Original Article

Lifestyle Risk Factors and Cardiovascular Disease Risk in Youth

Iris - Panagiota Efthymiou, MSc
Laboratory of Health Economics and Management (LabHEM), Economics Department, University of Piraeus, Greece

Athanassios Vozikis, PhD
Laboratory of Health Economics and Management(LabHEM), Economics Department, University of Piraeus, Greece

Petros Galanis, PhD
Center for Health Services Management and Evaluation (CHESME), Department of Nursing, University of Athens, Greece

Simos Sidiropoulos, MSc
Laboratory of Health Economics and Management(LabHEM), Economics Department, University of Piraeus, Greece

Ioannis Kyriazis, PhD
Diabetes & Obesity Outpatient Clinic, KAT General Hospital of Attica, Greece

Correspondence: Vozikis Athanassios, Laboratory of Health Economics and Management, (LabHEM), Economics Department, University of Piraeus, 80, Karaoli&Dimitriou str., 18534, Piraeus, Greece.tel: +30 2104142280, email: avozik@unipi.gr

Abstract

Cardiovascular diseases could be characterized as a modern-day epidemic; they rank first on the list of diseases that lead to fatality percentages in both developed and developing countries. Greece holds one of the highest positions on the list of the most affected countries. On an international level, the medical research community carries out a vigorous action concerning those diseases as well as concerning the ways of limiting their incidence, and the attributed risk factors, e.g., lifestyle.

It has been identified that the risk factors increasing the cardiovascular disease appearances relate to people's lifestyle and daily habits such as smoking, alcohol consumption, diet, and exercise, and can lead to increased possibilities of cardiovascular disease appearance, most commonly cerebrovascular episodes, and coronary artery disease. Given that lifestyle plays a determining role in cardiovascular diseases' prevention and combat, the World Health Organization (WHO) suggests mainly behavioral changes that can, in turn, lead to a decrease in those diseases' incidence.

This research study aims at examining and analyzing young people's everyday habits related to the risk factors of the diseases in question. It consists of a print questionnaire that was completed by a random sample student of Hellenic Academic in situations during the academic year 2017-2018. The data was collected in print form; the answers were electronically registered and then statistically analyzed with the help of SPSS. The result obtained by the student sample was that they had a high possibility of developing cardiovascular issues. Therefore, we must form the appropriate preventive actions – interventions aiming at a change in our lifestyle and daily habits, aim to decrease the risk of developing obesity, cancer or cardiovascular diseases in the coming years. The findings are also confirmed by the health researches of the Greek Statistics Authority (ELSTAT) in 2014 and 2017 and of the international literature.

Keywords: health risk factors, lifestyle, cardiovascular diseases, smoking, alcohol consumption, obesity, diet, exercise ,youth

Introduction

Health is the highest human good and all citizens of all countries should have access to high-quality health services. These services should specifically be provided to citizens through the health system of the country where they live in or reside temporarily. Both health and quality of life constitute multidimensional phenomena, which aligns with the satisfaction of a modern-day individual's needs (Efthymiou and Vozikis, 2017). The term QoL (Quality of Life) is governed by the principles of both universality and individuality and, in general incorporates the interaction of personal and social life's factors and aspects (Yfantopoulos J., 2001).

Today chronic noncommunicable diseases are the main cause of death and disability. Yet the main risk factors associated with chronic diseases are largely preventable. In the year 2012, according to the World Health Organization (WHO), noncommunicable diseases were responsible for 68% of all deaths globally; up from 60% in 2000,NCD deaths were projected to increase by 15% globally between 2010 and 2020. It should also be noted that in the year 2012, communicable, maternal, neonatal, and nutrition conditions collectively caused 23% of global deaths, while injuries caused 9% of all deaths. Europe is the most affected by NCDs WHO region.

Concerning the economic impact of NCDs, it has been found that it affects national income as they also pose a significant financial burden on health care budgets and nations' welfare, which is expected to rise. For example, the economic burden of life lost due to all NCDs ranges from US$ 22.8 trillion in 2010 to US$ 43.3 trillion in 2030 (Bloom et al., 2012). In Europe, 20% of health spending is due to socio-economic disparities. These health inequalities are expected to widen due to the economic crisis and pose a challenge for health systems (Divajeva et al., 2014).

Given that lifestyle plays a determining role in cardiovascular diseases' prevention and combat, the World Health Organization (WHO) suggests mainly behavioral changes that can lead to a decrease in those diseases' incidence. In 2011, the UN General Assembly adopted a political declaration that mobilized member countries for the reduction and control of NCDs. Specifically, the resolution includes an ultimate sustainable development goal target to reduce by one-third premature mortality from NCDs by 2030. To achieve this, countries agreed on nine voluntary global targets for 2025 (with a baseline of 2010), including a target to reduce overall mortality from the four main NCDs by 25% (Devaux et al., 2019). Nowadays, actions to improve people's health by making their behaviors and consumption choices healthier are starting to receive more attention in European countries' public health policies. Countries are increasingly reluctant to accept the detrimental consequences of unhealthy habits, such as tobacco smoking, harmful use of alcohol, unhealthy diets and sedentary lifestyles, among other risk factors.

It has been identified that the risk factors increasing the cardiovascular disease appearances relate to people's lifestyle and daily habits such as smoking, alcohol consumption, diet, and exercise, and can lead to increased possibilities of cardiovascular disease appearance, most commonly cerebrovascular episodes, and coronary artery disease. According to WHO (2017), CVDs are the number 1 cause of death globally: more people die annually from CVDs than from any other cause. An estimated 17.9 million people died from CVDs in 2016, representing 31% of all global deaths. Of these deaths, 85% are due to heart attack and stroke. Cardiovascular diseases account for most NCDs deaths, or 17.9 million people annually, followed by cancers (9.0 million), respiratory diseases (3.9million), and diabetes (1.6 million) (WHO, 2018).

Cardiovascular diseases could be characterized as a modern-day epidemic, and Greece holds one of the highest positions on the list of the most affected countries. Today the medical research community carries out a vigorous action concerning cardiovascular diseases (CVDs) and ways of limiting their incidence. For example,Vineis, P. et al. 2014, deal with the environmental roots of non-communicable diseases (NCDs) and the epigenetic impacts of globalization. Fiuza-Luces, Carmen, et al. (2018) explore the exercise benefits in cardiovascular disease. According to the authors, regular physical activity or exercise induces a myriad of physiological adaptations that benefit human cardiovascular health either directly or indirectly. Kammar-García, A. et al. (2019) conducted a cross-sectional study using a sample of 1351 young adults, different body composition parameterscolcude that the Body Mass Index (BMI) and Body Surface Area (BSA) correlate

with a cardiovascular disease risk factor.

