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ORIGINAL ARTICLE

Mass media information and adherence to Mediterranean diet: results from the Moli-sani study

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Abstract
Objective To investigate the association between mass media information, dietary habits and risk factors for cardiovascular disease in an Italian adult population.
Methods Subsample of 1,132 subjects (mean age 53 ± 10, 50% men) enrolled in the Moli-sani Project, a population-based cohort study. A specific questionnaire on exposure to information from various media sources was elaborated, validated, and administered. A mass media exposure score was obtained from principal component analysis of ten items of media exposure. Dietary habits were assessed based on eating patterns obtained from principal component analysis of 45 food groups derived from the EPIC food frequency questionnaire and by the Mediterranean score.
Results In a multivariable general linear regression analysis including age, sex, social status, physical activity, C-reactive protein, total calories intake, three dietary patterns or Mediterranean score, higher media exposure was positively associated with adherence to a Mediterranean-like eating pattern ($P = 0.0018$) as well as to the Mediterranean score ($P = 0.0005$).
Conclusions Exposure to mass media information is significantly associated with greater adherence to both Mediterranean diet and Mediterranean-like eating pattern, an association that public health strategies should take into account.

Keywords Mass media exposure · Mediterranean diet · Cardiovascular risk factors

Introduction

It is widely recognized that exposure to mass media sources can deeply influence people's behavior, affecting both lifestyles and health. Previous studies have linked Television viewing (TV) to adverse cardiovascular outcomes and obesity in adults (Cleland et al. 2008; Wijndaele et al. 2010; Tucker and Bagwell 1991; Tucker and Friedman 1989), children and adolescents (Jackson et al. 2009). In addition, TV has been strongly associated both with metabolic syndrome (Mark and Janssen 2008; Chang et al. 2008) and elevated cardiovascular risk, and was found to be a predictor of cardiovascular and all-cause mortality risk (Wijndaele et al. 2011; Dunstan et al. 2010). In the US, as well as all over the Western world, TV rates were dramatically increased during the past decades becoming one of the main leisure-time activities.

The majority of the studies conducted so far consider mass media exposure as a measure of sedentary activity rather than a behavior-conditioning source (Hu et al. 2003). Yet other Authors (Redelmeier and Stanbrook 2003) suggested that association between prolonged TV watching

On behalf of the Moli-sani Project Investigators. Moli-sani Project Investigators are listed in the Appendix 1.

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and risk of obesity may be ascribed to TV content rather than to reduced exercise. The latter hypothesis is quite difficult to prove as TV is just one of the mass media information offerings, besides newspaper and magazine reading and Internet surfing. Thus, little evidence is available on the role of mass media information in promoting behavioral models.

Although the exposure to mass media messages—conceived as a more complete indicator than simply TV watching or surfing the Web—is reportedly associated with either unhealthy food choices (Cleland et al. 2008) and behaviors, evidence is still weak on its association with eating pattern and resulting health outcomes. Evaluating how and to what extent exposure to media information might affect behavior, mainly healthy food choice, might help defining new strategies in prevention of cardiovascular disease.

The aim of the present study was to investigate the effect of mass media information exposure per se, not just as a mere indicator of physical inactivity, on several parameters of cardiovascular risk with particular regard to dietary habits.

Methods

Study population

The Moli-sani Project is a population-based cohort study which randomly recruited 24,325 citizens of Molise, a region placed between Central and Southern Italy. The study enrolled men and women aged ≥35 years, randomly recruited from subjects included in the city-hall registries of Molise (Iacoviello et al. 2007). Exclusion criteria were pregnancy, disturbances in understanding/willing processes, ongoing poly-traumas or coma, and refusal to sign the informed consent; 30% of subjects refused to participate; these were generally older and had a higher prevalence of cardiovascular disease.

