

A breaking down of the Mediterranean diet in the land where it was discovered. A cross sectional survey among the young generation of adolescents in the heart of Cilento, Southern Italy

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Parole chiave: Dieta Mediterranea, abitudini alimentari, survey, studenti, adolescenti, Italia

Abstract

Background. To investigate dietary habits among young people in the Mediterranean lands, exactly where the health benefits of the Mediterranean diet (MD) were discovered by Ancel Keys.

Study design. A cross-sectional study design.

Methods. A 10-items food-frequency questionnaire was administered to 1117 students in the schools of the Cilento area. Adherence to the MD was appraised according to a scale of 0-10. A logistic regression model was used to identify possible factors associated with "Following an unhealthy diet". Results were expressed as Odds Ratio with 95% confidence interval and the level of significance was set at $p < 0.05$.

Results. A percentage of 63.8 reached a score under six, indicating that the majority of the students did not respect the rules of the Mediterranean diet and only 36.2% (n. 371) exceeded a score of 6 adhering to it in varying degrees. At the logistic regression analysis smokers resulted to be affected by almost a double risk of getting away from the Mediterranean dietary pattern (OR = 1.93; CI 95% 1.44-2.57); on the contrary, those with a higher PCS12 (Physical Component Summary score) were in a lower risk to move away from the MD style (OR = 0.98; 95% CI = 0.96-0.99).

Conclusion. Despite its increasing popularity worldwide, adherence to the MD model is decreasing. The new generation of young people does not adhere to the MD pattern although they live in the lands characterized by the tradition and culture of healthy diet and where the benefits from this pattern were initially discovered. Interventions and specific education about the healthy diet may be useful to recover student's dietary patterns as in the old eating tradition.

Introduction

The Mediterranean dietary pattern is a useful tool in the primary and secondary prevention of cardiovascular diseases, and its adoption has significantly beneficial public health implications (1-3).

In fact, the adherence to Mediterranean diet (MD) has long been reported as a model of healthy eating, and it has been widely recognized to be the optimal diet for preventing non-communicable diseases and preserving good health.

The contribution of MD to a favorable

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healthy status and its numerous health benefits are extensively linked with the reduction of cardiovascular disease events – especially with the incidence of recurrent myocardial infarction and cerebrovascular events – of some cancers, and of chronic degenerative diseases and mortality (4) as well as with brain health (i.e., Alzheimer's disease) and cognitive improvement (5, 6).

The selected components of the MD are associated with better cardiovascular health. Especially, a low consumption of meat and meat products, a moderate intake of ethanol (mostly from wine), and a high consumption of vegetables, fruit, nuts, legumes, fish, and olive oil has already been recognized as beneficial in the process of coagulation and inflammation - due to the significant source of antioxidant vitamins provided by MD (7, 8). Furthermore, increasing evidences indicate that the synergy among these components may result in beneficial changes in intermediate pathways of cardio metabolic risk, such as lipids, insulin sensitivity, oxidative stress, inflammation, and vaso-reactivity. Therefore, a Mediterranean dietary pattern may favourably modify numerous cardiovascular risk factors, such as dyslipidemia, hypertension, metabolic syndrome, and diabetes (9, 10).

Also, a recent study reported that adherence to the MD may have a beneficial influence on academic performance in youth, independent of potential confounders, including body mass index, physical activity, fitness, and sedentary behaviour (11). Several plausible mechanisms can explain the protective effect of adherence to the MD on cognition, including antioxidative and anti-inflammatory effects and reduced vascular comorbidities (7, 8).

Other studies reported that the higher academic achievement, in both children and adolescents, were associated with richer intakes of fruits and vegetables (12-16).

Additionally, few studies in adolescents found a beneficial influence of fish

consumption on academic indicators (17-18).

At the contrary, McIsaac et al. found that youth that are moving away from the MD to adopt a less healthy diet (e.g., junk diet), may negatively affect their academic performance (19).