It should be mentioned at his point that in the international literature, there is variation both in the number and type of diseases characterized as chronic diseases and in what the duration of a condition or disease must be so that it can be considered chronic. Even within professional communities (i.e., medical, public health, academic, and policy), there is a large degree of variation in the use of the term chronic disease (Bernell and Howard, 2016). These differences can potentially cause confusion and misunderstanding when talking about the impact, cost, and methods of dealing with and minimizing chronic diseases. In any case, the need for investing in health promotion and noncommunicable disease prevention is stronger than it has ever been.

NCDs and CVDs

The main types of NCDs are cardiovascular diseases (eg. heart attacks and stroke), cancers, chronic respiratory diseases (e.g as chronic obstructive pulmonary disease and asthma) and diabetes (WHO, 2018) and affect citizens of all countries but mostly those of in low- and middle-income countries, people of all age groups and sex.

Cardiovascular diseases (CVDs) are a group of disorders of the heart and blood vessels and they include, among others, diseases of the blood vessels that supply human organs such as the brain, legs, arms etc., diseases that damage to the heart muscle and heart valves, malformations of heart structure existing at birth, blood clots in the leg veins, which can dislodge and move to the heart and lungs. (WHO,2017).

Health Risk Factors

Health risk factors can be classified as genetic, demographic, environmental, behavioral, or physiological. The genetic factors are associated with genetic predispositions; the demographic concern individuals, namely gender, age, religion, income, the environmental are the ones being developed within a broader social, economic and political context. The latter category includes air pollution, access to clean water and hygiene conditions of a population. Behavioral factors are associated with the actions of an individual or a society, their lifestyle habits, such as dietary habits, smoking, alcohol consumption, exercise etc. The physiological can result in obesity and/or high levels of cholesterol, glucose and blood pressure, that is, the factors stemming from a mixture of genetic and behavioral risk factors (WHO, 2009).

Health risk factors can also be divided into modifiable and non-modifiable, with modifiable ones including factors, such as gender, age and ethnicity and non-modifiable including habits which are intrinsic in people's lifestyle. They are acquired in the course of people's life due to their social, economic and cultural characteristics. Among those habitual behaviors are the following: smoking, overconsumption of alcohol, low intake of fruit and vegetables, lack of exercise, obesity, high levels of cholesterol and blood pressure, drug use, and unsafe sex. According to Greece's Organization for Economic Cooperation and Development (OECD), the first seven have been established as the main health risk factors in the international literature (Petrelis and Domeyer, 2016).

The factors mentioned above, either individually or combined, underly and lead to a quality of life with a minus sign and today's high percentages of early mortality on a global scale. These factors have been found to be linked directly to chronic noncommunicable diseases such as cardiovascular diseases and cancers, that is, the most frequent causes of death in Europe (World Health Organization- Europe, 2016). It has been estimated that by 2030, noncommunicable diseases will represent the 75% of global mortality, while cardiovascular diseases will be responsible for more deaths in comparison to noncommunicable diseases, such as tuberculosis, malaria or even diseases due to HIV infection, in low-income countries (Bruneau, 2008).

International Literature

Research concerning NCDs and attitudes concerning their risk factors has been gaining interest due to the effect on human health, QoL, and economic burden they impose on countries. Even though this is not a systematic review, some notable cases are briefly presented.

Vineis et al. (2014) in their work deal with the environmental roots of noncommunicable diseases (NCDs) and the epigenetic impacts of globalization. They assume that environmental factors can become "embedded" in the biology of humans, and also that the "embedding" partly occurs because of epigenetic changes. They conclude that epigenetic modifications related to globalization may help explain current and future

patterns of NCDs and deserve attention from environmental researchers, public health experts, policymakers, and concerned citizens, especially because of the "25×25 strategy". Codella et al. (2016) address the importance of physical exercise in reversing the scenario of unhealthy diets and sedentary lifestyles in our modern society and the direct link between a variety of addictions and mood states to which exercise could be relieving. According to the authors, seeking high-sugar diets, also in a reward- or craving-addiction fashion that can generate drastic metabolic derangements, often interpolated with affective disorders, for which exercise regularly can provide positive effects and can act as a complementary therapeutic strategy. It should be mentioned that inadequate physical activity is causally linked to more than three million deaths globally and is estimated to cause a decrease in average life expectancy by 0.68 years. Moreover, physical activity seems to decrease the risk for a stroke, as it improves the parameters associated with hypertension, cardiovascular diseases, diabetes mellitus and body weight Lee I.M. et al. (2012). An increase in physical activity can decrease the risk for a stroke by 20%, while a sedentary life increases the risk of developing cardiovascular disease by 50%. (IHME, 2010). Even moderate physical activity, such as walking three hours weekly, contributes to the decrease of mortality due to cardiac events by 30-50%. (Gately, 2001; WHF https://www.world-heart-federation.org/resources/risk-factors/.). Moreover, Díaz-Gutiérrez et al. 2018 explored the association between a healthy lifestyle score and the risk of cardiovascular disease in the SUN Cohort (The SUN project is a dynamic, prospective, multipurpose cohort of Spanish university graduates with a retention proportion of 92%) and conclude that a healthy lifestyle score including several simple healthy habits was associated with a lower risk of developing primary CVD.

Methodology

This research study aims at examining and analyzing young people's dietary and other habits related to the risk factors of the diseases in question. The primary data collection period took place in April 2018 using a structured and fully anonymous questionnaire based on the template of the school of public health of the Harvard University (Healthy Heart Score, Harvard School of Public Health), with which students' lifestyles can be documented in detail. Specifically, the HeaIthy Heart Score estimates cardiovascular disease risk in seemingly healthy individuals and is a simple tool that can be used to identify individuals at high risk for cardiovascular disease due to unhealthy lifestyle habits (Healthy Heart Score uses lifestyle behaviors to estimate cardiovascular disease risk, 2014).

The research consists of a print questionnaire that was pilot tested in a cohort of 20 students and then completed by a random sample of 1.347 (as well as an additional 672 students from other academic institutions) Piraeus University students during the academic year 2017-2018. The data was collected in print form; the answers were electronically registered and then statistically analyzed with the help of SPSS.

Ethical issues

We declare that our research satisfies the ethics protocol and is approved by the University of Piraeus.

Statistical analysis

Statistical analysis was performed with the Statistical Package for Social Sciences software (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.).

Continuous variables are presented as mean and standard deviation, while categorical variables are presented as numbers and percentages. The Kolmogorov-Smirnov test ($p>0.05$ for all variables) and graphs (histograms and normal Q-Q plots) were used to test the normality assumption. Correlations between cardiovascular disease risks were estimated with Spearman's correlation coefficient. Cardiovascular disease risks were the dependent variables. A chi-square test was used to identify differences between groups. Independent samples t-test was applied for the analysis of group differences within continuous variables. Variables that were significantly different ($p<0.2$) in bivariate analysis were entered into the backward stepwise multivariate logistic regression analysis. Criteria for entry and removal of variables were based on the likelihood ratio test, with enter and remove limits set at $p<0.05$ and $p>0.05$. We estimated adjusted odds ratios with 95% confidence intervals for the independent variables included in the model. All tests of statistical significance were two-tailed, and a p-value of less than 0.05 was considered significant.