Dietary information

The validated Italian EPIC food frequency questionnaire (FFQ) was used to determine food intake (Pala et al. 2003; Pisani et al. 1997). The questionnaire, computerized with tailor-made software, allowed us to interview participants in an interactive way, including illustrations of sample dishes of definite sizes or by reference to standard portion sizes. To simplify interpretation of data and to minimize within-person variations in intakes of individual foods, 188 food items were classified into 45 predefined food groups on the basis of similarity in nutrient characteristics or culinary usage.

Data collection

Body mass index (BMI) was calculated as kg/m^2. Waist circumferences were measured according to the NIH, Heart, Lung, and Blood guidelines (Janssen et al. 2002). Blood pressure was measured by an automatic device (OMRON-HEM-705CP) three times on the non-dominant arm and the average of the last two values was taken as the BP. Hypertension, diabetes, and dyslipidemia were defined as self-reported health professional-diagnosis and anti-hypertensive, anti-diabetics or lipid-lowering medication use. Socio-economic status was defined as a score based on eight variables (income, education, job, housing, ratio between the number of live-in partners and the number of rooms (both current and in the childhood) and availability of hot water at home in the childhood); the highest the score, the highest the level of socio-economic status. Physical activity was assessed by a structured questionnaire (24 questions on working time, leisure time, and sport participation) and expressed as daily energy expenditure in metabolic equivalent task-hours (MET/d). The risk of fatal cardiovascular events at 10 years was calculated using the CUORE risk equation (http://www.cuore.iss.it/).

Metabolic syndrome (MetS) was defined according to Adult Treatment Panel III criteria (NCEP 2001). Serum lipids and glucose were assayed by enzymatic reaction methods using an automatic analyzer (ILab 350, Instrumentation laboratory (IL), Milan, Italy). LDL-cholesterol was calculated according to Friedewald. High sensitivity C-reactive protein (CRP) was measured in fresh serum, by a latex particle-enhanced immunoturbidimetric assay (IL Coagulation Systems on ACL9000). Inter- and intra-day CV were 5.5 and 4.17%, respectively.

Mass media exposure questionnaire

A questionnaire on mass media information exposure was developed by our Science Communication Unit. The questionnaire included ten questions on (a) newspaper, magazine and specialized press reading frequency; (b) whether subjects feel inclined to receive information on health and prevention from a list of different sources, and (c) whether they use the Internet to visit press agency websites or for reasons other than checking their own mail. We did not take into account time spent sitting watching TV, since we do not believe it might provide any clue on quality information, while participants were asked how often they use to watch TV-news. The description and sorting of the items are illustrated in Table 1. The questionnaire was administered to a sub-sample of the Moli-sani Project cohort.

All subjects ($n = 1{,}132$) recruited in the Moli-sani study from May 2009 to April 2010 (end of the whole Moli-sani

Table 1 Factor loadings of the Mass Media exposure information score empirically derived by PFA in 959 men and women from the Moli-sani Project (Italy, 2011, Moli-sani Project)

Questions	Possible answers (one answer only)	Factor loading
How often do you watch TV news?	Many times a day	0.57
	Every day	
	Some days a week	
	Some days a month	
	Never or almost never	
How often do you buy newspapers per week?	Daily	0.52
	4–5 times	
	A couple of times	
	Never or almost never	
How often do you read newspapers not bought directly by you (bar, doctor, dentist)	Daily	0.47
	4–5 times	
	A couple of times	
	Never or almost never	
How often do you buy weekly newspapers in a month?	Once a week	0.47
	A couple of times	
	Never or almost never	
How often do you read weekly newspapers not bought directly by you in a month? (bar, doctor, dentist)	Once a week	0.44
	A couple of times	
	Never or almost never	
How often do you buy monthly magazines in a year?	Once a month	0.41
	Less than 4 times per year	
	Never or almost never	
How often do you read monthly magazines not bought directly by you in a year?	Once a month	0.39
	Less than 4 times per year	
	Never or almost never	
Have you ever received information on health and prevention?	Yes	0.36
	No	
Do you read newspapers on line when surfing the Internet?	Yes	0.23
	No	
Do you read press agency on line when surfing the Internet?	Yes	0.11
	No	

