



Cardiovascular risk knowledge and related behaviors among youths: a cross-sectional study in a sample of Italian undergraduates

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Received: 19 May 2023 / Accepted: 22 October 2023
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Abstract

Aim A great number of individual and environmental risk factors have been identified for cardiovascular diseases (CVDs). In the perspective of CVD prevention, people's awareness and risk perception about these factors is fundamental. This cross-sectional study was performed to analyse the undergraduates' knowledge of cardiovascular risk factors and to highlight possible associations between knowledge and adoption of health-related behaviors.

Subject and methods During the years 2021 and 2022, a web-based questionnaire was administered to students from three Italian universities in order to collect their socio-demographic and behavioral characteristics and assess knowledge about a set of factors related with CVDs.

Results A total of 744 students (mean age 23.9 ± 5.4 , 62.5% F) participated in the survey. Nearly 90% of the sample identified correctly the most common factors associated with CVDs, while lower proportions identified the association with the remaining proposed factors, especially the environmental ones. Better knowledge was mainly associated with greater age and attendance of a healthcare-related degree course. No correlations were found between knowledge and healthy behaviors.

Conclusion Information programs about CVD risk and how it can be controlled should be offered to this target population.

Keywords Cardiovascular Diseases · Undergraduate · Risk factors · Lifestyle

Introduction

Cardiovascular diseases (CVDs) are a major public health problem and represent the leading cause of death worldwide, with an estimated 17.9 million people dying each year (WHO 2021). The Italian age-standardized mortality rates are lower respect to those estimates worldwide (113/100,000 vs. 233/100,000), but prevalence of Italian CVDs are in line with the global scenario (age-standardized prevalence equal

to 6.2% vs. 6.3%) (Saglietto et al. 2021). Thus, CVDs are one of the most important public health concern and determine a very relevant socioeconomic loss. For example, Bloom et al. (2012) estimated that, in United States, the management of CVDs alone results in a socio-economic burden of up to \$320 billion annually. Also, estimates of lost Gross Domestic Product (GDP) due to CVDs in the United States is about 11.3 trillions of 2010 USD in the period between 2015 and 2050 (Chen et al. 2018).

Data reported above are inconceivable from a public health point of view considering that there are a great number of modifiable risk factors that contribute to the development of CVDs (Flora and Nayak 2019). Several modifiable incorrect habits and lifestyle or some conditions are well-recognized risk factors for CVDs, such as high blood levels of low-density lipoproteins, cholesterol and triglycerides, high fasting plasma glucose, high systolic blood pressure, impaired kidney function, high Body Mass Index, physical inactivity, improper diet, smoking and alcohol abuse (Roth et al. 2020). In addition to the traditional risk factors for CVDs, ever-increasing scientific

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evidence show that CVDs may be determined by the exposure to several environmental stressors, such as air pollutants present in the atmosphere or indoor, noise, water hardness, marital status and others (Al-Kindi et al. 2020, de Bont et al. 2022, Gianfredi et al. 2017, Hahad et al. 2019, Kim et al. 2020, Münzel et al. 2021, 2022, Wong et al. 2018).

Given the “modifiability” of some of these risk factors, health education campaigns aimed at the general population are a key point in preventing CVDs. However, data on the incidence and mortality of CVDs show that dedicated prevention interventions are still not very effective, especially among young people. In fact, young people often do not know all the risk factors for CVDs and/or have difficulty to perceive the importance of their contribution to the development of these pathologies. A study carried out on a sample of medical students showed that the participants had numerous lacks in terms of knowledge of the CVDs’ risk factors and perception of the role of prevention measures (Reiner 2012). Similarly, another study performed to evaluate the awareness of cardiovascular risk factors among university students in Turkey evidenced the need for increasing the knowledge in this field (Güneş et al. 2019). In contrast, another study found that university students present a good knowledge about CVDs’ risk factors, but did not perceive themselves as at risk for CVDs (Tran et al. 2017). It is important to highlight that the cited studies investigated the knowledge about the most known and traditional risk factor such as drinking, smoking, obesity, hypertension, stress, family history of CVDs, inappropriate diet, diabetes, hypercholesterolemia, and so on.