Results

Demographic characteristics: The study population included 2019 students in 8 universities in Greece. The demographiccharacteristics of the participants are shown in *Table 1*. The mean age of thepopulation was 21.1 years, while the minimum age was 18 years and the maximum was 51 years. The majority of the participants were white (98.4%) and students of the University of Piraeus (69%). Males and females participants were equally (50% in each group).

Table 1. Demographic characteristics of the participants

Characteristics	N	%
Gender		
Males	1010	50
Females	1009	50
Age	21.1[a]	2.8[b]
Race		
White	1944	98.4
Black	6	0.3
Spain	6	0.3
Asian	3	0.2
Other	16	0.8
University		
Piraeus	1347	69
Agricultural	63	3.2
National and Kapodistrian University of Athens	204	10.4
Athens University of Economics and Business	60	3.1
Panteion	110	5.6
West Attica	59	3
Harokopio	70	3.6
Deree	40	2
Department		
Industrial management and technology	123	8.5
International and European Studies	147	10.2
Maritime studies	155	10.7
Business administration	172	11.9
Economic science	170	11.9
Informatics	146	10.1
Statistics	146	10.1
Tourism studies	34	2.4
Banking and financial management	115	8
Digital systems	139	9.6
Music	30	2.1
Law	39	2.7
Physical exercise	30	2.1
Semester		
2	566	35.7
3	73	4.6
4	309	19.5
6	294	18.5
8	345	21.7

[a] mean [b] standard deviation

Table 2. Clinical characteristics of the participants

Characteristics	N	%
Heart attack or stroke		
Yes	10	0.5
No	2009	99.5
Diabetes		
Yes	16	0.8
No	2003	99.2
Smoking		
Current smoker	595	29.5
Ex-smoker	222	11
Never smoker	1202	59.5
BMI (kg/m^2)	23.1[a]	3.3[b]
BMI categories		
Underweight	95	4.7
Normal (healthy weight)	1412	69.9
Overweight	437	21.6
Obese Class I (Moderately obese)	64	3.2
Obese Class II (Severely obese)	8	0.4
Obese Class III (Very severely obese)	3	0.1

[a] mean [b] standard deviation

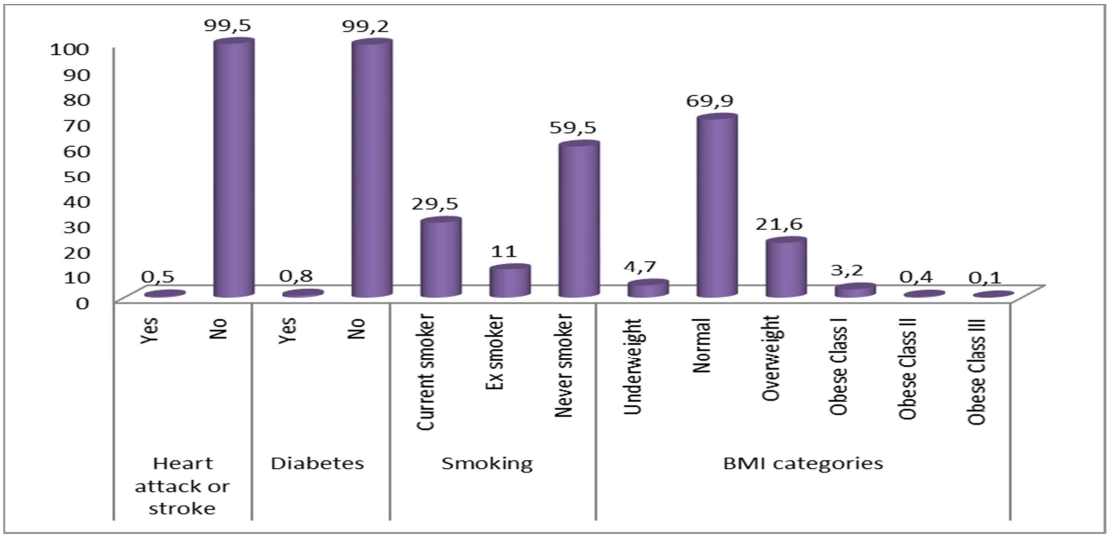

Figure 1. Clinical characteristics of the participants

Table 3. Physical activities of the participants

During the past year, what was your average time per week spent doing each of these activities?	0 min		1-4 min		5-19 min		20-59 min		60 min		1-1.5 hours		2-3 hours		4-6 hours		7-10 hours		>10 hours	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Slow walking (slower than 3 miles per hour)	85	4.2	33	1.6	192	9.5	263	13	162	8	315	15.6	320	15.8	307	15.2	174	8.6	168	8.3
Brisk walking (3 mph or faster) or hiking outdoors	313	15.5	173	8.6	351	17.4	337	16.7	156	7.7	276	13.7	205	10.2	110	5.4	52	2.6	46	2.3
Jogging (slower than 10 min/mile)	809	40.1	205	10.2	309	15.3	212	10.5	99	4.9	175	8.7	102	5.1	61	3	25	1.2	22	1.1
Running (10 min/mile or faster)	766	37.9	225	11.1	303	15	224	11.1	93	4.6	178	8.8	102	5.1	72	3.6	29	1.4	27	1.3
Bicycling (including stationary machine)	1285	64.4	108	5.4	194	9.7	141	7.1	72	3.6	78	3.9	66	3.3	25	1.3	17	0.9	10	0.5
Lap swimming	1390	68.8	96	4.8	126	6.2	103	5.1	56	2.8	91	4.5	59	2.9	48	2.4	23	1.1	27	1.3
Tennis	1866	92.4	40	2	24	1.2	18	0.9	10	0.5	23	1.1	16	0.8	11	0.5	2	0.1	9	0.4
Calisthenics/Aerobics/Aerobic Dance/Rowing Machine	962	47.6	80	4	151	7.5	159	7.9	91	4.5	198	9.8	167	8.3	123	6.1	44	2.2	44	2.2
Squash or racquet Ball	1661	82.3	76	3.8	87	4.3	54	2.7	29	1.4	48	2.4	28	1.4	18	0.9	8	0.4	10	0.5
Yoga	1789	88.6	39	1.9	36	1.8	36	1.8	33	1.6	10	2	25	1.2	12	0.6	3	0.1	6	0.3
Strength training	786	38.9	107	5.3	196	9.7	193	9.7	105	5.2	220	10.9	189	9.4	114	5.6	49	2.4	60	3
Other moderate and vigorous intensity activity	951	47.1	90	4.5	167	8.3	173	8.6	97	4.8	193	9.6	124	6.1	111	5.5	49	2.4	64	3.2