Project recruitment) were asked to fill the self-questionnaire; participants reporting missing values for media exposure were excluded. The final study sample was 959 subjects. The 173 subjects who were excluded from the analysis were comparable for sex distribution but were older ($P < 0.0001$) and had a lower social status ($P < 0.0001$) in comparison with the 959 subjects who were included in the analysis. It is likely that the questionnaire on mass media information exposure—which was self-administered—was too articulated to be completed by older people and those having lower social status because they might find the questionnaire, largely addressing modern technologies, too far away from their daily experience, and refrained from completing it properly. Yet the 959 analyzed subjects were comparable with the whole Moli-sani Project population in terms of sex distribution, social status, cardiovascular disease, and metabolic syndrome prevalence, BMI, cardiovascular risk and dietary patterns, whereas mean age was only slightly lower (52.8 ± 9.6 vs. 55.6 ± 11.9).

To establish validity, test–retest method was used. The questionnaire was administered twice, with a 2-week separation, to a group ($n = 27$) of researchers at the Catholic University of Campobasso. Cronbach's alpha was used to estimate internal consistency reliability of questionnaire.

Statistical analysis

The mass media exposure score was obtained using principal component analysis (PCA). The purpose of PCA is to derive a small number of components that can account for the variability found in a relatively large number of measures. This procedure, called data reduction, is typically performed when a researcher does not want to include all of the original measures in analyses, but still wants to work with the information that they contain. PCA was conducted on the correlation matrix of the ten items in the mass media exposure (predictors) and determines linear functions of predictors (named factors) that explain as much predictor variation as possible. In determining the number of factors to retain in PCA we used the criterions of an eigenvalue >1.0, the scree test and the interpretability of the final solution (Kim and Mueller 1978). The correlations between each extracted factor and predictors are called factor loadings. Each subject was attributed, for each pattern, a factor score, calculated by summing all the predictors, each weighted by factor loadings. The application of the PCA to our database clearly indicates the existence of a single factor, whose loadings are illustrated in Table 1. Ranking of the factor in tertiles allowed to classify subjects in three different levels of exposition as light, moderate, and heavy.

Food consumption patterns were generated using PCA conducted on the correlation matrix of the 45 food groups (Centritto et al. 2009). Three main factors emerged with PCA, in agreement with previous findings in the same population (Centritto et al. 2009). The first pattern, named "Olive Oil and Vegetables", was characterized by high positive loadings of olive oil, vegetables, legumes, soups, fruits, and fish. The second pattern, named "Pasta and Meat", was characterized by high positive loadings of pasta, cooked tomatoes, red meat, animal fats and alcoholic beverages, and negative loadings of breakfast cereals, and yogurt. The "Eggs and Sweets" pattern was characterized by high positive loadings of eggs, margarines, processed meat, sugar, and sweets Table 5 in Appendix 2.

We evaluated the adherence to Mediterranean diet using the Mediterranean diet score (MDS) elaborated by Trichopoulou et al. (2003) which was obtained by assigning a value of 0 or 1 to each of nine indicated components with the use of the sex-specific median as the cut-off. The total Mediterranean- diet score ranged from 0, which indicates the minimal adherence to the traditional Mediterranean diet, to 9, namely the maximal adherence.

CRP was transformed into natural logarithm to reduce positive skewness, but data were reported untransformed for clarity. Values for continuous variables are mean ± SD.

The potential predictors tested for association with tertiles of the score of media exposure included socio-demographic variables (age, sex, smoking habit, and social status), serum lipid concentrations (total-, HDL, and LDL-cholesterol, and triglycerides), systolic and diastolic blood pressure, blood glucose, BMI, waist to hip ratio, physical activity (expressed as MET/d), cardiovascular risk score, and C-reactive protein. We also considered the association between mass media information exposure and two different definitions of metabolic syndrome.