In addition, according to a recent study, MD has beneficial effects also in relation to the physical performance. In fact, in a cohort study (20), individuals in the highest MD adherence group were more likely to be male, less likely to smoke, and more likely to have lower body mass index, higher energy intake, and greater physical activity ($P < 0.05$). Usual and rapid 20-m walking speed were highest in the high MD adherence group than in the other groups. Higher MD adherence was an independent predictor of less decline in usual 20-m walking speed. Over 8 years of follow-up, the group with the highest adherence to the MD performed better at all time points.

At the contrary, a study conducted by Al-Attas et al., has demonstrated that, despite its positive effects on adiponectin, the MD failed to negate the adiponectin-lowering effect of cigarette smoking, demonstrating the profound and independent capacity of cigarette smoke to negatively influence human health (21).

The Mediterranean-style diet is not only a specific diet, but rather a collection of eating habits traditionally followed by people in the different countries bordering the Mediterranean Sea: *“Passed down from generation to generation, it is constantly recreated by communities in response to their environment, their interaction with nature and their history, providing them with a sense of identity and continuity”* (22).

The traditional MD refers to a dietary profile commonly available in the early 1960s in the Mediterranean regions and characterized by an elevated consumption of plant based foods (e.g., fruits, nuts, and

vegetables), a moderate-to-high consumption of fish and seafood, the use of olive oil as the main source of fat, a low intake of red meat and dairy products and a low-to-moderate amount of red wine during meals as typical of Crete, Greece, and southern Italy.

MD's origins lie in the heart Cilento - at Pioppi- from where Ancel Keys, the father of the MD, launched the most famous epidemiological study "Seven Countries Study" (23) that examined the nutritional habits of 12,000 persons aged between 40 and 60, with 20 years of follow up. The large epidemiological study, conducted across seven Nations, resulted in high geographical variability concerning incidence rates for cardiovascular diseases: regions considered from the Mediterranean Basin reported a lower incidence of cardiovascular diseases (CHD) in comparison to Northern Europe countries and USA (24, 25).

Populations that follow the MD pattern showed a 50% lower rate of cardiovascular mortality due to lesser cardiovascular disease and higher longevity (26).

In January 1993, international experts on diet, nutrition, and health convened to review research on the composition and health implications of MD patterns during the past half century. The International Conference on the Diets of the Mediterranean was the first in a series jointly organized by Oldways Preservation & Exchange Trust and the World Health Organization (WHO)/Food and Agriculture Organization (FAO) Collaborating Center in Nutritional Epidemiology at Harvard School of Public Health to describe and evaluate the public health implications of traditional diets. This collaboration led to the development of numerous food guide pyramids reflecting the diversity of worldwide dietary traditions associated with good health.

In 2013, the United Nations Educational, Scientific and Cultural Organization (UNESCO) added the MD to the Representative List of the Intangible Cultural

Heritage of Humanity of Italy, Spain, Portugal, Morocco, Greece, Cyprus, and Croatia (27, 28).

The objective of this study is to investigate dietary habits and lifestyle among students of middle and high schools of the Cilento area, acquiring information on eating habits especially in relation to the score of adherence to the MD pattern.

Methods

A cross-sectional survey was conducted in the first semester of 2014.

Data collection was carried out through a questionnaire created ad hoc for the survey. It was distributed by teachers in middle and high schools. The questionnaire was administered to 1117 students (n. 111 in the middle school - 6 classes - and n.1016 in the high school – 50 classes) attending the school lessons and it was self-compiled.

The proposal of the survey was approved by the head office of each school.

The questionnaire was composed mainly by close-ended type of questions, with multiple response options (except for some answers about age, city of residence and some others) and was administered according to an anonymous, voluntary procedure. The questions were distributed in five sections, namely:

1. Demographics data
2. Diet and food consumption
3. Alcohol consumption
4. SF12 test to determine quality of life concerning physical status (PCS) and mental status (MCS).
5. Tobacco use

Statistical analysis

Data were analysed with the software SPSS 19.0 for Windows.

Descriptive analyses were performed using frequencies, percentages, frequency tables for categorical variables and means \pm

standard deviation (SD) at 95% confidence intervals (95% CI) for quantitative variables.