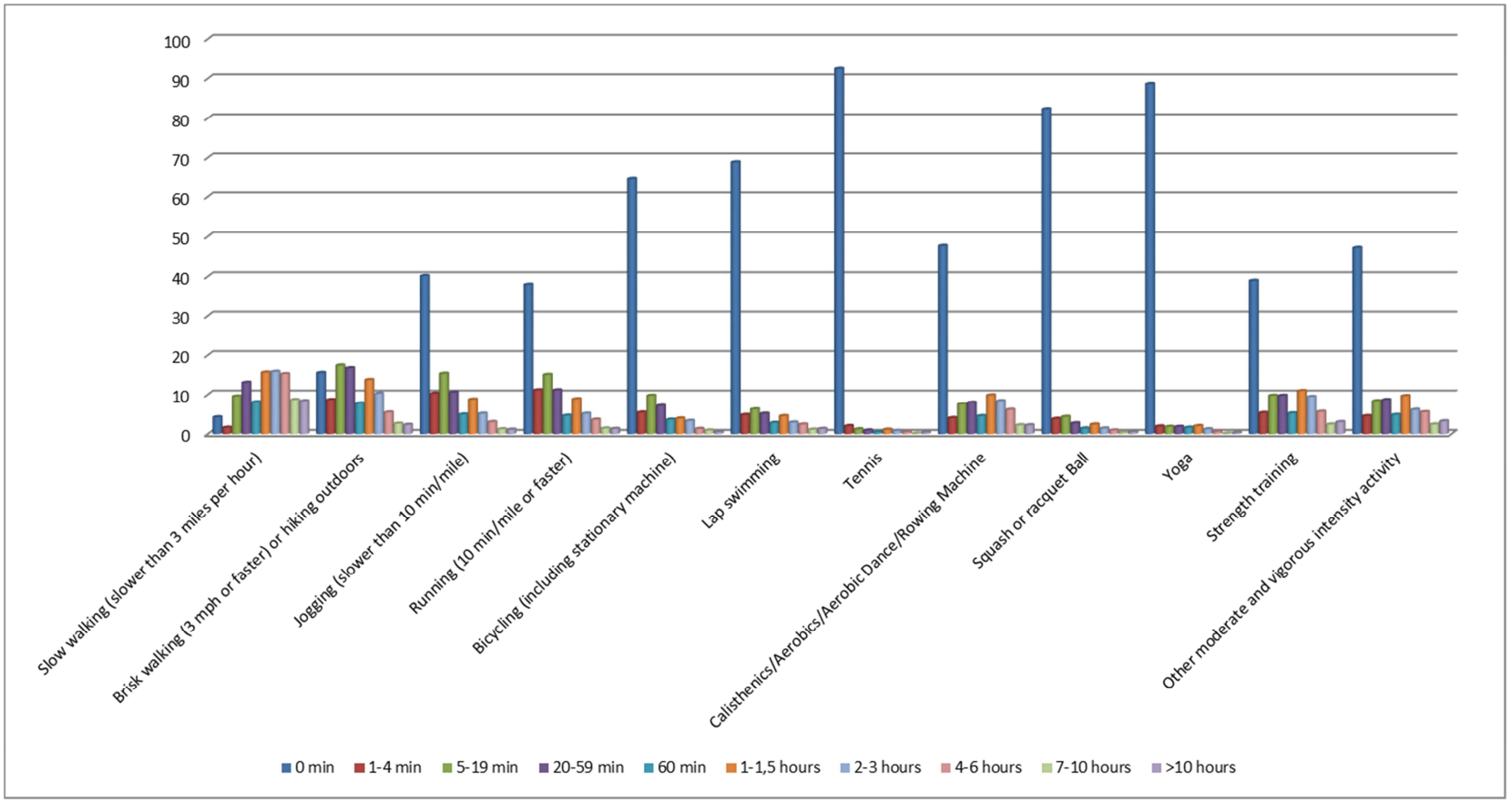

Figure 2. Physical activities of the participants (percentages)

Table 4. Eating habits of the participants

During the past year, how often, on average, do you eat	Never		1-3 per month		1 per week		2-4 per week		5-6 per week		1 per day		2-3 per day		>3 per day	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
A serving of fruit	62	3.1	242	12	354	17.5	637	31.6	218	10.8	318	15.8	161	8	27	1.3
A serving of vegetables	65	3.2	212	10.5	383	19	714	35.4	248	12.3	222	11	145	7.2	30	1.5
A serving of nuts or nut butter	230	11.4	625	31	523	25.9	351	17.4	135	6.7	112	5.5	35	1.7	8	0.4
High fiber cold cereal (≥8 grams of fiber)	356	17.6	349	17.3	326	16.1	420	20.8	226	11.2	272	13.5	51	2.5	19	0.9
Low fiber cold cereal (≤ 1 gram of fiber)	661	32.7	452	22.4	370	18.3	273	13.5	101	5	122	6	29	1.4	11	0.5
Other cold cereal	929	46	383	19	287	14.2	209	10.4	85	4.2	90	4.5	22	1.1	14	0.7
Oatmeal/oat bran	1251	62	307	15.2	164	8.1	144	7.1	47	2.3	79	3.9	18	0.9	9	0.4
Other cooked breakfast cereal	1347	66.7	316	15.7	169	8.4	107	5.3	38	1.9	32	1.6	9	0.4	1	0.01
Whole wheat, oatmeal, or other whole grain bread	796	39.4	352	17.4	292	14.5	306	15.2	117	5.8	101	5	45	2.2	10	0.5
Rye or pumpernickel bread	969	48	327	16.2	278	13.8	255	12.6	78	3.9	79	3.9	29	1.4	4	0.2
White bread	273	13.5	256	12.7	341	16.9	486	24.1	258	12.8	238	11.8	132	6.5	35	1.7
Pasta	69	3.4	112	5.5	476	23.6	999	49.5	227	11.2	90	4.5	33	1.6	13	0.6
Bagels, english muffins, rolls	926	45.9	654	32.4	251	12.4	105	5.2	39	1.9	28	1.4	11	0.5	5	0.2
Pancakes	745	36.9	885	43.8	246	12.2	85	4.2	22	1.1	23	1.1	5	0.2	8	0.4
Crackers (triscuits, saltines, ritz, etc)	649	32.1	786	38.9	291	14.4	208	10.3	42	2.1	33	1.6	8	0.4	5	0.1
Popcorn, low-fat or fat free	579	28.7	993	49.2	276	13.7	115	5.7	33	1.6	18	0.9	3	0.1	2	0.1
Brown rice	1121	55.5	436	21.6	268	13.3	149	7.4	28	1.4	14	0.7	2	0.1	1	0.01
Added bran	1674	82.9	181	9	84	4.2	39	1.9	23	1.1	15	0.7	1	0.01	2	0.1
Other grains (barley, quinoa, etc)	1026	50.8	540	26.7	273	13.5	133	6.6	25	1.2	14	0.7	7	0.3	1	0.01
Added germ	1502	74.4	267	13.2	134	6.6	59	2.9	31	1.5	16	0.8	6	0.3	4	0.2
A serving of red meat	42	2.1	218	10.8	584	28.9	914	45.3	180	8.9	50	2.5	20	1	11	0.5
A serving of processed meat	111	5.5	324	16	430	21.3	691	34.2	251	12.4	149	7.4	54	2.7	9	0.4
A serving of alcohol	140	6.9	517	25.6	554	27.4	507	25.1	142	7	93	4.6	39	1.9	27	1.3
A serving of sugary drinks	343	17	557	27.6	411	20.4	408	20.2	134	6.6	110	5.4	46	2.3	10	0.5

