# **Dietary Habits and Behaviors on Cardiovascular**

# **Disease Risk Factors in Elders Residing on the**

## **Mediterranean Islands**

By

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### Abstract

As the global population continues to age at an alarming rate, elders (65 years and older) will comprise a large share of the total population. The factors that encourage longevity gain must be identified and their affect on health status must be explored. As a result, there is a growing need to explore the effect of diet and lifestyle on cardiovascular disease risk factors (such as hypertension, hypercholesterolemia, diabetes, and obesity) that are increasingly pronounced in older populations. Recommendations for the healthy ageing of elders must be strong and applicable to varying demographic groups. The Mediterranean Island Study (MEDIS) is a health and nutrition survey wherein demographic, behavioral, clinical and dietary data were collected from 1812 participants from twelve Mediterranean islands (10 Greek islands, the Republic of Cyprus and Malta). The purpose of this work is to explore various lifestyle and dietary characteristics of a healthy (without a history of cardiovascular disease or cancer) long-lived population residing on the Mediterranean islands. Furthermore, as a smaller aprt of the present work, a case study from the northern villages of Karpathos was conducted in order to determine the core diet of a population that has been minimally eroded by industrialization and tourism, and to examine factors

that may contribute or delay dietary change. Analysis of MEDIS data suggests that physical activity, smoking cessation, mid-day naps and adherence to the Mediterranean diet are modifiable characteristics that may encourage healthy ageing, and that dietary modification is occurring at varying rates throughout the Mediterranean islands. Data from the case study completed on the island of Karpathos, in the northern isolated villages of Olympos and Avlona suggests that the absence of mechanized farming, the social role of women and customs of inheritance are factors that can contribute to the preservation of traditional food-related practices. As older Mediterranean populations modify their dietary behaviors, they also lose the health benefits associated with the traditional Mediterranean diet. There is a growing need to identify and understand the role of various characteristics, such as diet on longevity gain and health.

### Περίληψη

Καθώς ο παγκόσμιος πληθυσμός συνεχίζει να γηράσκει με ανησυχητικό ρυθμό, υπερήλικες (65 ετών και άνω) θα αποτελούν ένα μεγάλο μερίδιο του συνολικού πληθυσμού. Οι παράγοντες που ενθαρρύνουν την αύξηση μακροζωίας πρέπει να προσδιοριστούν και η επιρροή εις τόν τομέα υγείας πρέπει να διερευνηθεί. Ως αποτέλεσμα, υπάρχει μια αυξημένη ανάγκη ερευνάς ως πρός την επίδραση της διατροφής και τρόπου ζωής για καρδιαγγειακούς παράγοντες κινδύνου (όπως η υπέρταση, η υπερχοληστερολαιμία, ο διαβήτης και η παχυσαρκία), που εντείνεται όλο και περισσότερο σε πληθυσμούς ηλικιωμένων ατόμων. Συστάσεις για την υγιή γήρανση των ηλικιωμένων πρέπει να είναι ισχυρή και να εφαρμόζονται σε διάφορες δημογραφικές ομάδες. Η Μελέτη MEDIS είναι μια έρευνα για την υγεία και τη διατροφή όπου δημογραφικές, συμπεριφορές, όπου κλινικά και διαιτητικά στοιχεία συλλέχθηκαν από 1812 συμμετέχοντες από δώδεκα νησιά της Μεσογείου (10 Ελληνικά νησιά, η Δημοκρατία της Κύπρος και η Μάλτα). Ο σκοπός της παρούσας εργασίας είναι να διερευνήσει διάφορους τρόπους ζωής και διατροφικών χαρακτηριστικών για υγειή (χωρίς ιστορικό καρδιαγγειακής νόσου ή καρκίνου) ηλικιωμένων πληθυσμό που κατοικούν στα νησιά της Μεσογείου. Επιπλέον, ένας μικρότερος στόχος του παρόντος έργου συμπεριλαμβάνει μια μελέτη περίπτωσης από τα βόρεια χωριά της