Generalized linear models (PROC GENMOD in SAS) were used for testing the association of mass media exposure classification (considered as the dependent variable) with potential predictors. The multivariable models were built up as follows: (a) simple univariable analysis was used to identify variables associated with light, moderate, and heavy mass media exposure at the level $P < 0.10$ adjusted for age and sex; (b) the variables identified in step a) were inserted in a full model all together. The data analysis was generated using SAS/STAT software, Version 9.1.3 of the SAS System for Windows©2009. SAS Institute Inc. and SAS are registered trademarks of SAS Institute Inc., Cary, NC, USA.

Results

Validation

Mass media exposure score was not different between test and retest groups (paired t test $P = 0.40$) and the two scores were highly correlated ($r = 0.84$, $P < 0.0001$). The reliability of test for items used in media exposure score was 0.66 (as measured by Cronbach's Alpha, standardized).

Mass media information exposure and population characteristics

Table 2 shows the characteristics of the sub-sample of the Moli-sani Project population who completed the mass media information exposure questionnaire.

In univariable analysis people heavily exposed to information showed a significantly higher social status ($P < 0.0001$), lower level of physical activity ($P = 0.014$), and reduced levels of CRP ($P = 0.031$) (Table 2).

In the multivariable analysis controlled for age and sex, heavy mass media exposure remained inversely associated with physical activity ($P = 0.0063$) and positively linked to lower levels of CRP ($P = 0.04$) and higher social status ($P < 0.0001$) (Table 2).

Association between dietary patterns and mass media information exposure

The heavy mass media information exposure group showed a higher adherence to the pattern "Olive Oil and Vegetables" both in age/sex adjusted model ($P = 0.0002$) and in the multivariate model ($P = 0.0018$) which included social status, daily energy intake, physical activity, PFA pattern "Pasta and Meat", PFA pattern "Eggs and Sweets", CRP (Table 2). Data are corroborated by the trend observed in the heavily exposed group which shows a significantly lower adherence to the PFA pattern "Pasta and Meat" compared with the light-moderate exposed groups, either in the univariate model ($P = 0.39$) or in the sex–age adjusted model ($P = 0.035$) (Table 2). Similar results were found when social status was replaced by educational level in multivariable model ($P = 0.0027$ and $P = 0.034$ for "Olive oil and vegetables" and "Pasta and Meat" patterns, respectively).

In regard to MDS, subjects in the heavy mass media information exposure group reported higher score than those in the light and moderate categories both in the sex–age adjusted model ($P = 0.0008$) and in the two multivariable models ($P = 0.0005$ with social status and $P = 0.0008$ with adjustment for education) suggesting that the more people are exposed to information, the more they follow the Mediterranean diet. Yet the difference between heavy and light mass media exposure in Mediterranean score was less than one point (Table 2). Moreover, subjects more exposed to information had higher consumption of fruits and fish ($P = 0.0031$ and $P = 0.0007$, respectively, in multivariable analysis) and lower intakes of animal fats ($P = 0.029$ in multivariable analysis) (Table 2).

Stratification for social status

To further investigate the role of social status and education, we performed additional analyses stratified for these variables. After stratifying by social-status, the same trends recorded in general population were observed (Table 3). Subjects in high, medium, or low social-status categories showed an increasing adherence to both Mediterranean-like eating pattern and MDS according to mass media information exposure (Table 3).

Table 2 Score of media exposure obtained from principal component analysis of $n = 10$ items (Italy, 2011, Moli-sani Project)