Considering that health-related behaviors and lifestyles are established at a young age, it is fundamental that youths would be made aware of risk factors associated with CVDs.

The aim of this study is to evaluate, in a sample of Italian university students, the knowledge about a set of traditional and less known cardiovascular risk factors and to assess possible associations between the knowledge and the exposure to them.

Method

The “Study on undergraduates Preparation on cardiovascular Events and Risks” – SPERi - involved undergraduate students from three universities located in central and south Italy. The study was conducted through a web-based questionnaire between January 2021 and December 2022. The investigation was carried out based on the principles of the Declaration of Helsinki. Ethical approval was obtained from the Research Committee of the University of Rome “Foro Italico” (approval n CAR 80/2021).

Participants

Undergraduate students attending the universities of Rome (Sapienza university of Rome and University of Rome “Foro Italico”) and Naples (University of Naples “Parthenope”) were invited to participate. The estimated total population included 120,779 undergraduates. A sample of at least 384 students would have been required, assuming a 95% confidence level and a 50% response proportion.

Patient and public involvement

No patients were involved in this study. Participants were not involved in the design of the study. Aggregated results were presented during lessons at the end of the study.

Questionnaire

A questionnaire was elaborated ad hoc on the basis of other questionnaires already used in previous studies (Reiner et al. 2012, Badir et al. 2015, Dadda et al. 2008, Mosca et al. 2013). Participation was voluntary and anonymous. The questionnaire included different sections focused on the following information: socio-demographic (gender, age, university, year, and degree course attended, nationality, and educational level of parents), habits and lifestyle (smoking, alcohol consumption, physical activity, diet), family and personal history of CVDs, knowledge of CVDs.

The questionnaire was validated by its preliminary administration to a sample of 20 subjects of age and education level similar to the population sample which was then selected for the study. Validation was performed in order to identify any critical issues such as structure, clarity and comprehensibility of questions and answers. After this step, the tool was modified on the basis of the comments and suggestions of the subjects who participated in the validation. The validity of the questionnaire was also examined by analyzing the internal consistency of the items using Cronbach’s alpha statistical index.

The aim of the study and the questionnaire were presented to the students during lessons and administered by means of the Google modules platform. All the answers were coded and added in a database, specifically elaborated for statistical purposes.

Statistical analysis

A descriptive analysis was performed on sociodemographic and behavioral characteristics of participants, and on their answers regarding the identification of the proposed factors as determinants of cardiovascular risk. Continuous variables

were expressed as mean values \pm standard deviation (SD), while categorical variables were expressed as number and percentage values of respondents. Univariate analyses were performed using the chi-squared test to assess possible differences in characteristics of respondents (age lower or equal/higher than median value, female or male gender, parents' degree or not, healthcare or other degree course, and family history of CVDs) for each factor.

Multiple logistic regression analyses were performed by considering the knowledge of each proposed factor as outcome and considering those participants' characteristics which showed significant differences in the univariate analyses for the same factor as independent variables. Significant associations were reported as Odds Ratios and corresponding 95% Confidence Interval (OR 95%CI).

Kendall's correlation analyses were performed between the health-related behaviors declared by participants (consumption of fruit and vegetables, PA or sport, tobacco smoking, alcohol consumption and hours of sleep per night) and their knowledge of the association between the corresponding factors and cardiovascular risk.

The significance level was assumed as $p < 0.05$. Analyses were conducted using the statistical software STATA, version 17.0 (StataCorp LLC, College Station, Texas USA).

Results

A total of 744 complete questionnaires were obtained. Table 1 shows the socio-demographic characteristics and health-related behaviors of participants. The sample had a mean age of about 24 years and a mean BMI of about 23 kg/m² and was composed mainly by women and students from healthcare degree courses. The most commonly reported parents' educational level was high school. A family history of CVDs was reported by about the half of the sample. As for behaviors, about 70% of respondents were non-smokers and alcohol consumers; less than the half of them reported a regular consumption of fruit and vegetables, and nearly the 80% was engaged in some physical activity or sport and slept at least 7 hours per night.