For the univariate analysis, the chi-square test was performed to evaluate differences for categorical variables.

A logistic regression model was used to identify possible factors associated with unhealthy lifestyle that is “Following an unhealthy diet”. Moreover, gender and year of course, as possible confounders, were included into the regression model such as some other variables (smoking habits and physical activity) that may have affected the outcome variable. Before the analysis all variables were transformed into binary ones: e.g. year of course: <3 vs ≥ 4 . Results were expressed as Odds Ratio (OR) with 95% CI. The approach to the regression model was carried out using the procedure “Backward stepwise (Wald)”; the goodness of the model, “the goodness of fit” of different regression models made, was assessed using the Hosmer-Lemeshow test (29); the level of significance was set at $p < 0.05$.

Outcome measures

The association between determinants and the outcome variable “no-adherence to the MD” was analysed using the binary regression model, where those who did not adhere to the MD resulted in a score < 5 vs those who were adherent to the MD pattern that obtained a MD score. The outcome measures were declared one by one in the binary logistic regression analysis.

Dietary assessment

The usual dietary habits of the participants, over the year preceding enrolment, were assessed with the use of a food-frequency questionnaire (FFQ), which included about 10 food groups that are commonly consumed: cereals, legumes, vegetables, fruits, dairy products, meat, fish, eggs, monounsaturated lipids (mainly olive oil), sugar and sweets.

For each of the items, respondents were asked to report their monthly, weekly, or daily average frequency of consumption in the last 6-12 months. The frequencies of consumption of the food items were reported on an incremental scale with nine levels (never or almost never, 1–3 times per month, once per week, 2–4 times per week, 5–6 times per week, once per day, 2–3 times per day, 4–6 times per day, and more than six times per day) (30). A dietary pyramid developed by CIISCAM (Inter-University Centre for International Studies on Mediterranean Food Cultures) in collaboration with former INRAN (National Institute for Food and Nutrition Research) - now CREA (Research Centre on Foods and Nutrition) - was used to describe the Mediterranean dietary pattern (31).

The MD has been described by the following characteristics: an abundance of plant foods (fruits, vegetables, breads, other forms of cereals, potatoes, beans, nuts, and seeds); minimally processed, seasonally fresh, and locally grown foods; fresh fruit as the typical daily dessert, with sweets containing concentrated sugars or honey consumed only a few times per week; olive oil as the main source of fat; dairy products (principally cheese and yoghurt) only in low-to-moderate amounts; red meat in low amounts; and wine, usually red wine, in low-to moderate amounts, normally during meals (32, 33).

The MD score

Adherence to the MD was appraised according to the score such as that created by Trichopoulou et al. (34). A composite Mediterranean diet score was calculated for each participant on the basis of frequency of foods consumption of the main food groups typical of the Mediterranean diet, where those denoting a positive aspect with regard to the Mediterranean diet are assigned a value of +1 and those with a negative aspect a value of 0 (34, 35).

High MD scores are characterized by high intakes of vegetables, legumes, fruits and nuts, cereals, fish, and olive oil and relatively low intakes of dairy products and meat. The total MD score ranged from 0 (minimal adherence to the traditional MD) to 10 (maximal adherence). Values of 0 or 1 were assigned to each indicated components: people whose consumption of presumed beneficial components (vegetables, legumes, fruits, cereals, fish) was below the recommended frequency consumption were assigned a value of 0, and a value of 1 otherwise. People whose consumption of presumed detrimental components (meat and dairy products) was below the recommended frequency consumption were assigned a value of 1, and a value of 0 otherwise. This MD score can take a value from 0 (minimal adherence) to 10 (maximal adherence). Higher values of this diet score indicate a greater adherence to the MD, whereas lower values indicate adherence to a Westernized diet.

Adherence to the MD was categorized in a binary way as low (score 0–6), or high (score 7–10).