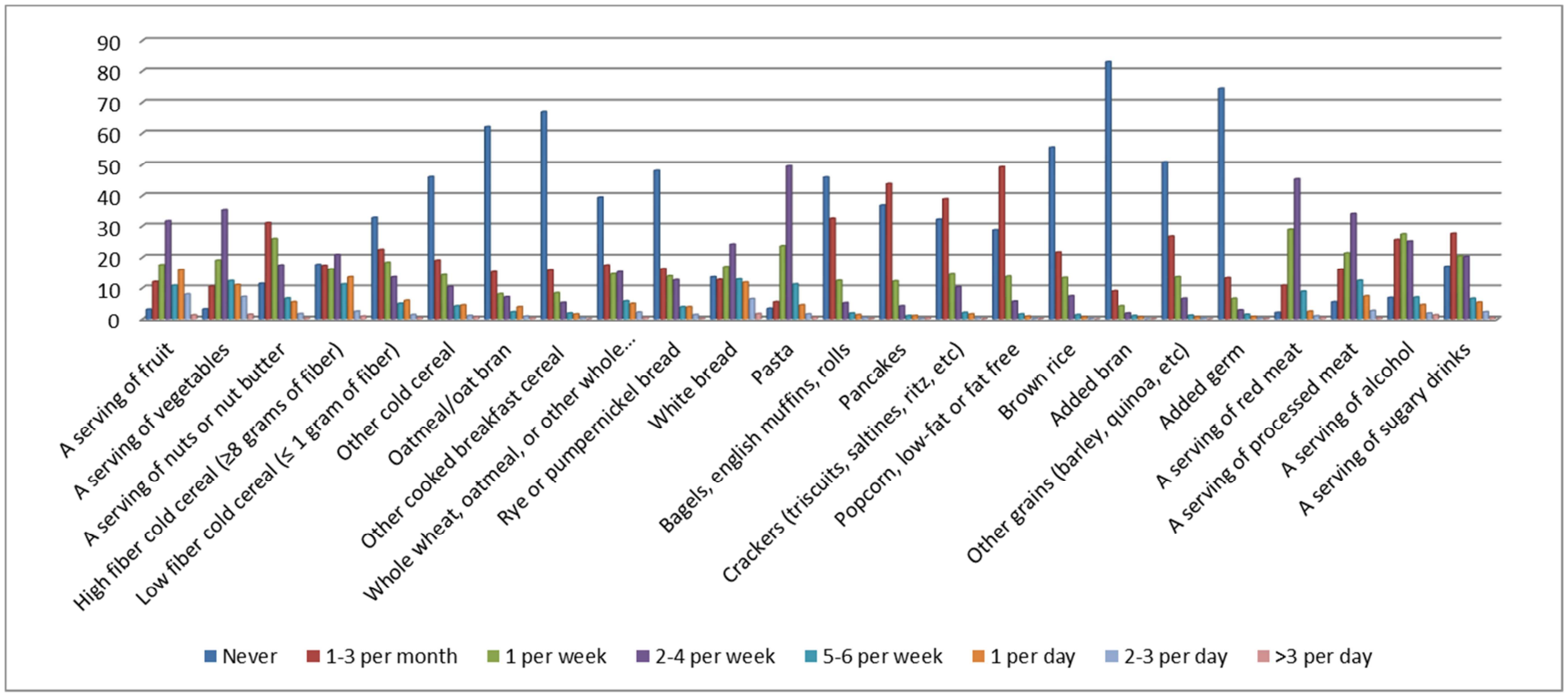

Figure 3. Eating habits of the participants (percentages)

Table 5. Cardiovascular disease risk of the participants

Risk compared to	Low		Moderate		High	
	N	%	N	%	N	%
Total risk compared to a healthy lifestyle	198	10.7	1010	54.7	637	34.5
BMI	1341	66.7	408	20.3	263	13.1
Physical activity	1139	56.6	811	40.3	63	3.1
Smoking	1201	59.7	216	10.7	595	29.6
Fruits and vegetables	114	5.7	142	7.1	1757	87.3
Whole grains	421	20.9	1028	51.1	563	28
Red meat	828	41.2	906	45	278	13.8
Processed meat	121	6	19	0.9	1866	93
Nuts and seeds	161	8	1623	80.6	229	11.4
Sugary drinks	382	19	1570	78	60	3
Alcohol	1946	96.4	34	1.7	31	1.5

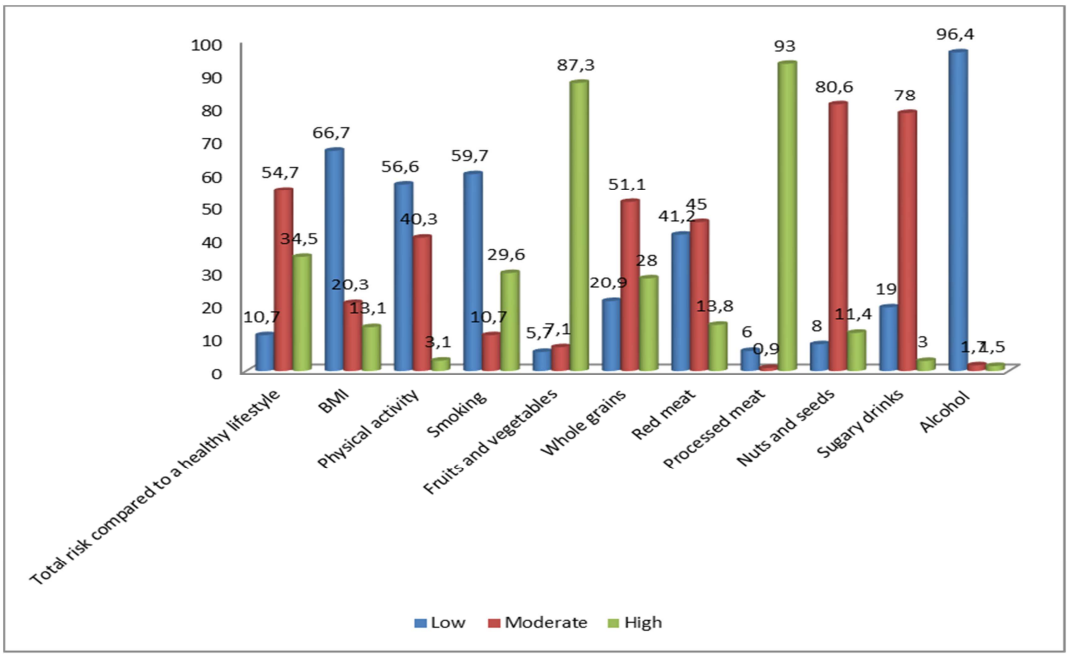

Figure 4. Cardiovascular disease risk of the participants (percentages)