Καρπάθου όπου έγεινε προκειμένου να καθορίσει τον πυρίνα της διατροφής ενός πληθυσμού που έχει ελάχιστα διαβρωθεί από την βιομηχανία και τον τουρισμό, για να εξετάσει τους παράγοντες που μπορούν να συμβάουν ή να καθυστερήσουν της διαιτητικές αλλαγές. Ανάλυση των στοιχείων MEDIS δείχνουν ότι η σωματική άσκηση, διακοπή του καπνίσματος, και ξεκούραση μικρής διάρκειας στη μέση της ημέρας και η τήρηση της Μεσογειακής διατροφής είναι τροποποιήσιμα χαρακτηριστικά που μπορούν να ενθαρρύνουν μία υγιή γήρανση, και ότι η τροποποίηση της διατροφής εμφανίζεται σε διάφορα ποσοστά σε όλα τα νησιά της Μεσογείου. Στοιχεία από τη μελέτη ολοκληρώνωται στο νησί της Καρπάθου, στα βόρεια απομονωμένα χωριά της Ολύμπου και Αυλώνα δείχνουν ότι η απουσία της μηχανικής καλλιέργειας, ο κοινωνικός ρόλος των γυναικών και τα έθιμα της κληρονομιάς αποτελούν παράγοντες που μπορούν να συμβάλουν στη διατήρηση των παραδοσιακών τροφίμων. Αν συνεχίζουν οι ηλικιωμένει Μεσογειακή πληθυσμεί να διαφοροποιούν τη διατροφική συμπεριφορά τους, θα χάσουν επίσης τα οφέλη για την υγεία που συνδέονται με την παραδοσιακή μεσογειακή διατροφή. Υπάρχει μια αυξανόμενη ανάγκη να εντοπιστούν και να κατανοήσουν το ρόλο των διαφόρων χαρακτηριστικών, όπως η διατροφή στην αύξηση τις μακροζωίας και υγείας.

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#### I: INTRODUCTION

#### 1.1. Growing Interest of Diet and Disease in Older Populations

The age distribution of the global population is changing. The proportion of older persons (60 years and older) is increasing while the proportion of children (aged 15 years and younger) is steadily declining. Currently, the oldest old (80 years and older) are the fastest growing age group, and by 2045, for the first time, the proportion of elders worldwide is predicted to exceed the proportion of children (United Nations 2009). Interpretation of demographic data can become more valuable when it is incorporated with cause-specific mortality since a number of diseases are more pronounced at certain ages. For instance, heart disease is the primary cause of death amongst older populations. According to the U.S. Census Bureau, as age advances, increasingly more deaths in people aged 75 and over are related to heart disease, roughly 49 percent compared to 18 percent for cancers (Kinsella and Velkoff 2001). By 2020, the global burden of fatal and non-fatal cardiovascular disease (CVD) is expected to increase; projections estimate that of the 68 million deaths worldwide from all causes, roughly 1 in 3 deaths (37%) will be due to CVD (Neal et al. 2002). Demographic and mortality trends underscore the need to examine CVD risk factors on older populations. There is a growing need to develop health

messages to protect against heart disease for the fastest growing demographic sector of the world's population – the elderly.

CVD is related to factors in the diet, which suggests it is potentially preventable, or that dietary factors can protect against CVD. Currently, limited data exists on how diet and lifestyle characteristics relate to cardiovascular disease risk in older populations. Although causal and protective links between specific diets and lifestyle have been explored (Haveman-Nies 2002, Knoops et al. 2004), such associations must be strong and applicable to varying demographic groups before recommendations can be made to policy-makers and the general public.

#### 1.2. Population Ageing and the Demographic Transition

Population ageing is largely a result of decreased fertility and mortality rates, a process known as the demographic transition. Kirk (1996) offers a thorough review on the demographic transition theory including details on the theory's forerunners, criticisms and justifications, in addition to the various factors that may contribute to fertility and mortality decline. In brief, cultural settings and family practice programs influence the decline in fertility rates while rising incomes, a decrease in violence (eg. local wars), an established transport and commerce infrastructure, and improvements in agriculture, hygiene and medicine are possible factors responsible for mortality decline (Kirk 1996). The demographic transition has been

illustrated in Figure 1. The stages at the top of the figure represent the different stages of the Demographic Transition. As countries move through these stages (birth rates decline and death rates are delayed) the total population increases encouraging population ageing.