Table 2 highlights the awareness of factors associated with cardiovascular risks among participants. Age, diet, physical activity, tobacco smoking, alcohol consumption, body weight, stress, triglyceride and cholesterol blood levels, blood pressure, personal or family history of CVDs were recognized as factors related with cardiovascular risk by approximately or more than 90% of the sample. However, the relationship between risk and gender, sleep quality, and waist circumference were known by about the half of the sample and, more remarkably, lower proportions of the sample were able to identify the association with the remaining proposed factors.

Table 1 Socio-demographic and behavioral characteristics of the sample (n=744)

Variable	Outcome
Age, mean \pm SD median (IQR)	23.9 \pm 5.4 22 (3)
Gender, n (%)	
female	465 (62.5)
male	279 (37.5)
BMI (kg/m ²), mean \pm SD median (IQR)	22.6 \pm 3.6 22.1 (3.9)
Mother's educational level, n (%)	
mandatory	149 (20.0)
high school	351 (47.2)
degree	244 (32.8)
Father's educational level, n (%)	
mandatory	183 (24.6)
high school	346 (46.5)
degree	215 (28.9)
Educational area	
healthcare	434 (58.3)
other	310 (41.7)
Family history of CVDs	
no	349 (46.9)
yes	395 (53.1)
Smoker	
no	490 (65.9)
yes	254 (34.1)
Alcohol user	
no	242 (32.5)
yes	502 (67.5)
Regular fruit and vegetables consumer	
no	387 (52.0)
yes	357 (48.0)
Engaged in physical activity or sport	
no	149 (20.0)
yes	595 (80.0)
Sleeping at least 7 hours/night	
no	160 (21.5)
yes	584 (78.5)

As for the regression analyses, Table 3 reports the variables that have been found to be associated with the participants' knowledge of each factor related with cardiovascular risk among those which showed significant differences in the univariate analyses (as shown in Electronic Supplementary Material 1).

Higher age was positively associated with the correct identification of almost all the proposed factors as cardiovascular risk determinants but marital status, physical activity, tobacco smoking, previous CVD and outdoor air quality. Female gender was inversely associated with the recognition of the role of age, marital status, sleep quality, waist circumference, and outdoor air quality. Mother's educational level was found to be inversely related with the

Table 2 Participants' knowledge of factors related with cardiovascular risk

Factor	Answers n (%)
Age	
no	47 (6.3)
unsure	25 (3.4)
yes	672 (90.3)
Gender	
no	180 (24.2)
unsure	130 (17.5)
yes	434 (58.3)
Socio-economic level	
no	315 (42.3)
unsure	144 (19.4)
yes	285 (38.3)
Marital status	
no	555 (74.6)
unsure	134 (18.0)
yes	55 (7.4)
Diet	
no	50 (6.7)
unsure	60 (8.1)
yes	634 (85.2)
Physical activity	
no	55 (7.4)
unsure	10 (1.3)
yes	679 (91.3)
Tobacco smoking	
no	13 (1.7)
unsure	16 (2.2)
yes	715 (96.1)
Alcohol consumption	
no	25 (3.4)
unsure	37 (5.0)
yes	682 (91.7)
Sleep quality	
no	115 (15.5)
unsure	152 (20.4)
yes	477 (64.1)
Stress	
no	41 (5.5)
unsure	41 (5.5)
yes	662 (89.0)
Pregnancy	
no	263 (35.3)
unsure	246 (33.1)
yes	235 (31.6)
Menopause	
no	156 (21.0)
unsure	258 (34.7)
yes	330 (44.4)
Body weight	
no	22 (3.0)
unsure	16 (2.2)
yes	706 (94.9)

Table 2 (continued)