Table 6. Spearman's correlation coefficients between CVD risks

	Total risk compared to a healthy lifestyle	BMI	Physical activity	Smoking	Fruits and vegetables	Whole grains	Red meat	Processed meat	Nuts and seeds	Sugary drinks
BMI	**0.09**									
Physical activity	**0.22**	**0.11**								
Smoking	**0.29**	**0.08**	**0.06**							
Fruits and vegetables	**0.11**	-0.01	0.02	0.03						
Whole grains	**0.14**	-0.03	**0.19**	0.03	**0.22**					
Red meat	**0.08**	0.04	0.01	**0.09**	0.00	**-0.07**				
Processed meat	0.05	0.01	-0.02	0.01	**0.15**	**0.06**	**0.08**			
Nuts and seeds	**0.11**	-0.01	**0.08**	0.02	**0.25**	**0.21**	0.02	0.04		
Sugary drinks	**0.09**	0.05	0.04	**0.13**	**0.09**	**0.05**	**0.08**	**0.13**	0.02	
Alcohol	0.01	**0.06**	**0.05**	**0.11**	**-0.12**	**-0.05**	**0.07**	-0.04	**-0.07**	**0.08**

**p-value<0.001 in all cases **Values in bold indicate statistically significant correlations (p<0.001*

Table 7. Bivariate analysis between independent variables and total risk compared to a healthy lifestyle

Independent variables	Total risk compared to a healthy lifestyle				P-value
	Low		Moderate to high		
	N	%	N	%	
Gender					**<0.001[a]**
Males	69	7.5	852	92.5	
Females	129	14	795	86	
Age[b]	21.0	3.1	21.1	2.8	0.4[c]
Race					0.6[a]
White	192	10.8	1584	89.2	
Other	6	8.7	63	91.3	
Heart attack or stroke					0.9[a]
Yes	1	11.1	8	88.9	
No	197	10.7	1639	89.3	
Diabetes					0.9[a]
Yes	1	7.7	12	92.3	
No	197	10.8	1635	89.2	
Smoking					**<0.001[a]**
Current smoker	12	2.2	522	97.8	
Ex smoker	19	9.3	186	90.7	
Never smoker	167	15.1	939	84.9	
BMI (kg/m^2)[b]	21.7	2.6	23.3	3.4	**<0.001[c]**
BMI risk					**<0.001[a]**
Low	167	13.6	1064	86.4	
Moderate to high	30	4.9	583	95.1	
Physical activity risk					**0.1[a]**
Low	122	11.6	926	88.4	
Moderate to high	76	9.5	720	90.5	
Smoking risk					**<0.001[a]**
Low	166	15	940	85	
Moderate to high	32	4.3	705	95.7	
Fruits and vegetables risk					0.4[a]
Low	8	8.3	88	91.7	
Moderate to high	190	10.9	1558	89.1	
Whole grains risk					0.3[a]
Low	35	9.2	346	90.8	
Moderate to high	163	11.1	1299	88.9	
Red meat risk					**<0.001[a]**
Low	99	13.1	655	86.9	
Moderate to high	99	9.1	990	90.9	
Processed meat risk					**0.1[a]**
Low	17	15.5	93	84.5	
Moderate to high	181	10.5	1546	89.5	
Nuts and seeds risk					0.2[a]
Low	11	7.6	133	92.4	
Moderate to high	187	11.0	1513	89.0	
Sugary drinks risk					**0.1[a]**
Low	44	12.8	300	87.2	
Moderate to high	154	10.3	1345	89.7	
Alcohol risk					**0.1[a]**
Low	196	10.9	1595	89.1	
Moderate to high	2	3.9	49	96.1	

[a] chi-square test [b] mean (standard deviation) [c] independent samples t-test

Table 8. Multivariate logistic regression analysis with total risk compared to a healthy lifestyle as the dependent variable (low risk: reference category)

Independent variables	Odds ratio	95% confidence interval for odds ratio	P-value
Current smokers vs. never smokers	7.05	3.87 to 12.82	<0.001
BMI (kg/m^2)	1.11	1.04 to 1.19	0.002
Moderate to high BMI risk vs. low risk	2.09	1.37 to 3.21	0.001

Clinical characteristics

The clinical characteristics of the participants are shown in *Table 2 and Figure 1*. The mean BMI of the study population was 23.1 kg/m^2, minimum BMI was 15.3 kg/m^2 and the maximum was 41.5 kg/m^2, while 69.9% had normal BMI, 4.7% were underweight and 25.4% were overweight/obese. Only 0.5% of the participants had a heart attack or stroke and 0.8% had diabetes, while 29.5% were current smokers and 11% were ex-smokers.

Physical activities

Physical activities of the participants are shown in *Table 3* and *Figure 2*. 71.5% of the participants of the study performed slow-walking ≥60 min per week, 41.9% performed brisk walking, 24% performed jogging, 24.8% performed running, 13.5% performed bicycling, 15% performed lap swimming, 3.4% played tennis, 33.1% performed calisthenics/aerobics/aerobic dance/rowing machine, 7% played squash or racquetball, 5.8% did yoga, 36.5% performed strength training and 31.6% performed other moderate and vigorous-intensity activity.

Eating habits

The eating habits of the participants are shown in *Table 4* and *Figure 3*. 85% of the participants ate a serving of fruit at least per week, 86.4% ate a serving of vegetables, 57.6% ate a serving of nuts or nut butter, 65% ate high fiber cold cereal, 44.7% ate low fiber cold cereal, 35.1% ate other cold cereal, 22.7% ate oatmeal/oat bran, 17.6% ate other cooked breakfast cereal, 43.2% ate whole wheat, oatmeal, or other whole grain bread, 35.8% ate rye or pumpernickel bread, 73.8% ate white bread, 91% ate pasta, 21.6% ate bagels, english muffins, rolls, 19.2% ate pancakes, 28.9% ate crackers, 22.1% ate popcorn, low-fat or fat-free, 22.9% ate brown rice, 8% ate added bran, 22.3% ate other grains, 12.3% ate added germ, 87.1% ate a serving of red meat, 78.4% ate a serving of processed meat, 67.3% consumed a serving of alcohol, and 55.4% consumed a serving of sugary drinks.