Figure 1. The Demographic Transition

	Examples	A few remote groups Egypt, Kenya, India		Brazil	USA, Japan France, UK	Germany
Birth rate         High         High           Death rate         High         Falls rapidly           Natural increase         Stable or slow increase         Very rapid increase		High	Falling	Low	Very low	
		Falls more slowly	Low	Low		
		Increase slows down	Stable or slow increase	Slow decrease		
	Reasons for changes in birth rate	Many children needed for farming. Many children die at an early age. Religious/social encouragement. No family planning.		Improved medical care and diet. Fewer children needed.	Family planning. Good health. Improving status of women. Later marriages.	
	Reasons for changes in death rate	Disease, famine. Poor medical knowledge so many children die.	Improvements in med and sanitation. Fewer	ical care, water supply children die.	Good hea Reliable fo	Ith care. ood supply.

The United Nations has developed population pyramids that illustrate the age composition (in 1999 and 2050) of less developed regions, more developed regions, and the global population (see Figure 2). The triangular shape of the pyramid observed in 1999 will be replaced by a more cylinderlike structure by 2050, across all regions. In more developed countries (for example Sweden and Greece) that have slow or negative growth, the population pyramid takes on a cup-like structure, suggesting a greater proportion of older individuals compared with youths. Population ageing is occurring on a global scale, although demographic changes are most pronounced in less developed regions. This variation is demonstrated in the shape of the population pyramids wherein sharp changes appear in the age structure of less developed regions, between 1999 and 2050, as compared to the more subtle changes observed amongst more developed regions.

Throughout the next 30 years, the World Health Organization predicts increases of 200 to 400 percent in the older populations of developing countries (WHO 2002). Europe has the oldest population, having the greatest proportion of elders (60 years and older). In 2009, the median age of Europe was double that of Africa, forty years compared to 19 years in Africa (U.N. 2009). The WHO Active Ageing Policy Framework (2002) reports that nearly 1 in every 4 individuals in Italy, Japan, and Germany are over the age of 60 with levels approaching or exceeding 23% in Greece, Belgium and Spain. Not only is the global population ageing, but also elders

themselves are ageing. Amongst the older population, the oldest-old (80 years and older) are the fastest growing age group, which account for roughly 1 out of every 7 elders (60 years and older) (U.N. 2009).



Figure 2. Population Pyramids – 1999 and 2050

Source: United Nations Population Division

The growth of centenarians and the increasing female share of older populations are also themes of demography to be explored by policymakers. Females constitute an increasing proportion of the older population as they typically experience greater life expectancy and lower mortality compared to their male counterparts (Kinsella and Velkoff 2001, United Nations 2009). A population report developed by the National Institute on Ageing and the U.S. Census Bureau (Kinsella and Velkoff 2001) reports that in 2001, European and North American women had an approximate life expectancy that was 7 years longer than that of men, while female mortality rates were significantly lower than male rates. For instance, in Canada and Germany male mortality rates were nearly twice that of the female rates (in the 65 to 74 age group). Furthermore, in developed nations where life expectancies are higher, centenarians will constitute a small, but growing segment of the population. Monographs on population ageing prepared by Jeune and James (1995) employing reliable statistics approximate that under current mortality rates, in countries such as Japan where female life expectancy approaches or exceeds 80 years, 2 of every 100 women will become centenarians. Such gender variations may hold important implications for social support, as older women (65 years and older) usually live alone, have fewer years of schooling and lower incomes (Tourlouki et al. 2009).