Factor	Answers n (%)
Waist circumference	
no	220 (29.6)
unsure	136 (18.3)
yes	388 (52.2)
Blood triglyceride level	
no	21 (2.8)
unsure	53 (7.1)
yes	670 (90.1)
Blood cholesterol level	
no	10 (1.3)
unsure	25 (3.4)
yes	709 (95.3)
Blood pressure	
no	12 (1.6)
unsure	24 (3.2)
yes	708 (95.2)
Previous CVD	
no	14 (1.9)
unsure	6 (0.8)
yes	724 (97.3)
Diabetes	
no	45 (6.0)
unsure	97 (13.0)
yes	602 (80.9)
Family history of CVDs	
no	14 (1.9)
unsure	23 (3.1)
yes	707 (95.0)
Indoor air quality	
no	193 (25.9)
unsure	273 (36.7)
yes	278 (37.4)
Outdoor air quality	
no	181 (24.3)
unsure	270 (36.3)
yes	293 (39.4)
Water hardness	
no	340 (45.7)
unsure	311 (41.8)
yes	93 (12.5)
Noise	
no	523 (70.3)
unsure	165 (22.2)
yes	56 (7.5)

knowledge of the association between previous CVD and cardiovascular risk, while father's degree was positively related with the identification of family history of CVDs as a risk factor. Attending a degree course in the healthcare area was found to be strongly related with a better knowledge of all the factors related with cardiovascular risk but previous CVD and outdoor air quality. Having a family history of CVDs was positively related to the knowledge

Table 3 Results of the logistic regression analyses performed considering the knowledge of CVD risk factors as outcomes

Dependent out-comes	Independent variables					
	Age (>22 years)	Gender (female)	Mother's educational level (degree)	Father's educational level (degree)	Educational area (healthcare)	Family history of CVDs (yes)
Age	1.73 (1.04-2.93) 0.038	0.58 (0.33-0.98) 0.046	n.s.	1.67 (0.88-3.37) 0.13	4.46 (2.59-7.98) <0.001	n.s.
Gender	2.65 (1.89-3.76) <0.001	0.91 (0.64-1.29) 0.600	1.18 (0.78-1.80) 0.400	1.09 (0.70-1.68) 0.700	6.41 (4.53-9.19) <0.001	1.50 (1.08-2.09) 0.016
Socio-economic level	2.26 (1.64-3.14) <0.001	0.74 (0.52-1.03) 0.077	1.32 (0.89-1.95) 0.200	1.14 (0.76-1.70) 0.500	4.64 (3.25-6.71) <0.001	n.s.
Marital status	1.72 (0.98-3.07) 0.062	0.47 (0.27-0.84) 0.010	n.s.	n.s.	2.94 (1.57-5.87) 0.001	n.s.
Diet	1.89 (1.24-2.94) 0.004	0.88 (0.57-1.36) 0.600	n.s.	1.40 (0.85-2.40) 0.200	3.36 (2.17-5.30) <0.001	n.s.
Physical activity	0.95 (0.57-1.61) 0.900	1.44 (0.86-2.41) 0.200				1.77 (1.05-3.02) 0.033
Tobacco smoking	1.81 (0.84-4.13) 0.140	0.64 (0.27-1.40) 0.300	n.s.	n.s.	2.66 (1.24-5.99) 0.014	n.s.
Sleep quality	2.07 (1.51-2.85) <0.001	0.59 (0.42-0.82) 0.002	n.s.	n.s.	2.22 (1.61-3.07) <0.001	1.27 (0.93-1.74) 0.130
Stress	1.73 (1.08-2.84) 0.025	0.72 (0.43-1.18) 0.200			2.66 (1.65-4.35) <0.001	
Pregnancy	1.85 (1.33-2.58) <0.001	0.78 (0.55-1.10) 0.200	1.16 (0.78-1.72) 0.500	1.30 (0.86-1.96) 0.200	3.15 (2.20-4.58) <0.001	1.32 (0.95-1.83) 0.100
Menopause	2.26 (1.64-3.15) <0.001	1.34 (0.96-1.89) 0.086	n.s.	n.s.	5.11 (3.64-7.24) <0.001	1.48 (1.08-2.04) 0.016
Waist circumference	2.47 (1.81-3.38) <0.001	0.62 (0.44-0.86) 0.004	n.s.	1.38 (0.97-1.95) 0.072	3.08 (2.22-4.30) <0.001	1.26 (0.93-1.72) 0.140
Blood triglyceride level	1.87 (1.13-3.15) 0.016	0.75 (0.44-1.25) 0.300	n.s.	n.s.	2.97 (1.79-5.00) <0.001	n.s.
Blood cholesterol level	2.18 (1.07-4.71) 0.038	0.95 (0.46-1.93) 0.900	n.s.	n.s.	2.98 (1.46-6.37) 0.003	n.s.
Blood pressure	2.70 (1.31-6.00) 0.010	1.29 (0.64-2.59) 0.500	n.s.	n.s.	3.41 (1.66-7.43) 0.001	n.s.
Previous CVD	2.07 (0.82-5.94) 0.140	1.41 (0.56-3.48) 0.500	0.33 (0.13-0.81) 0.017	n.s.	n.s.	n.s.
Diabetes	2.01 (1.37-2.98) <0.001	1.06 (0.71-1.56) 0.800	n.s.	n.s.	2.42 (1.65-3.57) <0.001	n.s.
Family history of CVDs	3.32 (1.57-7.67) 0.003	1.18 (0.58-2.38) 0.600	n.s.	4.11 (1.42-17.4) 0.022	3.59 (1.71-8.10) 0.001	1.91 (0.95-3.98) 0.074
Outdoor air quality	0.90 (0.66-1.21) 0.500	0.59 (0.44-0.80) <0.001	n.s.	n.s.	n.s.	0.76 (0.56-1.02) 0.072

