# Dietary Intake of Free-Living Elderly in Northern Greece

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**ABSTRACT.** The aim of the present study was to investigate the nutrient intake of a non-institutionalized Greek elderly population. Dietary intake and anthropometric data were investigated in 100 elderly subjects from Grevena, Greece, all belonging to the race of "Hasiotes." According to BMI classification, 48% of the subjects are considered overweight and 20% obese. WHR for women and men was 0.91 and 0.98, respectively. Both genders presented insufficient energy intake (7.27 ± 3.49MJ/d) in 3 ± 0.9 feeding sessions daily. Mean protein and fiber intake was 0.82 ± 0.43 and 0.29 ± 0.2g/kg BW, respectively. The diet presented insufficient amounts of vitamins A, B6, D, E, K, Biotin, Pantothenic acid, Cu, I, Mg, Mn and Zn. Female subjects exhibited low dietary intake of vitamins B2, B3 and Ca. The diet had many characteristics of the traditional

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Mediterranean diet and comprised of a high intake of goat-milk yoghurt, olive oil, goat cheese, traditional alcohol drinks, pies, legumes, fruits and meat. The majority of the sample (70%), reported fasting on Orthodox celebrations. Further research should assess adherence to the Mediterranean diet with the use of scores and compare diet characteristics to other regions in Greece, in order to present regional differences in Greek diet variations. doi:10.1300/J052v26n01_08 

**KEYWORDS.** Macronutrient, micronutrient, traditional diet, Greek, Mediterranean diet

## *INTRODUCTION*

The diet of elderly Europeans is of increasing concern. The European population as a whole is ageing, being fed on monotonous diets, poor in nutrients (Schroder et al., 2004; Pala et al., 2006). In order to promote health and longevity in both institutionalized and free-living elderly, scientists have suggested adherence to the Mediterranean diet (Polychronopoulos, Panagiotakos & Polystipioti, 2005; Lasheras, Fernandez & Patterson, 2000; Osler & Schroll, 1997; Trichopoulou et al., 1995). The particular diet has many intracultural variations within Greece, due to different races or influences by neighboring countries (Ferro-Luzzi, James & Kafatos, 2002). Scientists, who examined dietary intake in several regions throughout Greece, have presented diets with different proportions of macronutrient contribution to the total energy intake (Keys, Aravanis & Sdrin, 1968; Trichopoulou & Efstathiadis, 1989; van de Vijver et al., 2000), all under the term "Mediterranean diet." In addition, various foods have been proposed as the basic energy clusters of the Mediterranean diet, depending on the study setting (Ferro-Luzzi, James & Kafatos, 2002). Each one of these diet variations is equally important as, it is the overall Mediterranean dietary pattern that is more important for the health and longevity of the Greeks, and not the single nutrients (Trichopoulou, 2001).

It has been suggested (Kouris-Blazos et al., 1996; Trichopoulou, Kastouvanni & Gnardellis 1993; Trichopoulou & Efstathiadis, 1989) that the elderly living in rural areas might comprise a representable sample of traditional Greek diet, since they are less influenced by western-type culture and remain loyal to customs and traditional cuisine. However,

only two studies exist in literature that examined the diet of Greek elderly in rural Crete as part of the Mediterranean diet (Kafatos et al., 1993; Euronut SENECA Investigators, 1991). Although rural elderly samples could provide information on the variations of the Mediterranean diet, most research uses them as part of general population samples (Trichopoulou et al., 2005; Trichopoulou et al., 2005b; Blackberry et al., 2004). Literature on the diet of the Greek elderly population is limited and is focused mainly on immigrants in Australia (Wahlqvist, Kouris-Blazos & Wattanapenpaiboon, 1999; Kouris-Blazos et al., 1996) or in comparing institutionalized and free-living individuals in urban Greece (Papanikolaou, Hassapidou & Andrikopoulos, 1999).

The aim of the present study was to examine the dietary habits of the elderly population of the Hasiotes, a local race, who live in the mountainous area of Grevena, in Greece and present their dietary pattern as a variation of the well-known "Mediterranean diet."