Population characteristics	All ($N = 959$)	Categories of mass media information exposure			*P* value		
		Light ($n = 319$)	Moderate ($n = 320$)	Heavy ($n = 320$)	Univariable	Sex/ age adj	Multivariable*
Age (years)	52.8 (9.6)	53.1 (10.3)	52.3 (9.3)	52.9 (9.2)	<0.0001	–	0.10
Female *n*, (%)	480 (50)	187 (58.6)	156 (48.7)	137 (42.8)	0.0003	–	<0.0001
Male *n*, (%)	479 (50)	132 (41.4)	164 (51.2)	183 (57.2)			
Smokers *n*, (%)					0.039	0.11	
Never	402 (41.9)	154 (48.3)	115 (35.9)	133 (41.6)			
Current	263 (27.4)	78 (24.4)	98 (30.6)	87 (27.2)			
Former	294 (30.7)	87 (27.3)	107 (33.4)	100 (31.2)			
Socio-economic status	7.4 (2.35)	6.58 (2.05)	7.41 (2.28)	8.12 (2.45)	<0.0001	<0.0001	<0.0001
Physical activity (MET-h/day)	43.8 (8.1)	44.8 (8.7)	43.8 (8.2)	42.8 (6.5)	0.014	0.0063	0.22
BMI (kg/m^2)	27.9 (4.7)	28.1 (4.8)	27.8 (4.7)	27.9 (4.6)	0.75	0.72	
WH-ratio	0.89 (0.08)	0.89 (0.08)	0.89 (0.08)	0.89 (0.08)	0.17	0.96	
Systolic blood pressure (mmHg)	134.4 (18.8)	134.2 (18.4)	135.3 (19.4)	133.7 (18.8)	0.80	0.47	
Diastolic blood pressure (mmHg)	81.7 (9.3)	81.8 (9.2)	82.2 (9.5)	81.2 (9.1)	0.47	0.32	
Metabolic syndrome (ATPIII) *n*, (%)	240 (25.2)	86 (27.1)	79 (24.8)	75 (23.7)	0.59	0.58	
Metabolic syndrome (IDF) *n*, (%)	352 (36.9)	121 (37.9)	114 (35.7)	117 (36.9)	0.85	0.91	
CVD risk	4.3 (5.6)	4.1 (4.9)	4.6 (6.3)	4.2 (5.3)	0.061	0.32	
Total cholesterol (mg/dL)	207.7 (44.8)	209.6 (45.3)	205.5 (45.7)	207.9 (43.5)	0.42	0.51	
HDL cholesterol (mg/dL)	55.8 (15.2)	57.4 (15.8)	54.6 (14.3)	56.4 (15.5)	0.064	0.20	
LDL cholesterol (mg/dL)	126.9 (36.9)	128.2 (38.3)	125.9 (37.6)	126.5 (34.8)	0.65	0.73	
Triglycerides (mg/dL)	125.7 (82)	124.1 (74.1)	127.1 (76.6)	125.8 (94.1)	0.41	0.89	
Blood glucose (mg/dL)	100.8 (30.6)	99.4 (25.5)	100.8 (34.5)	102.1 (31.02)	0.53	0.64	
CRP (mg/L)	2.28 (2.7)	2.45 (2.78)	2.30 (2.80)	2.06 (2.57)	0.031	0.04	0.16
Energy intake (kcal/day)	2,084 (596)	2,066 (651)	2,061 (555)	2,121 (575)	0.056	0.32	0.36
Alcohol intake (g/day)	14.3 (19.6)	14.1 (21.8)	13.8 (18.7)	15.03 (18.2)	0.73	0.34	
Dietary pattern 1 (Olive Oil and Vegetables)	−0.012 (0.80)	−0.11 (0.82)	−0.04 (0.74)	0.11 (0.82)	0.0014	0.0002	0.0018**
Dietary pattern 2 (Pasta and Meat)	0.11 (0.85)	0.13 (0.89)	0.14 (0.84)	0.055 (0.83)	0.39	0.035	0.068**
Dietary pattern 3 (Eggs and Sweets)	0.15 (0.83)	0.12 (0.91)	0.13 (0.79)	0.19 (0.78)	0.41	0.52	0.73**
Mediterranean Medscore	4.37 (1.61)	4.09 (1.62)	4.42 (1.64)	4.61 (1.54)	0.0003	0.0008	0.0005***
Fruits (g/day)	323.2 (175.8)	296.7 (165.6)	329.3 (190.3)	343.3 (167.1)	0.0008	0.0024	0.0031
Fish (g/day)	23.14 (17.5)	19.5 (15.6)	24.3 (18.2)	25.5 (18)	<0.0001	<0.0001	0.0007
Animal fats (g/day)	1.71 (1.52)	1.85 (1.45)	1.70 (1.63)	1.56 (1.48)	0.43	0.04	0.029