of the relationship between gender, physical activity and menopause and CVDs.

Table 4 shows the correlations between participants' knowledge of cardiovascular risk factors and adoption of the corresponding behaviors. Only the inverse association between identification of sleep as a factor related with cardiovascular risk and sleeping at least 7 hours per night was found to be significant.

Discussion

The aim of this investigation was to analyze the knowledge of cardiovascular risk factors in a sample of Italian university students. In general, a high proportion of participants was able to identify the most common risk factors, showing a satisfactory awareness about the issue. However,

Table 4 Kendall's tau correlations between knowledge of cardiovascular risk factors and adoption of the corresponding behaviors

Factor related with cardiovascular risk	Kendall's tau p value	Declared behavior
Diet	-0.02 0.507	Regular fruit and vegetables consumption
PA	0.05 0.197	Regular PA or sport
Smoke	0.03 0.448	Tobacco smoking
Alcohol	0.07 0.053	Alcohol consumption
Sleep	-0.08 0.034	Sleeping at least 7 hours/night

about the half of the sample was not aware of the role of other important factors, such as gender, sleep quality, and waist circumference. Interestingly, a very small part of the sample attributed to environmental factors a role in determining CVDs.

Although the evidence regarding the knowledge of CVD risk among undergraduates is still scarce, previous studies on this topic reported that young people have rather limited awareness of certain risk factors of CVD (Reiner et al. 2012, Aminde et al. 2017).

In 2019, Güneş analyzed the awareness of CVD risk in a sample of healthy university students from Turkey (2019). The majority of the sample, ranging from 72.3% to 44.4%, identified high cholesterol, stress, hypertension, smoking, obesity, diabetes, inactivity, and CVD in family history as main risk factors for CVD; unhealthy diet, exposure to second-hand cigarette smoking, and poor socioeconomic status were also considered to be important by a sample proportion ranging from 15.3% to 34.0%. In line with these results, our findings underline that some risk factors whose association with CVDs has been proven are still unknown by the majority of the sample. This highlights the need of improving the information in the target population regarding cardiovascular risk factors.