## *SUBJECTS AND METHODS*

Research took place during the summer of 2006. The sample consisted of 100 free-living non-institutionalized adults aged > 60-years-old (Mean age 69.02 ± 6.23 years), from the area of Grevena, the town of Deskati and Dasohori village. The subjects were autochthons that had descendance from the Hasiotes, a race that gave its name to the local mountains, the Hasia Mountains. Participants were selected by their family names, as the family names of the Hasiotes have certain desinences. All of the selected elderly were eager to participate in the study as the local diet had never been recorded. The sample consisted of 58 women aged 69.12 ± 6.46-years-old, and 42 men, aged 68.88 ± 5.98-years-old. Participants were all elderly people, because they remain intact to traditions and customs and would represent more accurately a race's dietary habits (Kouris-Blazos et al., 1996; Trichopoulou et al., 1993; Trichopoulou & Efstathiadis, 1989). Subjects were informed of the nature of the study and gave their written consent before participating. Approval for the research was obtained from the Alexander Technological Educational Institute of Thessaloniki.

### *Nutritional Assessment*

A qualified dietician visited the subjects in their home and interviewed them with the use of a standard 2-part questionnaire. The first

part included a 3-day 24 h recall that involved 2 weekdays and a weekend day; for each recall, the interview took place one day after the recorded day in order to assure that subjects still remembered the amount and quality of their food intake. In order to help subjects estimating portion sizes, standard food portions (National Dairy Council, 1990) were used. Data was analyzed using Food Processor 7.4 software (ESHA Research, Portland, Oregon) with the addition of Greek recipes (Trichopoulou, 1982). Nutrient intake was compared to the RDA in order to estimate risks for possible nutrient deficiencies.

The second part of the questionnaire involved a semi quantitative food frequency questionnaire (Gnardellis et al., 1995), with emphasis on selected food groups characterizing the Mediterranean diet (Trichopoulou et al., 1995), in order to minimize interview time and avoid tiring the subjects. Local pie recipes and dishes were also added in the food frequency questionnaire.

### *Physical Activity Assessment*

Energy expenditure was calculated with a three-day activity record that accompanied the 24 h food intake recalls. For the calculation of each participant's basal metabolic rate (BMR), the formulae suggested by the UK Department of Health was used (1991), as it is age-adjusted. Physical activity level (PAL) was assessed with the Bouchard et al. method (1983). PAL was multiplied to BMR in order to calculate energy expenditure for each day and the mean of the three examined days was compared to the dietary energy intake for each participant.

### *Health and Sociodemographic Variables*

Several sociodemographic, health and dietary habits related variables were recorded with the use of a simple, multiple-choice questionnaire. These included marital status, level of education, health status, number of meals consumed every day, snacking and fasting habits.

### *Anthropometry*

Anthropometric data, body weight (BW) and height were taken by the same physician, in morning hours, with the use of an analog portable weight scale with a stadiometer (SECA 789), which was calibrated daily during the measurements. All subjects were able to perform the measurements (step on scale, keep straight body, etc.). Waist and hip perimeter

were measured by the same physician, with the use of a common measuring tape. Waist-to-hip ratio (WHR) and Body Mass Index (BMI) were calculated from the anthropometric data.

### *Data Analysis*

Independent samples t-test was performed in order to assess differences by gender. Frequencies in categorical data were compared by Chi-square test. All statistical calculations were performed with the use of SPSS 12.0 software (SPSS Inc, Chicago, IL, U.S.A.).

## *RESULTS*

Anthropometric data of the sample are presented in Table 1. The majority of the participants (68%) were either overweight or obese, according to BMI categorization. Men presented significantly higher values in body mass, body height and WHR, whereas women had larger hip perimeters ($p \leq 0.01$).

Sociodemographic and health status of the sample are shown in Table 2, and selected data on dietary habits are summarized in Table 3. Of the participants 16% smoked, all males, 39% reported being hypercholesterolaemic, 44% suffered from hypertension, 13% from cardiovascular

TABLE 1. Anthropometric Data of the Sample (Mean ± SD)

| | (n = 58) | | (n = 42) | | Total (n = 100) | | P |
|---|---|---|---|---|---|---|---|
| WHR | 0.91 ± 0.07 | | 0.98 ± 0.07 | | 0.94 ± 0.08 | | p ≤ 0.01 |
| Waist perimeter (cm) | 102.9 ± 0.99 | | 102.1 ± 0.89 | | 102.5 ± 0.93 | | – |
| Hip perimeter (cm) | 135.0 ± 1.78 | | 122.0 ± 2.20 | | 129 ± 2.04 | | p ≤ 0.01 |
| Body height (m) | 1.58 ± 0.06 | | 1.69 ± 0.07 | | 1.63 ± 0.86 | | p ≤ 0.01 |
| Body weight (kg) | 68.00 ± 10.02 | | 76.88 ± 11.94 | | 71.79 ± 11.67 | | p ≤ 0.01 |
| BMI (kg/m$^2$) | 51.60 ± 1.6 | | 51.10 ± 1.8 | | 51.3 ± 1.69 | | – |
| BMI categorization | N | % | n | % | n | % | P |
| Underweight (BMI < 18.5) | 1 | 1.7 | 0 | 0 | 1 | 1 | – |
| Normal weight (18.6 < BMI < 25) | 16 | 27.6 | 15 | 35.7 | 31 | 31 | – |
| Overweight (25.1 < BMI < 30) | 27 | 46.6 | 21 | 50 | 48 | 48 | – |
| Obese (BMI > 30.1) | 14 | 24.1 | 6 | 14.3 | 20 | 20 | – |

TABLE 2. Sociodemographic and Health Data of the Sample (n, %)

| | (n = 58) | | (n = 42) | | Total (n = 100) | | P |
|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | |
| **Marital status** | | | | | | | |
| Married | 41 | 70.7 | 35 | 83.4 | 76 | 76 | p 0.05 |
| Widowed | 16 | 27.6 | 3 | 7.1 | 19 | 19 | p 0.05 |
| Single | 1 | 1.7 | 4 | 9.5 | 5 | 5 | p 0.05 |
| **Education** | | | | | | | |
| University education | 2 | 3.4 | 3 | 7.1 | 5 | 5 | – |
| School education | 36 | 62.1 | 25 | 59.6 | 61 | 61 | – |
| Uneducated | 20 | 34.5 | 14 | 33.3 | 34 | 34 | – |
| **Health data** | | | | | | | |
| Smoking | 0 | 0 | 16 | 38.1 | 16 | 16 | p · 0.01 |
| Diabetes | 5 | 8.8 | 7 | 16.7 | 12 | 12 | – |
| Hypertension | 29 | 50.9 | 15 | 33.3 | 44 | 44 | p 0.05 |
| Hyperlipidaemia | 21 | 37.5 | 18 | 42.9 | 39 | 39 | – |
| Anemia | 5 | 8.8 | 2 | 4.8 | 7 | 7 | – |
| Osteoporosis | 12 | 21.1 | 1 | 2.4 | 13 | 13 | p · 0.05 |
| Cardiovascular | 4 | 7 | 9 | 21.4 | 13 | 13 | p · 0.05 |
| Ulcer | 5 | 8.8 | 1 | 2.4 | 6 | 6 | – |
| Atherosclerosis | 0 | 0 | 0 | 0 | 0 | 0 | – |
| Hepatic diseases | 0 | 0 | 0 | 0 | 0 | 0 | – |
| Renal diseases | 0 | 0 | 2 | 4.8 | 2 | 2 | – |
| Constipation | 6 | 10.5 | 3 | 7.1 | 9 | 9 | – |
| Dental problems | 9 | 15.8 | 7 | 16.7 | 16 | 16 | – |
| **Consume** | | | | | | | |
| Medication | 44 | 77.2 | 30 | 71.4 | 74 | 74 | – |
| **Underwent** | | | | | | | |
| Surgery recently | 21 | 36.8 | 19 | 45.2 | 40 | 40 | – |

disease, 12% from diabetes and 16% experienced dental problems that affected food choices. The majority of the sample fasted on Christian celebrations (74%) and 19% had adopted low-fat foods in their diets; 12% reported consuming vitamin/mineral supplements, the majority of which were women tackling osteoporosis.

A great majority of the subjects (95%) reported eating breakfast everyday, including milk and pies. Pies were inextricable in every meal of the day, substituting bread, made from several materials such as spinach,

TABLE 3. Selected Data on Dietary Habits of the Sample (n, %)

| | (n = 58) | | (n = 42) | | Total (n = 100) | | P |
|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | |
| **No Meals/d:** | | | | | | | |
| 1 | 3 | 5.3 | 2 | 4.8 | 5 | 5 | – |
| 2 | 12 | 21.1 | 11 | 26.1 | 33 | 33 | – |
| 3 | 19 | 33.3 | 21 | 50 | 40 | 40 | – |
| 4 | 22 | 38.5 | 7 | 16.7 | 29 | 29 | – |
| 5 | 1 | 1.8 | 1 | 2.4 | 2 | 2 | – |
| **No of feeding sessions/d (mean ± SD)** | 3.1 ± 9.4 | | 2.86 ± 0.84 | | 3 ± 0.9 | | – |
| **Consume** | | | | | | | |
| Light foods | 10 | 17.5 | 9 | 21.4 | 19 | 19 | – |
| Vitamin/mineral supplements | 10 | 17.5 | 2 | 4.8 | 12 | 12 | $p < 0.05$ |
| Fruits between meals | 40 | 69 | 25 | 59.5 | 65 | 65 | – |
| Dairy between meals | 5 | 8.6 | 1 | 2.4 | 6 | 6 | – |
| Pies between meals | 21 | 36.2 | 15 | 35.7 | 36 | 36 | – |
| Alcohol daily | 25 | 26.3 | 15 | 59.5 | 40 | 40 | $p \leq 0.01$ |
| Fast | 53 | 93 | 21 | 50 | 74 | 74 | $p \leq 0.01$ |

nettles, leeks, goatcheese, minced-meat, pumpkin or custard and covered by home-made flaky pastry and eggs. According to the frequency-record, 2.1 pieces of pies were being consumed everyday by the subjects. Cooking fat involved olive oil and fresh animal butter. The subjects reported consuming 3.7 fruits everyday, 2.65 portions of legumes and 180g of fish on a weekly basis. The Hasiotes did not favor meat intake daily, however approximately 980 g of red and white meat were consumed every week, in the form of roast, smoked, umbles, stewed and mixed with legumes or pasta, home-made pork sausages, or as a pie filling. Home-made yoghurt from full-fat milk was consumed on an average of 7.57 small pipkins every week, whereas 23.1 equivalents of vegetables were eaten weekly by the participants.

Nutrient intake is presented in Tables 4 and 5. Mean energy intake was 7.27 ± 3.49MJ/d, which corresponded to 22.7% less than the calculated energy expenditure. Subjects failed to satisfy their requirements

TABLE 4. Mean Daily Energy and Macronutrient Intake (Mean ± SD)

| | (n = 58) | (n = 42) | Total (n = 100) | P |
|---|---|---|---|---|
| Energy (MJ) | 6.6 ± 3 | 7.7 ± 3.8 | 7.27 ± 3.49 | – |
| % energy expenditure | 67.12 ± 29.74 | 91.33 ± 21.26 | 77.29 ± 36.33 | p ≤ 0.01 |
| Protein (g) | 46.22 ± 22.98 | 73.33 ± 24.62 | 57.61 ± 28.77 | p ≤ 0.01 |
| Protein % energy | 12.91 ± 5.1 | 15.10 ± 4.07 | 13.83 ± 5.7 | – |
| Protein (g/kg BW) | 0.71 ± 0.39 | 0.89 ± 0.44 | 0.82 ± 0.43 | p ≤ 0.04 |
| CHO (g) | 197.55 ± 119.15 | 259.84 ± 59.36 | 223.72 ± 157.2 | p ≤ 0.05 |
| CHO % energy | 52.86 ± 13.76 | 47.17 ± 10.86 | 50.47 ± 13.88 | p ≤ 0.05 |
| Fiber (g) | 20.04 ± 13.32 | 20.86 ± 14.14 | 20.38 ± 13.46 | – |
| Fiber (g/kg BW) | 0.3 ± 0.2 | 0.28 ± 0.21 | 0.29 ± 0.2 | – |
| Fat (g) | 56.11 ± 28.49 | 85.84 ± 28.68 | 68.6 ± 35.08 | p ≤ 0.01 |
| Fat % energy | 34.57 ± 11.51 | 38.21 ± 9.06 | 36.1 ± 11.1 | – |
| Cholesterol (g) | 0.12 ± 0.15 | 0.24 ± 0.14 | 0.16 ± 0.19 | p ≤ 0.01 |

TABLE 5. Percentage RDA Coverage for Selected Vitamins and Minerals (Mean ± SD)

| | (n = 58) | (n = 42) | Total (n = 100) | P |
|---|---|---|---|---|
| %Vit A | 52.16 ± 47.89 | 64.28 ± 46.45 | 57.25 ± 47.43 | – |
| %Vit B1 | 101.28 ± 65.84 | 129.45 ± 91.5 | 113.11 ± 78.48 | – |
| %Vit B2 | 91.47 ± 55.63 | 151.93 ± 65.65 | 116.86 ± 66.83 | p ≤ 0.01 |
| %Niacin | 86.41 ± 46.52 | 109.24 ± 61.55 | 96 ± 54.25 | – |
| %Vit B6 | 59.03 ± 39 | 75.14 ± 53.03 | 65.8 ± 45.87 | – |
| %Vit B12 | 169.5 ± 351.63 | 331.86 ± 580.75 | 237.69 ± 466.2 | – |
| %Biotin | 28.79 ± 24.84 | 52.64 ± 35.74 | 38.81 ± 32 | p ≤ 0.01 |
| %Vit C | 190.14 ± 138.06 | 195.29 ± 172.39 | 192.3 ± 152.61 | – |
| %Vit D | 19.28 ± 35.95 | 37.83 ± 60.98 | 27.07 ± 48.67 | – |
| %Vit E | 76.47 ± 39.18 | 77.29 ± 43.53 | 76.81 ± 40.85 | – |
| %Folate | 170.52 ± 191.68 | 180.6 ± 223.03 | 174.75 ± 204.4 | – |
| %Pantothenic acid | 54.6 ± 32.36 | 83.45 ± 43.07 | 66.72 ± 39.7 | p ≤ 0.01 |
| %Ca | 77.6 ± 56.07 | 143.38 ± 66.93 | 105.23 ± 68.77 | p ≤ 0.01 |
| %Cu | 29.24 ± 15.44 | 40.69 ± 24.99 | 34.05 ± 20.69 | p ≤ 0.01 |
| %I | 28.26 ± 37.07 | 33.1 ± 35.3 | 30.29 ± 36.24 | – |
| %Fe | 107.53 ± 59.17 | 145.93 ± 80.26 | 123.66 ± 71.04 | p ≤ 0.01 |
| %Mg | 69.47 ± 33.1 | 73.90 ± 39.81 | 71.33 ± 35.94 | – |
| %Mn | 57.28 ± 48.98 | 81.05 ± 82.12 | 67.26 ± 65.67 | – |
| %P | 96.16 ± 51.41 | 167.43 ± 62.63 | 126.09 ± 66.31 | p ≤ 0.01 |
| %Se | 100.60 ± 73.51 | 127.64 ± 93.05 | 111.96 ± 82.93 | |
| %Zn | 48.38 ± 29.84 | 60.1 ± 27.24 | 53.3 ± 29.22 | p ≤ 0.05 |

on vitamins A, B6, D, E, K, Biotin and Pantothenic acid. Women also presented inadequate intake of Ca and vitamins B2 and B3. Mineral intake was insufficient compared to the RDA for Cu, I, Mg, Mn and Zn for both genders.

## *DISCUSSION*

Female subjects presented insufficient energy intake and this could be attributed to misreporting in the physical activity diary. Men, nearly met their daily energy requirements (91.33%) by consuming a high fat diet (38.21% of total energy intake). A study on Greek elderly immigrants in Australia (Kouris-Blazos et al., 1996) reported similar results in energy intake and research on the free-living elderly of urban Athens (Papanikolaou, Hassapidou & Andrikopoulos, 1999) presented lower (36.5%) fat intake. However, high fat intake of the Hasiotes might appear to be, it is within the proposed ranges for the Mediterranean diet (Keys, Aravanis & Sdrin, 1968; Ferro-Luzzi, James & Kafatos, 2002).

It should be noted that fat intake of the sample, although high, might actually be underestimated, since in the Greek country, people consume local unrefined full-fat dairy products. None of the computer software used for dietary analysis includes such products, thus the consumption of milk, butter, traditional goat-milk yoghurt and several local cheeses of the sample was underestimated. In dietary analysis computer databases, "full-fat milk" refers to the commercial full-fat milk which has 3.5% of actual fat content. In addition, assessing dietary fat is difficult in Greece since ample fat is added during domestic preparations of foods, and standard composition cannot identify the actual fat intake (Ferro-Luzzi, James & Kafatos, 2002). Thus, fat intake and actual energy intake of the subjects should be considered higher.

Compared to the free-living elderly of other European countries (Anderson et al., 2001; Haveman-Nies, de Groot & van Staveren, 1998), women of the present study consumed less energy than the Italians in Padua, the Swedish, the Polish, and more compared to the French in Romans or the Swiss. Although Hasiotes, in their majority are involved in stock farming and meat availability is plentiful, their protein intake (per kg of body weight) was lower in comparison to 1.3 g/kg of BW consumed by elderly in Switzerland (Dumartheray et al., 2006). Energy intake of the Hasiotes men was lower than the free-living Dutch, Italians and French (Haveman-Nies, de Groot & van Staveren, 1998). Generally, elderly populations

present difficulties in remembering dietary intake and experience is required from the examiner during dietary recall. The low energy intake of the Hasiotes could also be attributed to the fact that the study took place during summer months, when dietary intake is generally lower compared to the winter months, due to a decrease in basal metabolism (Umeniya, 2006).

The recorded Hasiotes diet provides sufficient amounts of iron, although it has been suggested (Huang et al., 2001) that in the elderly, amplitude iron intake does not defend against iron deficiency anemia. This might also explain the small ratio of the sample that suffers from anemia. The high dairy consumption reported by the Hasiotes women does not justify the low Ca intake; however, it is in accordance to findings of others (Shabayek & Saleh, 2000; Kouris-Blazos et al., 1996). Although the sample exhibited a low dietary intake of vitamin D, this finding should not be alarming, since the country has plenty of sunshine days. According to recent recommendations on the diet of the elderly, it is suggested that a variety of micronutrient-dense food choices should be consumed (Roberts et al., 2005; Foote, Giuliano & Harris, 2000). The Hasiotes diet complied to this recommendation, thus, the low intake of some micronutrients could be attributed to the insufficient energy intake, since nutrient intake mainly follows energy intake (Blixt, 1965), especially in the elderly (Galanos, 2001).

A total of 72% of the participants reported occasional snacking between meals; foods like fruits (90.3%), pies (50%), dairy (20.8%) and cooked meals (8.3%) were the most preferred. The majority (40%) reported eating 3 meals per day, 29% consumed 4 meals, 33% consumed 2 meals and only 2% reported consuming 5 meals daily. More than half of the sample (75%) reported eating at least two cooked meals each day, which is twice the amount reported for Greek elderly immigrants (Wahlqvist, Kouris-Blazos & Wattanapenpaiboon, 1999). Due to tradition, low environmental temperature (Mean annual temperature = 16.5°C) and altitude (850 m), 40% of the Hasiotes accompany alcohol such as wine, ouzo, tsipouro and retsina with one meal every day, a habit proven to encourage the consumption of a wider variety of foods and protect against cardiovascular diseases and mortality (Wahlqvist, Kouris-Blazos & Wattanapenpaiboon, 1999). Favorite foods of the subjects included a dessert made by milk and rice, pies, legumes and frumenty.

The majority of the Hasiotes (74%) reported fasting, which for the Orthodox means abstinence from meat and eggs every Wednesday and Friday, as well as for 40 days before Easter Sunday, 40 days before Christmas and 14 days before the celebration of Madonna in August.

