohol, has increased among Croatian islanders[22]. A positive association between high consumption of meat and beer and cardio-vascular risk factors among the overweight and obese Croatian individuals has been shown[14]; our results are in line with these observations. The higher consumption of meat and fish, instead of a more traditional dietary combination of vegetables and fish among young and middle aged affluent males possibly points to a fundamental change in the diet, at least in this particular demographic. The MAFp of our study showed some difference from the meat and alcohol pattern of studies from other nations due to differences in the cultural foods[23,24]; and probably because of this our results are in partial agreement with these studies. However, in several studies dietary patterns characterized by higher meat consumption have been associated with high glucose and MetS[25–27].

The SGFp consisted of a variety of foods that tend to predominate in a westernized dietary pattern including solid fat, and sweet/starchy foods; the educated and mostly females were found to be primarily consuming this type of pattern. The SGFp scores differed significantly between older, middle and younger adults, the younger adults showing the highest consumption for this pattern; however, no significant association was observed between SGFp and MetS. WC is a major component of MetS[19] and the SGFp showed a trend towards high WC. There are few Croatian studies that have accounted for sweets and baked food items in dietary studies. A study conducted on Croatians adolescents, however, had reported higher consumption of sweets and fast food among the urban mainland adolescents than those living in the Hvar island[28].

The OVFp was characterized by higher consumption of nutrient rich foods such as fruits, vegetables, and olive oil; and lower intakes of high calorie low nutrient foods such as meat, eggs and plant oil. The OVFp, however, did not associate significantly with MetS except for a trend for inverse association with high WC. A traditional Mediterranean diet encompasses a broader variety of food items including fruits, vegetables, fish and whole grains, and though the OVFp was closer to the more traditional pattern[6,11], the more limited scope of foods included may have masked the potential health benefits associated with the diet.

The MAFp affirm our findings that a diet rich in meat is significantly related to metabolic disturbances even if an individual's diet is supplemented with fish; and that intake of alcohol with meat likely exacerbates these adverse metabolic consequences. Croatians in general are believed to be practicing healthy methods of cooking such as boiling, grilling and smearing foods with olive oil; however possibility of changes in the cooking medium from olive oil to other oils/fats is expected. Use of principal component analysis to identify dietary patterns is a useful approach for understanding diet-disease relationship[29], as it examines the combined effect of several food items on health outcomes rather than just a single food; however, this methodology has its own inherent limitations[30]. The uniqueness of the island population, that it is genetically homogenous and isolated, reduces the chances of unknown confounders. On the contrary, because of this uniqueness the results of this study are limited in their ability to be generalized to other populations. During preliminary analyses we noticed loss of statistical power in examining dietary patterns and associating it with the outcomes by gender; the patterns were therefore developed for the whole population. The cross sectional study design further limits us in constructing a causal relationship.

The strength of this study is that we examined dietary patterns in a larger population taking into account all important influential variables. The priori based approach to study dietary patterns in this population also showed a deviation from a traditional Mediterranean diet, but the use of PCA as an empirical approach to examine dietary patterns of Croatians makes this study as one of the only studies. The study serves as an important step in understanding the intricate relationship between diet and metabolic disturbances, and in providing useful information which will be helpful in developing more comprehensive studies in the future.

Conclusions

In this study we examined the dietary patterns of a historically isolated island population of Croatia that has traditionally adhered to a Mediterranean diet. Our results in general show a departure from a traditional Mediterranean diet to several distinct patterns in the Adriatic population. The MAFp was the principal dietary pattern and it showed a strong association with metabolic disturbances, suggesting that higher intakes of meat and alcohol, even though supplemented by fish consumption, may have detrimental health consequences. This finding suggests a need to educate the islanders on food group combinations that may be more healthful.

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NAVIKE U PREHRANI ODRASLIH JEDNOG JADRASKOG OTOKA U HRVATSKOJ I NJIHOVE POVEZANOSTI SA METABOLIČKIM SINDROMOM I NJEGOVIM KOMPONENTAMA

SAŽETAK

Među stanovnicima jadranskih otoka postoji veća prevalencija metaboličkog sindroma (MetS) usprkos tradicionalno aktivnom životnom stilu i mediteranskoj dijeti. Proveli smo presječnu studiju ne bili identificirali navike u prehrani u uzorku od 1442 odrasle osobe s otoka Hvara te odredili jesu li MetS i njegove komponente povezane sa promijenjenim obrascem u tradicionalnoj mediteranskoj dijeti. Unos hrane određen je pomoću upitnika o učestalosti hrane. MetS je određen pomoću kriterija Međunarodne federacije za dijabetes (International Diabetes Federation). Naše istraživanje pokazalo je da su prehrambene navike ove populacije odvedene od tradicionalne dijete. Analiza glavne komponente identificirala je tri glavna obrasca. 30,6% ukupne prehrambene varijance činili su sljedeći obrasci: meso, alkohol i riba (MAFp), slatkiši, žitarice i masti (SGFp) te maslinovo ulje, povrće i voće (OVFp). MAFp se pokazao značajno povezan s MetS (p=0,027) te povišenom glukozom plazme (p=0,006).