* Adjusted for sex, age, total energy intake, social status, physical activity and C-reactive protein

** Adjusted for sex, age, total energy intake, physical activity, C-reactive protein and the other two dietary patterns

*** Adjusted for sex, age, total energy intake, physical activity and C-reactive protein

Both in the high and low educated group, adherence to Mediterranean diet (both Mediterranean-like eating pattern and Mediterranean score) followed the gradient of mass media information exposure (Table 4).

Discussion

Exposure to information delivered by mass media was associated with a greater adherence to both Mediterranean diet and Mediterranean diet-like eating pattern in a representative large sample of a general adult Italian population. We measured global information offered by mass media by a specific score to provide a reliable assessment of how people are exposed to media message on a regular basis.

We avoided to consider just the time subjects were engaged in activities such as sitting and watching TV or standing at the desk while surfing the Internet: these measures are useful to assess inactivity (Hu et al. 2003; Gao et al. 2007) but are less effective in determining whether

Table 3 Mass media information exposure and dietary patterns according to stratification by socio-economic status (SES) (Italy, 2011, Moli-sani Project)

Low SES	Categories of mass media information exposure			*P* value	
	Light ($n = 153$)	Moderate ($n = 110$)	Heavy ($n = 78$)	Univariable	Multivariable
Dietary pattern 1 (Olive Oil and Vegetables)	−0.14 (0.81)	−0.01 (0.73)	0.05 (0.69)	0.18	0.26*
Dietary pattern 2 (Pasta and Meat)	0.15 (0.95)	0.18 (0.88)	0.22 (0.81)	0.85	0.22*
Dietary pattern 3 (Eggs and Sweets)	0.09 (0.82)	0.17 (0.81)	0.19 (0.82)	0.58	0.51*
Mediterranean Medscore	4.09 (1.68)	4.62 (1.62)	4.72 (1.48)	0.0055	0.010**
Medium SES	**Categories of mass media information exposure**			***P* value**	
	Light ($n = 105$)	Moderate ($n = 106$)	Heavy ($n = 94$)	Univariable	Multivariable
Dietary pattern 1 (Olive Oil and Vegetables)	−0.13 (0.81)	−0.13 (0.73)	0.17 (0.69)	0.013	0.03*
Dietary pattern 2 (Pasta and Meat)	0.17 (0.86)	0.28 (0.86)	0.11 (0.77)	0.33	0.04*
Dietary pattern 3 (Eggs and Sweets)	0.16 (1.04)	0.15 (0.82)	0.30 (0.75)	0.44	0.79*
Mediterranean Medscore	4.00 (1.54)	4.19 (1.56)	4.52 (1.54)	0.059	0.04**
High SES	**Categories of mass media information exposure**			***P* value**	
	Light ($n = 58$)	Moderate ($n = 103$)	Heavy ($n = 148$)	Univariable	Multivariable
Dietary pattern 1 (Olive Oil and Vegetables)	−0.01 (0.82)	0.02 (0.73)	0.11 (0.69)	0.52	0.12*
Dietary pattern 2 (Pasta and Meat)	0.03 (0.77)	−0.06 (0.75)	−0.06 (0.86)	0.72	0.78*
Dietary pattern 3 (Eggs and Sweets)	0.10 (0.89)	0.08 (0.76)	0.14 (0.78)	0.81	0.16*
Mediterranean Medscore	4.29 (1.60)	4.43 (1.72)	4.60 (1.58)	0.43	0.48**

* Adjusted for sex, age, total energy intake, physical activity, C-reactive protein and the other two dietary patterns

** Adjusted for sex, age, total energy intake, physical activity and C-reactive protein

Table 4 Mass media information exposure and dietary patterns according to stratification by education (Italy, 2011, Moli-sani Project)