Results

Socio-demographic characteristics

The study was attended by 1117 students, 559 (50%) females and 558 (50%) males. 1094 (97.7%) were Italian and 23 (2.1%) were of other ethnic origin. 111 (9.9%) attended the middle school and 1006 (90.1%) the high school with different orientations (such as agriculture, finance, surveyor, music, nautical sciences, tourism, foreign languages, experimental sciences).

Mean age of all participants was 14.5 years (12.3 for middle schools and 16.7 for high schools).

Eating habits

In the occasion of the opening of the school year, eating habits had “certainly improved” for 128 (24.3%), “moderately improved” for 149 (28.3%). 57 (10.8%) answered “certainly worsened”, 104 (19.7%) “moderately worsened”, 60 (11.4%) “unchanged” and 29 (5.5%) “don’t know”.

Table 1 - Distribution of the Mediterranean Diet score adherence in the adolescents sample

Score	N (distribution of numbers)	(%) with missing data	% without missing data
1,00	2	0.2	0.2
2,00	23	2.1	2.2
3,00	124	11.1	12.1
4,00	215	19.2	21.0
5,00	290	26.0	28.3
6,00	264	23.6	25.8
7,00	80	7.2	7.8
8,00	26	2.3	2.5
9,00	1	0.1	0.1
Total	1,025	91.8	100
Missing	92	8.2	
Total	1,117	100	

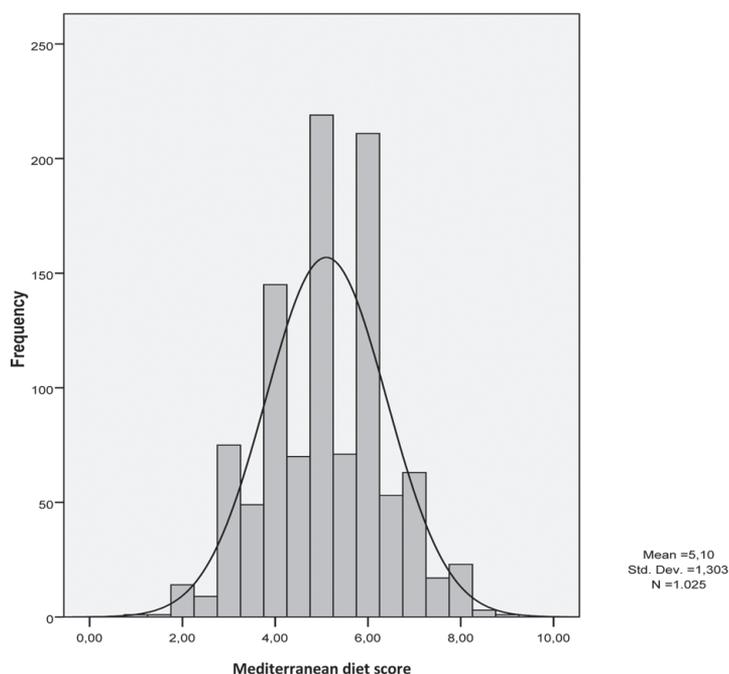


Figure 1 - Histogram of the adherence to the Mediterranean Diet

Score of Adherence to the MD

We were able to calculate the MD score on 1025 students (91.8% of the sample) because the remaining (8.2% of the sample) gave incomplete answers. 654 (63.8%) showed a score < 6, indicating that the majority of the students does not respect the rules of the MD; on the contrary, only 371 (36.2%) exceeded a score of 6, and therefore adhered in varying degrees.

In detail, 64 (25.7%) reached a score of 6, 80 (7.8%) reached a score of 7, 26 (2.5%) reached a score of 8 and X (0.09%) had a score of 9 and no one the maximum score of 10 (Figure 1 and Table 1).

Logistic regression analysis for the outcome “not adhere to the MD”

Values resulted from the analysis were statistically significant in the association with the outcome “non-adherence to the MD”, in fact the independent variable “current

smoking” was a variable “at risk”, that is, those who smoke have almost a double risk of getting away from the Mediterranean Dietary pattern (OR = 1.93; CI 95% = 1.44 – 2.57). At the contrary, those with a higher PCS12 are protected or are at a lower risk of adopting Western-style diet or to move away from the MD style (OR = 0.98; 95% CI = 0.96-0.99). Hosmer-Lemeshow Test was 0.641 (See Table 2).

Considerations and conclusions

The Mediterranean Diet (from the ancient Greek “*diaita*” = way of life) is more than just a defined diet, but it represents the plurality of various cultural expressions of different Mediterranean food cultures and lifestyles.

It constitutes a set of skills, knowledge, practices and traditions ranging from the

Table 2 - Logistic regression analysis. Dependent variable: “non-adherence to the Mediterranean Diet”; Covariates entered into the model: “City of residence > 5000 inhabitants”; “Current smoker”; “PCS12”; “MCS12”; “Sex”; “Year of curriculum”. Method: Backward Stepwise (Wald)

Covariates	Dependent variable “non- adherence to the Mediterranean Diet”			
	Crude OR	95% CI	Adjusted OR Exp (B)	95%CI
City of residence: > 5000 inhabitants (vs <5000)	1.14	0.9-1.44	1.10	0.84-1.44
To be a smoker: yes (vs no)	1.73	1.34-2.24*	1.93	1.44-2.57*
PCS12: higher (vs lower)	0.97	0.96-0.99*	0.98	0.96-0.99*
MCS12 higher (vs lower)	0.99	0.98-1	0.99	0.98-1
Sex (M vs F)	1.11	0.88-1.41	1.03	0.78-1.36
Years of attendance: middle (vs high schools).	0.94	0.86-1.03	0.94	0.86-1.03
<i>Hosmer-Lemeshow test</i>			5.358	

*statistically significant

landscape to the table, in total respect of the territory and of biodiversity. The MD is characterized by a nutritional model that has remained constant over time and space, consisting mainly in an elevated consumption of fruits, nuts and vegetables, a moderate-to-high consumption of fish and seafood, the use of olive oil as the main source of fat, a low intake of red meat and dairy products and a low-to-moderate amount of red wine during meals, always respecting beliefs and traditions of each community.

Nevertheless, our study reveals that in a Mediterranean area (Cilento) which gave birth, in the past,

to the MD, and where MD was a fundamental component of a healthy way of life, a tradition and a culture, there has been a complete break in eating habits from one generation to another.

The MD in fact is a documented model of healthy diet that always represented the dietary pattern of many populations from the Mediterranean areas (36). Diets consumed by Mediterranean populations have been a subject of interest since antiquity, with more recent investigations focused on their evident health benefits (37-39).

Benefits of the MD in fact suggest that widespread adoption of this dietary strategy could have significant public health implications, being able to lead to the prevention of degenerative pathologies and to an improvement in life expectancy, a net gain in health and a reduction in total lifetime costs (1).

Provided that there is a worldwide trend toward a dietary uniformity, classic MD may become a kind of “endangered species”, and research is needed to define the ways in which such traditional and healthful dietary patterns could be preserved and promoted.

Despite its documented healthiness, compliance with MD is low in non-Mediterranean countries, maybe because non-Mediterranean populations may find it difficult to comply with a diet which is foreign to them (40, 41). To the point that many Italian-style foods have been adopted but after a procedure of “Americanization”, which has made them far higher in energy, fat, cholesterol, and sodium than the traditional foods from which they were derived.

But also in the Mediterranean area adherence to MD has decreased, and a possible cause of this phenomenon could be

the increasing prices of some of the major food items of the Mediterranean pyramid; this seems to have led people to give up this eating pattern in favour of less expensive products that allow people to save money, but that are unhealthy (1).

Our results clearly show how the youth population of a Mediterranean area (exactly where Ancel Keys discovered the benefits of that dietary pattern!) left the consumption of typical foods of the MD and replaced them with those foods typical of the Western world, introduced into Italy by the Anglo-Saxons after the 2nd WW, based mainly on animal fats and red meat, devoid of the protective effects against cardiovascular and metabolic diseases. To the same conclusions came several observational studies investigating the eating habits of Italian population, so that health promotion of young generations is becoming a priority (42-46).