Cardiovascular disease risk

Cardiovascular disease risk of the participants is presented in *Table 5* and in *Figure 4*. 34.5% of the participants of the study show high total risk compared to a healthy lifestyle, 54.7% had moderate total risk and 10.7% had low risk. 97% have high risk compared to processed meat. 87.3% have high risk compared to fruits and vegetables. 29.6% have high risk compared to smoking. 28% have high risk compared to whole grains and 13.8% high risk compared to red meat.13.1% have high risk compared to BMI. 11.4% have high risk compared to nuts and seeds. 3.1% have high risk compared to physical activity. 3% have high risk compared to sugary drinks and 1.5% have high risk compared to alcohol.

Correlations and model construction

Correlations between *Cardiovascular Risk* are presented in *Table 6*. We found positive correlation between *Total Cardiovascular Risk* compared to a healthy lifestyle and risk compared to *BMI, physical activity, smoking, fruits and vegetables, whole grains, red meat, nuts and seeds and sugary drinks.*

Moreover,

1. *BMI*risk,was positively correlated to *physical activity, smoking, and alcohol.*
2. *Physical activity* risk, was positively correlated to *smoking, whole grains, nuts and*

seeds and alcohol.

3. *Smoking*risk, was positively correlated to *red meat, sugary drinks and alcohol*.

4. *Fruits and vegetables* risk, was positively correlated to *whole grains, processed meat, nuts and seeds, sugary drinks* and negatively correlatedwith *alcohol*.

5. *Whole grains*, was positively correlated to *processed meat, nuts and seeds and sugary drinks* and negative with *red meat and alcohol*.

6. *Red meat* risk, was positively correlated to *processed meat, sugary drinks and alcohol*.

7. *Processed meat* risk, was positively correlated to *sugary drinks*.

8. *Nuts and seeds*risk, was negatively correlated to *alcohol*.

9. Finally, *sugary drinks* risk, was positively correlated to *alcohol*.

Bivariate analysis between independent variables and total risk compared to a healthy lifestyle is shown in *Table 7*. Our findings indicate that 10 independent variables were associated with total risk compared to a healthy lifestyle at the level of 0.2 (p-value<0.2).

In *Table 8*, we present the *multivariate logistic regression* analysis with total risk compared to a healthy lifestyle as the dependent variable. According to the multivariate logistic regression analysis, *current smoking*, *increased BMI* and *moderate to high BMI risks* were associated with increased total risk compared to a healthy lifestyle. These independent variables explain 14% of the variability of total risk compared to a healthy lifestyle.

Discussion

The research study presented in this paper examined and analysed young people's dietary and other habits related to the risk factors of the diseases in question using an anonymous questionnaire. The questionnaire was completed by a random sample student of Hellenic Academic institutions. The majority of the participants were white (98.4%) and students of the University of Piraeus (69%), during the academic year 2017-2018. In total, the study population included 2019 students in 8 universities in Greece, with a mean age was 21.1 years. Males and females participants were equally (50% in each group).

Concerning clinical characteristics of the study population, 69.9% had normal BMI, 4.7% were underweight and 25.4% were overweight/obese. 0.5% of the participants had a heart attack or stroke and 0.8% had diabetes, 29.5% were current smokers and 11% were ex-smokers. Most of the participants did some short of regular exercise; 71.5% of the participants performed slowly walking ≥60 min per week, 41.9% performed brisk walking, 24% performed jogging, 24.8% performed running, 13.5% performed bicycling, 15% performed lap swimming, 3.4% played tennis, 33.1% performed calisthenics/aerobics/aerobic dance/rowing machine, 7% played squash or racquetball, 5.8% did yoga, 36.5% performed strength training and 31.6% performed other moderate and vigorous-intensity activity.

Concerning the eating habits of the population that participated in the survey, those could be further optimized. 85% of the participants ate a serving of fruit at least per week, 86.4% ate a serving of vegetables, 57.6% ate a serving of nuts or nut butter, 65% ate high fiber cold cereal, 44.7% ate low fiber cold cereal, 35.1% ate other cold cereal, 22.7% ate oatmeal/oat bran, 17.6% ate other cooked breakfast cereal, 43.2% ate whole wheat, oatmeal, or other whole-grain bread, 35.8% ate rye or pumpernickel bread, 73.8% ate white bread, 91% ate pasta, 21.6% ate bagels, English muffins, rolls, 19.2% ate pancakes, 28.9% ate crackers, 22.1% ate popcorn, low-fat or fat-free, 22.9% ate brown rice, 8% ate added bran, 22.3% ate other grains, 12.3% ate added germ, 87.1% ate a serving of red meat, 78.4% ate a serving of processed meat, 67.3% consumed a serving of alcohol and 55.4% consumed a serving of sugary drinks.

For the statistical analyses performed, we found a positive correlation between *total risk* compared to a healthy lifestyle and risk compared to *BMI, physical activity, smoking, fruits and vegetables, whole grains, red meat, nuts and seeds and sugary drinks*.

Moreover, 34.5% of the participants had a high total risk of cardiovascular disease compared to a healthy lifestyle, 54.7% had moderate total risk and 10.7% had low risk. The results of our survey are in accordance with similar national or international surveys. Our findings present

similarities with the EU's Eurobarometer 2017 survey (with statistical data collected in 2014), the Global Youth Tobacco Survey that was implemented during the academic year 2004-2005 in Greece by the University of Thessaly and the National School of Public Health, the Greek Statistical Authority (ELSTAT), the work of Öztürk, S. et al. (2019), Chattopadhyay et al. (2019), Marques et al. (2019) and the National Survey for Wales (NSW), that replaced the Welsh Health Survey (WHS) as the source of data on health-related lifestyle among adults from 2016-17 and relate to adults aged 16+.

Conclusions

International findings have well established that lifestyle plays a determining role in NCDs and CVDs' prevention and combat. This notion has been additionally strengthened by the policies of the World Health Organization (WHO), and only, that suggests, mainly behavioral changes that can, in turn, lead to a decrease in those diseases' incidence.

The work was carried out in

The Laboratory of Health Economics and Management, (LabHEM), Economics Department, University of Piraeus, 80, Karaoli & Dimitriou str., 18534, Piraeus, Greece.

References

Bahia LR, Araujo DV, Schaan BD, Dib SA, Negrato CA, Leão MPS, et al. (2011). The Costs of Type 2 Diabetes Mellitus Outpatient Care in the Brazilian Public Health System. Value Heal

Bernell, S., & Howard, S. W. (2016). Use your words carefully: what is a chronic disease?. Frontiers in public health, 4, 159.