#### 1.3. The Epidemiological Transition

Population ageing is closely tied to an epidemiological shift from infectious to chronic and degenerative diseases, referred to as the epidemiological transition. That is to say, as a population ages it is increasingly exposed to chronic diseases since they affect older adults at higher rates. The World Health Organization, Harvard University and the World Bank initiated the Global Burden of Disease Study in 1992, which attempts to systematically estimate worldwide and regional disease burden. Figure 3 summarizes the probability of dying throughout three stages of life (age 0-15, 15-60, and 60-70) by broad-cause, group, sex, and region in 1990 (Murray and Lopez 1997). Amongst both sexes, throughout all eight study regions, as age advances the probability of dying from a Group 2 cause (non-communicable disease) increases for both sexes. The probability of dying from a non-communicable disease is higher in developing regions than in established market economies. However, the burden of noncommunicable disease in developed regions cannot be overlooked - the proportion of deaths due to non-communicable disease is increased throughout developed regions, given that fertility and mortality decline have generated a higher proportion of older adults in such regions. This epidemiological shift can also be observed in the case of Singapore where life expectancy at birth rose from 40 years in 1948 to 70 years in the late 1970's, resulting in a rise in cardiovascular deaths (from 5 to 32 percent of

all deaths) and a decline in infectious disease (from 40 to 12 percent) (Kinsella and Velkoff 2001). As the world's population ages noncommunicable diseases become a growing burden. It remains to be seen whether increased longevity will produce improved years of healthy active living or extended disability and morbidity.

Figure 3. Probability of dying during three periods of life by broad-cause, group, sex and region, 1990



#### 1.4. Cardiovascular Disease

Amongst the worldwide emergence of non-communicable diseases, cardiovascular and neuropsychiatric disease and cancers have contributed heavily to the global burden of disease (WHO 1999). Table 1 underlines the change in the actual (1990) and predicted (2020) global disease burden for the ten leading causes. Cardiovascular deaths including, ischaemic heart and cerebrovascular disease were ranked fifth and sixth, respectively, in leading causes of death and disability in 1990 (see Table 1). In 2020, it is projected that they will rise to first and fourth, respectively. The increasing burden of CVD can have vast impacts on health, particularly in regions where elders constitute a large proportion of the total population. In Greece, (a country with an ageing rate amongst the highest in Europe) 49 percent of total deaths were due to CVD (WHO 2010).

	1990	2020	
Rank	Cause	Cause	
1	Lower respiratory infections	Ischemic Heart Disease	
2	Diarrheal diseases	Major depression	
3	Perinatal conditions	Road traffic accidents	
4	Major depression	Cerebrovascular disease	
5 Ischemic Heart disease		Chronic Obstructive Pulmonary	
		disease	
6	Cerebrovascular disease	Lower respiratory infection	
7	Tuberculosis	Tuberculosis	
8	Measles	War	
9	Road traffic accidents	Diarrheal diseases	
10	Congenital anomalies	HIV	

Table 1. Top Ten Leading Causes of Death - Actual (1990) and Predicted (2020) disease burden

Cardiovascular deaths including ischemic heart disease and cerebrovascular disease ranked 5<sup>th</sup> and 6<sup>th</sup>, respectively in 1990 are expected to rise to 1<sup>st</sup> and 4<sup>th</sup>, respectively in 2020. Source: Murray and Lopez, 1996

Disability-Adjusted Life Years (DALYs) are units of measurement that have been devised to quantify the number of deaths as well as the impact of premature death and disability. This means that, one DALY is equivalent to one year of healthy life lost (WHO 1999). The World Health Report (WHO 1999) estimates that cardiovascular disease accounts for 10% of DALYs in low and middle-income countries, and 18% of DALYs in high-income countries. Cardiovascular diseases are responsible for one in every eight DALYs globally (WHO 1999).

Table 2. Major Independent Cardiovascular Disease Risk Fac	Factors
--	---------

Major Independent Risk Factors
Cigarette smoking
Elevated blood pressure
Elevated serum total and LDL cholesterol*
Low serum HDL cholesterol*
Diabetes mellitus
Advancing age
*LDL is low density lipo-protein; HDL is high density lipo-protein
Grundy 1999

There are many risk factors associated with cardiovascular disease. In a statement for healthcare professionals from the American Heart Association and the American College of Cardiology (Grundy et al. 1999), the major and independent risk factors for coronary heart disease (CHD) reported were cigarette smoking, elevated blood pressure, elevated serum total and low-density lipoprotein (LDL) cholesterol, low serum high-density lipoprotein (HDL) cholesterol, diabetes mellitus, and advancing age (Table 2). These major risk factors are additive in predictive power, and therefore, the sum of risk imparted by each of the major risk factors can estimate the total risk of a person (Grundy 1999). Advancing age is a major risk factor for cardiovascular disease, further supporting the notion that CVD is expected to increase in the future due to rising life expectancy. Furthermore, several of these risk factors such as diabetes, hypertension and cholesterol are modifiable and influenced by diet.