Higher education ($n = 482$)	Categories of mass media information exposure			*P* value	
	Light ($n = 103$)	Moderate ($n = 172$)	Heavy ($n = 206$)	Univariable	Multivariable
Dietary pattern 1 (Olive Oil and Vegetables)	−0.083 (0.80)	−0.020 (0.74)	0.14 (0.86)	0.04	0.015*
Dietary pattern 2 (Pasta and Meat)	0.0073 (0.82)	0.082 (0.84)	−0.0013 (0.85)	0.6	0.22*
Dietary pattern 3 (Eggs and Sweets)	0.17 (0.83)	0.069 (0.77)	0.19 (0.76)	0.29	0.54*
Mediterranean Medscore	3.95	4.37	4.62	0.0020	0.015**
Lower education ($n = 476$)	**Categories of mass media information exposure**			***P* value**	
	Light ($n = 213$)	Moderate ($n = 146$)	Heavy ($n = 114$)	Univariable	Multivariable**
Dietary pattern 1 (Olive Oil and Vegetables)	−0.12 (0.83)	−0.07 (0.74)	0.07 (0.75)	0.10	0.09*
Dietary pattern 2 (Pasta and Meat)	0.20 (0.91)	0.20 (0.85)	0.16 (0.79)	0.89	0.06*
Dietary pattern 3 (Eggs and Sweets)	0.092 (0.95)	0.20 (0.83)	0.22 (0.82)	0.35	0.76*
Mediterranean Medscore	4.17 (1.71)	4.47 (1.63)	4.59 (1.56)	0.06	0.04**

* Adjusted for sex, age, total energy intake, physical activity, C-reactive protein and the other two dietary patterns

** Adjusted for sex, age, total energy intake, physical activity and C-reactive protein

people do receive real information or just entertainment (Redelmeier and Stanbrook 2003).

Whereas previous studies had shown that massive exposition to TV is linked to adverse cardiovascular outcomes such as increased overweight, obesity (Cleland et al. 2008; Wijndaele et al. 2010; Tucker and Bagwell 1991; Tucker and Friedman 1989), and metabolic syndrome (Mark and Janssen 2008; Chang et al. 2008), the present study, where an alternative measure of mass media usage was performed, mainly focused on information, and provides different results showing that the more the subjects get informed the more they stick to healthy eating habits.

On the basis of our findings, we speculate that information resulting from a balanced mix of different sources could positively influence people's food choices, leading them to combine healthy foods in their diet (Reger et al. 1999; Freisling et al. 2010) independently from other possible confounding factors such as social status.

In Italy, this could be partially ascribed to the growing attention mass media information is paying to nutrition, wellbeing, and good lifestyle in general. Newspapers, magazines, websites, radio, and TV broadcasting news are giving more and more space to health-related issues regarding nutrition, physical activity, quitting smoking, and management of body weight (Hornik and Kelly 2007). Mediterranean diet, even before being listed by UNESCO among world's cultural heritage (http://www.unesco.org/culture/ich/en/RL/00394; Bonaccio et al. 2011), has always received impressive media coverage on Italian press, generating a high level of interest towards this topic and a sense of national pride for culinary traditions typical of our Country. This may help explaining the linkage between high mass media information exposure and a greater adherence to Mediterranean-like eating pattern.

Limitations of the study

A major limitation of the present study is its cross-sectional nature which is a limit of epidemiological studies of this kind. Nevertheless, this type of investigation is useful to set new hypotheses to be tested in future prospective studies. Second, caution is needed in extending the results presented here to larger contexts since data were collected in a region located between Central and Southern Italy, Mediterranean by tradition and culture (Iacoviello et al. 2007). Yet, the main characteristics of our sample are comparable to those of the Italian Cardiovascular Epidemiological Observatory (Giampaoli et al. 2009), a large survey including random samples of the general population all over Italy; therefore our sample could be considered representative of the Italian population.

A third limit is related to the fact that due to the structure of the questionnaire, mainly addressing issues related to modern technologies, older people might have found it too difficult to complete. In fact the population included in the analysis was almost 3 years younger than the whole Moli-sani project sample and this was the only remarkable difference. Nevertheless, further studies should address this issue to include also older people in the analysis.

Fourth, our score of mass media information exposure was unable to define the type and quality of information subjects were exposed to, but only how much they were exposed to mass media information.

Potential confounding factors could be represented by social status and education which are potentially linked both to a better information level and adherence to healthy dietary pattern (Darmon and Drewnowski 2008). However, adjustment and stratification for social status index or educational levels did not influence the association between mass media exposure and adherence to Mediterranean-like eating pattern and MDS.

Conclusions

In conclusion, mass media do not necessarily represent a threat to public health, as suggested by previous studies, but they can play a positive role in promoting healthy behaviors through propagating balanced information. A role that public health strategies should take into account. In order to gain maximum advantage from mass media delivered messages, future research should extend knowledge on an issue not addressed by this study, namely analyzing the content quality of information sources.

Ethical issues The Moli-sani Project was approved by the Ethics Committee of the Catholic University, Rome. Participants signed an informed consent form before taking part in the study.

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Conflict of interest All authors had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. None of the authors had a personal or financial conflict of interest.

Appendix 1

Moli-sani Project Investigators

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Appendix 2

See Table 5.

Table 5 Food grouping used in the dietary pattern analyses

Foods or food groups	Food items
Potatoes	Potatoes
Cooked vegetables	Leafy vegetables, root vegetables, cabbages, onion, carrots, mushrooms, egg plants, artichokes, sweet peppers, spinach, pumpkins, canned vegetables in oil, picked vegetables
Raw vegetables	Raw leafy vegetables, raw tomatoes
Tomatoes (cooked)	Tomato sauces, tomatoes
Legumes	Beans, lentils, peas, chick peas
Fruit	Apples, pears, kiwi, bananas, grapes, peaches, apricots, oranges, tangerines, plums, strawberries, melon, khaki, figs, cherries
Nuts and dried fruit	Peanuts, almonds, hazelnuts, walnuts, dried figs, dried dates, prune
Olives	Olives
Milk	Milk
Yogurt	Yogurt
Fresh cheese	Mozzarella, ricotta cheese, taleggio cheese, gorgonzola cheese, melted cheese slices, other soft cream cheese
Seasoned cheese	Fontina cheese, emmenthal, gruyere, parmesan, caciocavallo cheese, other seasoned cheese
Pasta and other grains	Pasta, yellow maize meal
Rice	Rice
Bread	White bread, bread with oil and other bread
Crisp bread, rusks	Breads sticks, crisp bread
Breakfast cereals	Breakfast cereals
Salty biscuits	Crackers
Red meat	Beef, pork, lamb, horse, game, veal, other meats
White meat	Chicken, turkey, rabbit
Processed meat	Sausages, ham, bologna sausage, dried beef, salami
Offals	Liver, offals
Canned fish	Canned tuna fish and other fish
Crustaceans, molluscs	Crustaceans, molluscs
Fish	Other fish
Egg	Eggs

Table 5 continued

Foods or food groups	Food items
Vegetables oils	Seed oils (except olive oils)
Olive oil	Olive oil
Butter	Butter
Margarines	Margarines
Animal fats	Visible fat from meat, poultry skin, fat from ham
Sugar & sweets	Sugar, honey, cakes, ice cream, confections, pastry, pudding
Fruit juices	Orange juice, grapefruit juices, other fruit juices
Soft drinks	Soft drinks
Coffee	Coffee
Tea	Tea
Other sauces	Dressing sauces for pasta other than tomato sauce
Mayonnaises	Mayonnaises
Soups	Vegetable soups
Bouillon	Meat and stock-cube broth
Snacks	Vegetable quiche
Pizza	Pizza
Wine	Red wine, rosé wine, white wine
Spirits	Alcoholic beverages other than wine or beer
Beer	Beer

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