Bloom, D. E., Cafiero, E., Jané-Llopis, E., Abrahams-Gessel, S., Bloom, L. R., Fathima, S., & O'Farrell, D. (2012). The global economic burden of noncommunicable diseases (No. 8712). Program on the Global Demography of Aging.

Bruneau, B.G., (2008), The developmental genetics of congenital heart disease., Nature. 21;451(7181):943-8.

Chattopadhyay, K., Akagwire, U., Biswas, M., Moore, R., Rajania, G., & Lewis, S. (2019). Role of lifestyle behaviours in the ethnic pattern of poor health outcomes in Leicester, England: analysis of a survey data set. Public health, 170, 122-128.

Codella, R., Terruzzi, I., &Luzi, L. (2016). Sugars, exercise, and health. Journal of affective disorders.

Devaux, M., A. Lerouge, B. Ventelou, Y. Goryakin, A. Feigl, S. Vuik, and M. Cecchini. "Assessing the potential outcomes of achieving the World Health Organization global non-communicable diseases targets for risk factors by 2025: is there also an economic dividend?." Public health 169 (2019): 173-179.

Díaz-Gutiérrez, J., Ruiz-Canela, M., Gea, A., Fernández-Montero, A., & Martínez-González, M. Á. (2018). Association between a healthy lifestyle score and the risk of cardiovascular disease in the SUN Cohort. Revista Española de Cardiología (English Edition), 71(12), 1001-1009

Divajeva, D., Marsh, T., Logstrup, S., Kestens, M., Vemer, P., Kriaucioniene, V., ... & Webber, L. (2014). Economics of chronic diseases protocol: cost-effectiveness modeling and the future burden of non-communicable disease in Europe. BMC Public Health, 14(1), 456.

Efthymiou I.P. and Vozikis A. (2017). Medicine, A Pan-Historical, Pan-Cultural Science. Journal of Cardiology & Cardiovascular Therapy, ISSN: 2474-7580.

Efthymiou I.P (2016). Trends in Healthcare: A Global Challenge. Xlibris Publishing. ISBN: 978-1-5144-9930-6

Gately, I., A Cultural History of How an Exotic Plant Seduced Civilization. New York: Grove Press; 2001.

Gostin, L. O., Abou-Taleb, H., Roache, S. A., &Alwan, A. (2017). Legal priorities for prevention of non-communicable diseases: innovations from WHO's Eastern Mediterranean region. Public Health, 144, 4-12.

Fredrickson, B.L., (2013), Positive emotions broaden and build. Advances in Experimental Social Psychology, eds Plant EA., Devine PG., Burlington: Academic Press, Elsevier, 47,1–53.

Healthy Heart Score uses lifestyle behaviors to estimate cardiovascular disease risk (2014). Harvard School of Public Health. Retrieved 10 February 2020, from https://www.hsph.harvard.edu/nutritionsource/2014/11/19/healthy-heart-score-uses-lifestyle-behaviors-to-estimate-cardiovascular-disease-risk/

Institute of Health Metrics and Evaluation (IHME), Global Burden of Disease Study 2010. http://www.healthmetricsandevaluation.org/.

Kavoura, M., Kyriopoulos, G., Geitona, M., Vandorou, Chr., (2003), PoiotitaZois, Athens, JANSSEN-CILAG.

Lee, I.M., Shiroma, E.J., Lobelo, F., Puska, P., Blair, S.N., Katzmarzyk, P.T., et al., (2012), Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. Lancet.380(9838):219-29. PubMed PMID: 22818936. DOI:10.1016/S0140-6736(12)61031-9.

Marques, A., Peralta, M., Santos, T., Martins, J., & de Matos, M. G. (2019). Self-rated health and health-related quality of life are related to adolescents' healthy lifestyle. Public health, 170, 89-94.

Moschos, M.M., Nitoda, E., Laios, K., Ladas, D.S., and Chatziralli, I.P. (2015). The impact of Chronic Tobacco Smoking on Retinal and Choroidal Thickness in Greek Population, Oxidative Medicine and Cellular Longevity, 17, 1-7. http://dx.doi.org/10.1155/2016/2905789.

Muka, T., Imo, D., Jaspers, L., Colpani, V., Chaker, L., van der Lee, S. J., &Pazoki, R. (2015). The global impact of non-communicable diseases on healthcare spending and national income: a systematic review. European journal of epidemiology, 30(4), 251-277.

National Survey for Wales 2018-19: Adult lifestyle (2019).

Öztürk, S., Ertong-Attar, G., &Başar, D. (2019). Risk factors associated with cardiovascular diseases in Turkey: Evidence from National Health Survey Health Policy and Technology, 8(1), 61-66

Pan, T., & Palmer, M. (2018). Risk factors and non-communicable disease diagnosis in China. China Economic Review, 50, 72-84

Pearce, N., Ebrahim, S., McKee, M., Lamptey, P., Barreto, M. L., Matheson, D., Walls, H., Foliaki, S., Miranda, J., Chimeddamba, O. & Marcos, L. G. (2014). The road to 25× 25: how can the five-target strategy reach its goal? The Lancet Global Health, 2(3), e126-e128.

Petrelis M., Domeyer P.R. (2016). The "HEALTH 2020" and Greece. Contribution of general health check and screening. Rostrum of Asclepius/VimatouAsklipiou, 15(3), 223-236.

Special Eurobarometer 458, Attitudes of Europeans towards tobacco and electronic cigarettes, (2017), Fieldwork

Vineis, P., Stringhini, S., & Porta, M. (2014). The environmental roots of non-communicable diseases (NCDs) and the epigenetic impacts of globalization. Environmental Research, 133, 424-430.

Yfantopoulos, J., (2001c) Health-Related Quality of Life., Archives of Hellenic Medicine: 19: 131-146.

Watkins, D., Hale, J., Hutchinson, B., Kataria, I., Kontis, V., & Nugent, R. (2019). Investing in non-communicable disease risk factor control among adolescents worldwide: a modelling study. BMJ global health, 4(2), e001335.

World Health Organization (2003). Making choices in health: WHO guide to cost-effectiveness analysis. edited by T. Tan-Torres Edejer… [et al.]

World Health Organization. (2011). Scaling up action against noncommunicable diseases: How much will it cost?

World Health Organization, (2009)., Global health risks: Mortality and burden of disease attributable to selected major risks., Geneva: World Health Organization.

World Health Organization. (2014). Global status report on noncommunicable diseases 2014 (No. WHO/NMH/NVI/15.1). World Health Organization.

World Health Organization. Management of Substance Abuse Unit. (2014). Global status report on alcohol and health, 2014. World Health Organization.

World Health Organization. (2016). World health statistics 2016: monitoring health for SDGs sustainable development goals. World Health Organization.

World Health Organization. (2017). Cardiovascular diseases (CVDs). Retrieved 9 January 2020, from https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds)