

Eating habits in the population of the Aeolian Islands: an observational study

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Abstract

Objective: We conducted a study to describe food profile, health status and stroke risk factors in the population of the Aeolian Islands.

Design: Self-administrated questionnaires regarding eating habits, health status and stroke risk factors were obtained from a sample of the general Aeolian population. We analysed the difference from common healthy eating habits indicated by the Italian Institute of Nutrition.

Setting: Current evidence finds the Mediterranean diet is a protective factor for cardio- and cerebrovascular diseases. The Aeolian Islands are an interesting study setting because of their peculiarity in the epidemiology of cerebrovascular and neurodegenerative diseases.

Participants: Individuals (n 586; age range 15–93 years; mean 52 (sd 18) years) living in the Aeolian Islands.

Results: We found low fish consumption in 13.3% and vitamin intake deficiency in 5.8% of participants. A marked excess of saturated fats was observed in 71.0% of participants. Sodium excess was reported almost in half of participants (49.0%). Eating habits were characterized by high consumption of fruits and vegetables, consistent use of olive oil and scanty use of cured meat. Health status as evaluated by the General Health Questionnaire was characterized by 'normal distress' level in the majority of participants.

Conclusions: Study findings show the eating habits and health status of the Aeolian people in an interesting setting of low incidence of cerebrovascular disease. This nutrition regimen has been proved to be protective against cerebrovascular disease. Nutrition is likely to contribute to the low incidence of stroke in this population.

Keywords
Mediterranean diet
Cerebrovascular diseases
Aeolian Islands
Nutrition
Health status

The Aeolian Islands are part of the Mediterranean basin and are an interesting study setting since they can serve as an example of the Mediterranean cradle and because of their peculiarity in the epidemiology of cerebrovascular diseases⁽¹⁾, epilepsy⁽²⁾ and neurodegenerative diseases⁽³⁾. In this area the incidence and prevalence of these conditions are, indeed, lower than in other developed areas.

Mediterranean diet not only indicates nutritional education, but it is a concept that involves behavioural and lifestyle recommendations inspired by foods and ingredients available in the Mediterranean area. It represents a standard of healthy eating that aims to improve the global health status of the individual and to promote an

improvement of the quality of life⁽⁴⁾. The diet is based mainly on some ingredients such as vegetables, fruits and fish, and a moderate wine consumption during meals. Previous findings reported that strict adherence to the Mediterranean diet is associated with a significant overall health improvement, a reduction in total and cardiovascular mortality, cancer morbidity and mortality^(5–11), and a decrease in the risk of neurodegenerative conditions such as Parkinson's and Alzheimer's diseases^(12–17), as well as the risk of stroke^(18–24). Altogether, the currently available evidence suggests that the Mediterranean diet may be a protective factor against cardio- and cerebrovascular diseases^(25–27).

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A previous epidemiological study performed on the population of the Aeolian Islands demonstrated a lower incidence rate of first-ever stroke compared with similar Italian or international studies⁽¹⁾. Thus, we conducted the present study to describe the food profile, health status and stroke risk factors in the population of the Aeolian Islands to investigate if dietary habits of the Aeolian people differ from other regions.

Methods

Setting and study population

The Aeolian Islands include seven Sicilian volcanic islands off the north-eastern coast of Sicily. Population count was 13 431 inhabitants at the 2001 census and is equally distributed among urban and rural areas. Agriculture, fisheries and tourism are the main working activities. The climate is Mediterranean, with mild winters (temperature does not reach 0°C) and hot and sunny summers (the highest temperature recorded is 39°C). Medical care is guaranteed from the National Health Service, through ten general practitioners, ten first-aid stations and one public general hospital.

We considered all individuals > 14 years old registered in the lists of the general practitioners in the Aeolian Islands. All general practitioners in the Aeolian Islands accepted to collaborate in the present study. Data from the general practitioners' electronic databases included clinical and demographic information regarding the entire population of the Aeolian Islands. Individuals unable to feed autonomously or undergoing any type of enteral or parenteral nutrition were excluded. Randomly selected individuals were telephonically contacted by their general practitioner and invited to a face-to-face interview within two weeks.

Study design

All enrolled participants filled in self-administered questionnaires regarding: (i) eating habits (FFQ); (ii) health status (General Health Questionnaire (GHQ)); and (iii) stroke risk factors (familiarity of stroke, hypertension, cigarette smoking, dyslipidaemia, CVD, diabetes mellitus and cerebrovascular disorders, oral contraceptives use and headache).

The FFQ is the most common dietary assessment tool used in large epidemiological studies of diet and health and has been recently validated in the Italian language⁽²⁸⁾. The self-administered FFQ booklet asks participants to report weekly frequency of consumption, portion size and distribution of meals. Nutrient analyses were performed by computer software (Diet*Calc Analysis Program version 1.4.3; National Cancer Institute, 2005), thus obtaining deviations from eating habits indicated in the 'Guidelines for healthy feeding' from the Italian Institute of Nutrition

and identifying the main mistakes and nutritional risk factors. Findings of the FFQ were also used to indirectly assess total energy intake and vitamin deficiency using the same software analyses.

The GHQ⁽²⁹⁾ is a self-administered report that measures three aspects of psychological health status: (i) depression and anxiety; (ii) social dysfunction; and (iii) loss of trust. Based on the participants' answers, a score of psychological distress was computed for each of them: (i) <16 (normal); (ii) 16–20 (medium); and (iii) >20 (severe).

To better assess eating habits according the age-related stroke risk factors, we divided the population into three subgroups: (i) <46 years; (ii) 46–65 years; and (iii) >65 years.

Sample size calculation and statistical analysis

The sample size was determined considering the number of inhabitants at the 2001 census (N 13 431) aged between 15 and 93 years, stratified by sex and age group, by means of the following equation:

$$n = \frac{z_{\alpha/2}^2 N}{4(N-1)\theta^2 + z_{\alpha/2}^2},$$

where $1-\alpha$ is the CI, $z_{\alpha/2}$ is the value of the standard normal and θ is the error margin. Thus, we obtained n 586 as a representative sample size of the Aeolian population, considering a level of confidence equal to 90% and the error margin equal to 3%.

We calculated the percentage rate and related 95% CI of eating habit deviations from the Italian Institute of Nutrition guidelines and the percentage frequencies of BMI categories, stroke risk factors, FFQ and GHQ scores. For consumption of the principal ingredients, as listed in the FFQ, '1+2 times', '4+5+6 times' and 'more than 6 times+ in every meal' were merged together, to make data more reliable. When considering age group (<46, 46–65 and >65 years old), absolute frequencies were compared with the χ^2 test. The level of significance was set at $P < 0.05$.

Results

Initially, 671 individuals were contacted for the enrolment. Eighty-five denied their consent or refused to participate. A total of 586 individuals (age range 15–93 years; mean 52 (SD 18) years) accepted to participate in the study; 267 were men (45.6%) and 319 women (54.4%). Participants' characteristics and stroke risk factors are shown in Table 1; 6.3% suffered from diabetes and 1.27% had a previous stroke. Almost 40% of the study population was overweight and almost 40% was normal weight.

Eating habits

Weekly consumption frequencies of main foods (percentage rates) are summarized in Table 2. Percentage rates

and 95% CI of deviations from the Italian Institute of Nutrition guidelines are shown in Tables 3–5. Data from the FFQ evidenced low fish consumption in 13.3% and vitamin intake deficiency in 5.8% of the participants. Excess intake of simple sugars and of animal protein was observed in 8.9 and 5.0%, respectively. We did not observe large differences between males and females

Table 1 Characteristics and conventional stroke risk factors of the Aeolian population sample (*n* 586), June 2007

Characteristic/risk factor	<i>n</i>	%
Age (years), mean	586	52
SD		18
Sex (male)	267	45.6
Migraine (and headache)	129	22.0
Hypertension	120	20.5
Smoke	84	14.3
Hypercholesterolaemia	79	13.5
Familiarity for stroke	67	11.5
Cardiopathy	43	7.3
Diabetes	37	6.3
Oral contraceptives	19	3.2
Previous stroke	7	1.3
BMI		
Severe thinness (<16.0 kg/m ²)	1	0.2
Moderate thinness (16.0–16.9 kg/m ²)	3	0.4
Underweight (17.0–18.5 kg/m ²)	22	2.6
Normal weight (18.5–24.9 kg/m ²)	230	39.4
Overweight (25.0–29.9 kg/m ²)	220	37.6
Moderate obesity (30.0–39.9 kg/m ²)	108	18.5
Severe obesity (≥40.0 kg/m ²)	7	1.3

except for sodium and calcium intakes. Interestingly, we observed a marked excess of saturated fats (71.0% of people), especially in younger participants. Sodium excess was found almost in half of the participants (49.0%). When considering age groups, we noticed less inappropriate energy intake and less sodium excess in people aged >65 years. Notably, the Aeolian population exhibited a high consumption of olive oil (77.7% used it every day), a very low use of other fats (seed oil, butter, margarine), a scanty use of cured meat (60% never used it) and a low consumption of milk products.

Although not statistically significant, participants aged >65 years showed higher fibre deficiency (40.3%), people aged 46–65 years showed high excess of fats (36.7%) and, notably, higher excess of simple sugars was observed in younger participants (12.2%).

Data on daily alcohol consumption are shown in Table 6. Alcohol consumption was very scanty: almost 95% of the population denied intake of beer or hard liquor. Wine was consumed in moderation (23.6% consumed one or two glasses of wine daily).

Health status

The GHQ evidenced a 'normal distress' level in the majority of participants, whereas a significant increase of 'severe distress' was observed in older people (>65 years old; Table 7).

Table 2 Weekly consumption frequencies of main foods (percentage rates) in the Aeolian population sample (*n* 586), June 2007

	Cereals		Vegetables–legumes–fresh fruit			
	Pasta/rice	Bread/crackers	Vegetables	Legumes	Minestrone	Fresh fruit
Never or rarely	10.3	23.8	13.5	13.5	29.1	13.9
1–2 portions	8.9	2.0	16.9	45.7	48.1	5.1
3 portions	10.1	4.1	22.8	23.1	11.5	2.7
4–7 portions	47.3	32.9	39.0	16.1	10.3	32.9
Each meal or almost	23.5	37.2	7.7	1.5	1.0	45.4
	Meat/fish		Milk products			
	Meat	Cured meat	Fish	Cheese	Milk	Yoghurt
Never or rarely	38.4	59.9	15.7	50.0	63.5	81.8
1–2 portions	15.9	18.5	44.5	14.7	6.0	7.4
3 portions	22.1	8.7	18.7	12.3	3.9	4.4
4–7 portions	21.6	12.2	18.8	19.9	20.7	5.5
Each meal or almost	2.0	0.7	2.2	3.1	5.8	0.9
	Eggs	Sweets				
Never or rarely	25.4	29.9				
1–2 portions	54.7	41.9				
3 portions	12.9	9.3				
4–7 portions	5.4	15.6				
Each meal or almost	1.0	3.4				
	Added fats during or after preparation					
	Olive oil	Seed oil	Butter	Margarine	Mayonnaise	
Never or rarely	9.8	93.8	97.9	99.3	96.4	
Often	12.5	4.8	1.9	0.5	2.4	
Always or almost	77.7	1.4	0.2	0.1	1.2	

Table 3 Percentage rates (and 95 % CI) of deviations from the Italian Institute of Nutrition guidelines among the Aeolian population sample (n 586), June 2007

	n	%	95 % CI
Excess of saturated fats	415	71.0	67.1, 74.6
Inappropriate energy distribution	397	67.9	64.0, 71.7
Calcium intake deficiency	356	60.9	56.8, 64.9
Sodium excess	286	49.0	44.8, 53.1
Energy excess	276	47.1	43.0, 51.2
Fibre deficiency	213	36.5	32.6, 40.6
Fats excess	185	31.8	28.0, 35.7
Low fish intake	78	13.3	10.7, 16.3
Excess of simple sugars	51	8.9	6.7, 11.5
Vitamin intake deficiency	34	5.8	4.0, 8.0
Excess of animal protein	28	5.0	3.3, 7.0

Table 4 Percentage rates (and 95 % CI) of deviations from the Italian Institute of Nutrition, by sex, among the Aeolian population sample (n 586), June 2007

	Females			Males			χ^2
	n	%	95 % CI	n	%	95 % CI	
Inappropriate energy distribution	206	64.6	59.0, 69.8	192	71.9	66.1, 77.2	3.5
Energy excess	142	44.5	39.0, 50.2	134	50.2	44.0, 56.3	1.9
Excess of animal protein	14	4.4	2.4, 7.3	15	5.6	3.2, 9.1	0.5
Excess of saturated fats	221	69.2	63.9, 74.3	195	73.0	67.3, 78.3	1.0
Fats excess	98	30.7	25.7, 36.1	88	33.0	27.4, 38.9	0.3
Excess of simple sugars	24	7.5	4.9, 11.0	28	10.5	7.1, 14.8	1.6
Sodium excess	144	45.1	39.6, 50.8	143	53.6	47.4, 59.6	4.1*
Fibre deficiency	108	33.9	28.7, 39.3	106	39.7	33.8, 45.8	2.1
Calcium intake deficiency	181	56.7	51.1, 62.2	176	65.9	59.9, 71.6	5.1*
Vitamin intake deficiency	14	4.4	2.4, 7.3	20	7.4	4.6, 11.3	2.6
Low fish intake	46	14.4	10.8, 18.8	32	12.0	8.3, 16.5	0.7

Significant difference between men and women: * $P < 0.05$.

Table 5 Percentage rates (and 95 % CI) of deviations from the Italian Institute of Nutrition, by age group, among the Aeolian population sample (n 586), June 2007

	Age < 46 years		Age 46–65 years		Age > 65 years		χ^2
	%	95 % CI	%	95 % CI	%	95 % CI	
Excess of saturated fats	80.2	74.2, 85.4	71.7	65.1, 77.6	57.7	49.3, 65.4	22.6**
Inappropriate energy distribution	70.8	64.2, 76.8	71.2	64.6, 77.2	59.6	51.6, 67.2	7.0*
Calcium intake deficiency	56.8	49.8, 63.5	64.1	57.2, 70.6	62.1	54.1, 69.6	2.5
Sodium excess	58.2	51.2, 64.9	50.4	43.5, 57.3	34.7	27.4, 42.6	20.4**
Energy excess	47.4	40.5, 54.3	49.5	42.6, 56.4	43.4	35.6, 51.5	1.3
Fibre deficiency	37.5	31.0, 44.4	32.5	26.2, 39.3	40.3	32.7, 48.3	2.5
Fats excess	28.1	22.2, 34.7	36.7	30.2, 43.6	29.8	22.8, 37.5	4.0
Low fish intake	14.0	9.7, 19.4	10.8	7.0, 15.8	15.5	10.3, 22.0	1.9
Excess of simple sugars	12.2	8.1, 17.3	5.6	2.9, 9.6	8.7	4.8, 14.1	5.6
Vitamin intake deficiency	6.1	3.2, 10.2	5.6	2.9, 9.6	5.5	2.5, 10.3	0.0
Excess of animal protein	6.5	3.6, 10.7	3.3	1.3, 6.6	4.9	2.1, 9.5	2.4

Significant difference between age groups: * $P < 0.05$, ** $P < 0.0001$.

Discussion

The relevance of the Mediterranean diet in the prevention of CVD has been known since 1986, when Keys *et al.* reported low incidence of mortality and CVD in a cohort from the Greek island of Crete in the Seven Countries Study⁽³⁰⁾. We have already reported a low incidence of cerebrovascular

diseases⁽¹⁾ in our population from the Aeolian Islands and in the current study we observed an excess of saturated fat, a high use of fish, a high consumption of fruits and vegetables, and a constant use of olive oil.

Fish consumption at least one or two times weekly has been demonstrated to exert a strong protective action against stroke^(18,31–34). Notably, 44.5% of our study

Table 6 Percentage rates of daily alcohol consumption among the Aeolian population sample (*n* 586), June 2007

	Wine	Beer	Hard liquor
Never or rarely	71.2	93.7	98.3
1–2 glasses	23.6	5.0	1.2
3 glasses	2.9	0.7	0.0
4–5 glasses	1.9	0.7	0.3
6 or more glasses	0.3	0.0	0.2

Table 7 Percentage rates of responses to the General Health Questionnaire, by age group, among the Aeolian population sample (*n* 586), June 2007

	Age < 46 years	Age 46–65 years	Age >65 years
Normal stress (<16)	89.5	82.6	70.7
Moderate stress (16–20)	7.0	6.6	8.0
Severe stress (>20)	3.5	10.7	21.3

$\chi^2 = 28.795$; $P < 0.0001$.

population consumed fish once or twice weekly and 37.5% of the people consumed three to seven portions per week. The elevated frequency of fresh fruit and vegetable consumption observed in the Aeolian population (45.4% had them in almost every meal) reproduced the classic features of the Mediterranean diet⁽⁴⁾.

Studies performed in different countries showed an inverse relationship between stroke and fruit and vegetable use⁽³⁵⁾. A protective dose-dependent effect has been confirmed by a meta-analysis⁽³⁶⁾. Fruit and vegetable intake of more than 5 portions/d is associated with a marked reduction in the relative risk of stroke^(36,37). Vitamins, antioxidants, phenolic compounds, folates, minerals, hormones, plant enzymes and dietary fibre are probably the protective factors determining the evidenced positive effects^(4,5,25). Sodium excess (49.0%) and calcium intake deficiency (60.9%) found in the Aeolian participants were probably balanced by a relevant ingestion of potassium-rich foods such as fruits, vegetables and legumes which show anti-hypertensive effects and possible consequences on hypertension and risk of stroke^(38,39–50).

The use of olive oil in the Aeolian diet is another favourable factor to prevent vascular risk and has a beneficial role in reducing LDL-cholesterol and increasing HDL-cholesterol. Moreover, olive oil seems to be associated with a reduction of systolic and diastolic pressure, due to the presence of other chemicals that have a vasodilator effect (polyphenols increase nitric acid)^(51–53).

Wine, beer and spirits were used by only a third of our Aeolian participants. In a meta-analysis, daily mild-moderate use of alcohol during meals has been proved to be a protective factor against cerebrovascular ischaemic diseases^(54,55).

It is possible to evoke an association between the Aeolian dietetic profile and the low incidence of stroke

previously reported⁽¹⁾; our hypothesis can be further supported by the significant role of diet on the risk of stroke and the correlation with many nutrients and risk factors of stroke (hypertension, diabetes, obesity, hyperhomocysteinaemia)^(56,57). However, causality is difficult to determine, and further studies are needed to clarify the independent role of the diet on the risk of stroke and cerebrovascular diseases. There are many confounders that need to be considered. For instance, there are differences in cerebrovascular risk factors between Aeolian inhabitants and the Italian population. In fact, hypertension, which is present in 31% of the Italian population⁽⁵⁸⁾, has been identified in 20.5% of Aeolian people; and smoking, present in 22% of Italian people⁽⁵⁹⁾, in our sample is present in 14.3% of participants. Conversely, the prevalence of diabetes was 6.3% in the Aeolian Islands whereas it was 4.6% in Italy, and the prevalence of hypercholesterolaemia was 13.5% in the Aeolian Islands *v.* 8.5% in the Italian population⁽⁵⁹⁾. Interestingly, obesity (defined as BMI ≥ 30.0 kg/m²) was present in 18.5% of our sample and is higher than in the Italian general population (9.1%)⁽⁵⁸⁾. This discrepant finding seems to be related to the excess of energy present in the diet of 47.1% of Aeolian people along with the limited physical activity.

Finally, we evaluated health status through the GHQ. We found a significant increase of distress in older people (>65 years old), probably due to the lack of social activities on the islands that are mainly based on tourism and agriculture. However, in the majority of our sample we found a 'normal distress' level.

Strengths and limitations

The present study provides a descriptive analysis of the eating habits of 586 Aeolian people and is the first study that analyses the eating habits of the population of the Aeolian Islands, an interesting setting for its peculiarity in the incidence of neurological diseases. The population of these islands represents a confined and limited sample of the population of the Mediterranean basin.

Major limitations include the observational design and the small sample size. We also did not confirm by biochemical tests the vitamin deficiency and potassium intake, instead these were estimated indirectly by the quantity and quality of foods eaten. We did not include in the analysis some typical local foods, such as nuts or capers, key components of the Mediterranean diet, and lifestyle and physical activity. Finally, 13% of the individuals invited chose not to participate in the study and thus the presence of selection bias cannot be excluded.

Conclusions

Our study showed the eating habits of the population of the Aeolian Islands. This nutrition regimen was proved to

be protective against cardio- and cerebrovascular diseases. It is reasonable to argue that the protective effect of the diet and the level of psychological distress found in Aeolian people might contribute to the low incidence of stroke found in the population.

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