The more strict Christians, also abstain from dairy products. This religious tradition is still valid in Greece not only in the province, but also in urban areas. The custom is believed to have occurred for two reasons: in order to protect believers from diseases occurring from overconsumption of meat (cardiovascular, cancer, etc.), as well as for minimizing meat deprivation in periods when civilians were poor (the country was in seisin for over 500 years after A.D.). When fasting, the basic clusters of the Greek diet are legumes and vegetables. A study including Greek elderly, reported a 7-8% reduction in mortality hazard ratio with every 20 g increase in daily legume intake, with adjustment for location/ethnicity (Blackberry et al., 2004). Legumes were associated with long-lived food cultures such as the Mediterranean elderly who consume lentils, chickpeas and white beans.

According to BMI classification, the prevalence of overweight was 50% for the male subjects and 46.55% for the females. The prevalence of obesity was lower, reflecting 14.28% of the men and 24.13% of the women in the Hasia mountains. This is in accordance to Jensen and Friedmann (2002), who reported overweight and obesity in high proportions of free-living elderly in rural areas. In free-living elderly of urban areas in Greece, the prevalence of overweight and obesity has been reported to be 51 and 30.1% respectively (Papadopoulou, Laparidis & Hassapidou, 2005). In comparison to Greek adults classified by BMI (Panagiotakos et al., 2004), less elderly males and more elderly women of the present study were overweight and obese (53 & 20% of adult males and 31 & 15% of adult women were reported to be overweight and obese, respectively). Only free-living elderly from the capital of Greece (Papanikolaou, Hassapidou & Andrikopoulos, 1999) have been reported to have normal body weight according to BMI. Although BMI classification results are in accordance to other studies, mean gender BMI values of the present sample are extremely high compared to elderly residing in other European countries (Haveman-Nies, de Groot & van Staveren, 2006). Mean BMI of the Hasiotes women was 51.60 ± 1.6 kg/m$^2$ and of the men 51.10 ± 1.8kg/m$^2$, however, it has been suggested that high BMI rates in the elderly might enhance survival (Grabowski & Ellis, 2001; Hays, Keller & Østbye, 2005). However, since muscles weigh more than body fat, BMI is considered a crude indicator of obesity in populations with high lean body mass (Steward, 2000). In the present study body fat was not measured and this could explain the high values in BMI of the sample.

Waist-to-hip ratio (WHR) above 0.97 for the men and 0.85 for the women is an indicator for central obesity and in accordance to the high

BMI values of the sample. Pala and her associates (2006) suggested that a prominent WHR is a characteristic of sedentary elderly women, who are hypertensive and hyperlipidaemic, have considerable abdominal fat and tend to be fed on fruits, vegetables and seed oil (Costacou et al., 2003).

The participants suffered from osteoporosis, diabetes, hypertension and cardiovascular diseases in similar percentages compared to the urban elderly of Greece (Papadopoulou et al., 2003). High prevalence of hypertension in rural Greek elderly have also been reported elsewhere (Kafatos et al., 1991), and this was attributed to high obesity rates and increased alcohol intake (Ferro-Luzzi, James & Kafatos, 2002). As far as smoking is concerned, less Hasiotes reported smoking compared to Greek elderly living in cities (Papadopoulou, Laparidis & Hassapidou, 2005). Anemia was reported by 7% of the sample, mostly women and can be partly explained by menopause.

The elderly of Grevena presented a unique traditional diet of mountainous Greece, based on full-fat dairy products, legumes and pies. In addition, the Hasiotes retained all basic characteristics of the Mediterranean diet, such as wine, legume and olive oil consumption that are considered to protect health and prolong longevity (Trichopoulou et al., 2005b; Kouris-Blazos et al., 1996). Although no data on mortality of the subjects exists and the subjects reported suffering from several pathological conditions, this might be contributed to ageing instead of dietary habits.

Although one could argue that the presented diet is not sufficient in all micronutrients, neither did the initial Mediterranean diet model presented by Keys and his associates (1968). It is possible that a better methodological design, one that included recording intake for more days or one that assessed consumption throughout all four seasons instead of only one, would have provided a more adequate micronutrient intake.

The diet of Hasiotes consists of a Greek diet variation that could be studied further. Future research should focus on assessing adherence to the Mediterranean diet through a diet score and comparing data of elderly from isolated mountainous areas of Greece such as Grevena, to the diet of elderly in islands or other rural regions in order to assess regional variations.

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