Several aspects can influence the individual's level of knowledge about risk factors. In our study, the regression analyses showed that higher age and healthcare educational area were the main predictors of correct knowledge, maybe as a consequence of lived experiences and acquired information. Similarly, Reiner reported that the knowledge of some CVD risk factors was significantly better among graduating students respect to the freshmen; however, even in that study the knowledge of participants, in general, was considered not sufficient (Reiner et al. 2012). As expected, participants attending healthcare educational courses had better knowledge of risk factors than the others. This is in line with the higher level of health literacy found in a previous study among healthcare students from the same undergraduate populations (Gallè et al. 2020). Given

the burden of CVDs, this result highlights the need for improving knowledge about CVD risks in those university students who attend non-healthcare courses.

In addition, our finding show that males seem to be more aware of the relationship between the proposed variables and cardiovascular risk than their female counterparts, even for outdoor air quality. This is in contrast with previous studies in this field whose female participants showed higher awareness of CVD risk than their male counterpart (Güneş et al. 2019, Aminde et al. 2017).

In the perspective of CVD prevention, we also tried to assess the correspondence between knowledge of cardiovascular risk factors and adoption of healthy behaviors. Surprisingly, no significant correlations were found regarding diet, physical activity, tobacco smoking and alcohol consumption. Thus, the knowledge of cardiovascular risk factors does not necessary correspond to the adoption of the corresponding healthy behaviors. This discordance was already reported in literature, even for the same university population (Gallè et al. 2020). Similarly, in the survey by Tran et al. (2017), performed among a sample of college students, participants were knowledgeable on CVD risk factors but did not perceive themselves at risk for CVD. Indeed, people perceive and respond to risks according to several influences such as individuals' attitudes, beliefs, social or cultural values or dispositions; consequently, a better understanding of risk does not lead to a uniform response to it (Institute of Medicine (US) Vaccine Safety Forum 1997). Besides, it is well known that a relevant way to misperceive the occurrence and magnitude of risks is associated to an individual characteristic called "optimistic bias" or "unrealistic optimism", that is the inclination to believe that risks is less serious for oneself than for other persons. For example, a smoker tends to think that smoking may be a threat for the health of other persons but not for him/her own (Paek and Hove 2018). Given the importance of adequately perceiving the risks deriving from unhealthy behaviors in order to change them, it is essential to find ways to increase the perception of these risks.

Only the identification of sleep quality as a factor associated with cardiovascular risk was found to be related with the number of hours slept per night, suggesting that individuals who are not engaged in such a healthy behavior are more aware of its role.

This study has some limitations. First of all, due to the sampling procedure, the sample cannot be considered representative of the undergraduates' population examined. Moreover, the participants' characteristics were not assessed objectively, which could have led to inaccurate information. Furthermore, in order to contain the length of the questionnaire, some aspects which could be related with cardiovascular risk awareness have not been explored.

However, this study offers a picture of the cardiovascular risk knowledge among Italian undergraduates and draws attention on some critical issues that should be addressed through targeted policies.

Notwithstanding a general good awareness about the most common cardiovascular risk factors, the findings of this study show an unsatisfactory level of knowledge about some important individual and environmental aspects in the sample examined. Being older and attending health-care-related degree courses seem to favor a better information on the subject. Worryingly, a better knowledge seems not to be related with healthier behaviors. These aspects should be considered in the perspective of CVD primary prevention. Educational programs for schools and communities should include information about how also the lesser known factors can favor the development of CVDs and how they can be avoided. Universities should offer sensitization programs on CVDs to all the students, regardless of their field of study.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s10389-023-02133-7>.

Author's contributions All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Vittoria Cammalleri, Stefano Zanni, Francesca Gallè, Daniela Marotta, Federica Valeriani and Carmela Protano. The first draft of the manuscript was written by Stefano Zanni, Francesca Gallè, Federica Valeriani, Carmela Protano and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Funding Open access funding provided by Università Parthenope di Napoli within the CRUI-CARE Agreement.

Data availability The data are available from the corresponding author under reasonable request.

Code availability None.

Declarations

Ethical approval Ethical approval was obtained from the Research Committee of the University of Rome "Foro Italico" (approval n CAR 80/2021).

Consent to participate Informed consent was obtained from all individual participants included in the study.

Consent for publication The authors affirm that human research participants provided informed consent.

Conflict of interest The authors declare that they have no relevant conflict of interest.

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