Based on these facts, it is imperative initiating appropriate programs of prevention and health promotion in the various schools and in particular a promotion of proper nutrition, especially designed on the basis of specific peculiarities emerged from this investigation.

In addition, our results suggest that to be a smoker and to perform a reduced physical activity level could be a risk factor to move away from a healthy dietary pattern. In line with the literature, an unhealthy lifestyle (smoking, sedentarity) and a high body mass index are associated with an unhealthier diet (47).

It is increasingly being recognized that interventions which target more than one risky behaviour may be a more efficient way of improving people's lifestyles (48), and the specific education about the healthy diet is necessary to revert the dietary patterns of the young generations to the old eating traditions. Such interventions have the potential for greater health benefits, maximisation of health promotion opportunities, more adequate tailoring

to participants' behavioural profiles, and reduction of healthcare costs (49).

Worldwide, despite the increasing popularity of the beneficial effects arising from the adherence to the MD model, multifactorial influences – lifestyle changes, food globalization, economic and sociocultural factors - have jeopardized the healthy eating habits so much to pose threats to the preservation and transmission of the MD heritage to future generations. Today's challenge is to reverse such trends, especially in young populations living in the lands where the Mediterranean food tradition and culture are handed down from ancient times. Interventions and specific education about the healthy diet may be useful to recover dietary patterns as in the old eating tradition.

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Authorship: G.L.T. designed the study, and together with R.S. wrote the protocol and oversaw all aspects of the study. G.D.P. collected data from the sample, administering the questionnaire. R.S. conducted and performed the statistical analysis and wrote all the sections of the manuscript. M.S. contributed to the discussion and to the English language supervision. All Authors contributed to and approved the final manuscript.

Riassunto

La Dieta Mediterranea esiste ancora nella generazione di giovani che vivono nelle terre del Cilento, cuore delle tradizioni e della cultura Mediterranea? Una survey tra gli adolescenti.

Background: indagare le abitudini alimentari tra i giovani che vivono nelle terre del Cilento, luogo in cui è stato scoperto il valore della Dieta Mediterranea (DM) e gli effetti benefici sulla salute delle popolazioni che strettamente aderivano ai canoni di tale regime alimentare.

Disegno dello studio: Studio osservazione di tipo cross-sectional (survey).

Metodi: È stato somministrato un questionario (food-frequency questionnaire) di 10 items a 1117 studenti delle scuole del Cilento. L'aderenza alla DM è stata valutata tramite una scala con range 0-10. È stato utilizzato un modello di regressione logistica al fine di identificare possibili fattori che potessero influenzare l'esito "aderire a una alimentazione non salutare".

Risultati: Sono stati espressi in Odds Ratio (OR) con intervalli di confidenza (IC) posti al 95% e con livello di significatività di $p < 0.05$. Una percentuale di 63.8 ha raggiunto uno score < 6 , indicando che la maggior parte degli studenti non aderisce ai canoni della DM e solo il 36.2% (n. 371) superava lo score di 6, aderendo in diversi gradi alla DM. L'analisi di regressione logistica ha dimostrato come i giovani fumatori avessero un rischio di circa il doppio di non aderire a un pattern alimentare di tipo Mediterraneo (OR = 1.93; CI 95% 1.44-2.57); al contrario coloro che avevano ottenuto un PCS 12 (Physical Component Summary scores) più elevato avevano maggiori probabilità di aderire a una dieta salutare come quella Mediterranea (OR = 0.98; 95% CI = 0.96-0.99).

Conclusioni: Nonostante il valore e gli effetti benefici della DM siano riconosciuti oggi in tutto il mondo, l'aderenza alla DM è andata nel tempo via via decrescendo. La nuova generazione di giovani, e in questo caso di coloro che vivono nelle terre in cui sono stati individuati gli effetti benefici sulla salute dei propri antenati, tendono ad allontanarsi dalle tradizioni e dalla cultura culinaria propria di quelle aree che affacciano sul bacino del Mediterraneo.

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