#### 1.5. Diets and Cardiovascular Disease

Coronary heart disease, stroke, cancer and diabetes are amongst the leading causes of death that are associated with diet (WHO 2000). Dietary patterns can play a role in the development and prevention of CHD. Interest in the Mediterranean diet began circa the 1950's when it was observed that countries in the Mediterranean region had amongst the lowest rates of chronic disease along with increased life expectancies, even when compared to more affluent countries. Such observations led to the initiation of the Seven Countries Study, an epidemiological study including sixteen cohorts from seven countries (USA, Finland, The Netherlands, Italy, Yugoslavia, Greece, Japan) that examined diet and heart disease amongst other factors (Keys 1970). Analysis of the Seven Countries' data by Menotti and associates (1999) showed large differences in 25-year death rates from CHD amongst the sixteen cohorts - from 25 per 1000 in Crete, Greece to 268 per 1000 in East Finland (see Table 3).

Cohorts	N	CHD
		(death rates/1000)
US Railroad, USA	2571	160
East Finland, Finland	817	268
West Finland, Finland	860	180
Zutphen, The Netherlands	878	169
Crevalcore, Italy	993	93
Montegiorgio, Italy	719	60
Rome Railroad	768	87
Dalmatia, Croatia	671	54
Slavonia, Croatia	696	80
Velika Krsna, Serbia	511	43
Zrenjanin, Serbia	516	116
Belgrade, Serbia	536	106
Crete, Greece	686	25
Corfu, Greece	529	48
Tanushimaru, Japan	508	30
Ushibuka, Japan	502	36

Table 3. 25-year death rates per 1000 from Coronary Heart Disease in sixteen cohorts of the Seven Countries

Source: Menotti et al. Food intake patterns and 25-year mortality from coronary heart disease: Crosscultural correlations in the Seven Countries Study. Journal of Epidemiology 1999(15):507-15.

Similarly, dietary intake greatly varied throughout the cohorts: a high consumption of dairy products was observed in Northern Europe, meat in the USA, vegetables, legumes, fish and wine in Southern Europe and cereals, soy and fish in Japan. Further data analysis showed that food patterns that were characterized by high intakes of butter, dairy products and other animal products that usually contain high levels of saturated fatty acids and cholesterol were associated with high CHD mortality rates. Evidence from the Seven Countries Study suggested that the Cretan diet could be a model of healthy eating. The Lyon Diet Heart Study was conducted to evaluate the effect of a Mediterranean-type diet (modeled after the Cretan diet) on CHD morbidity and mortality. The Lyon Heart Study was a secondary, randomized prevention trial in which 605 patients recovering from myocardial infarction where randomized into two groups: 1) the test group followed a diet modeled after the Cretan Mediterranean diet 2) the controls were prescribed the prudent diet, typically prescribed after first myocardial infarction (Renaud et al. 1995). The advice given to the Mediterranean Cretan diet patients was summarized into Six Dietary Commandments (see Table 4). Since olive oil is not typically favored amongst the French a gastronomically acceptable margarine was developed for the French study population that had a similar composition to olive oil.

Table 4 – Dietary Advice developed for the Mediterranean Cretan Diet Test Group

Six Dietary Commandments				
1. More Bread				
2. More vegetables and legumes				
3. More fish				
<ol><li>Less meat (beef, lamb, pork) replaced by poultry</li></ol>				
5. No day without fruit				
6. No more butter and cream, to be replaced as a special margarine				
Source: Renaud et al. Cretan Mediterranean diet for prevention of coronary heart disease. Am J Clin				
Nutr 1995;61:1360S-7S.				

After a mean follow-up period of 27 months, in the group consuming

the Cretan Mediterranean diet, recurrent myocardial infarction, all

cardiovascular events, and total deaths were significantly decreased by >

70% (de Lorgeril et al. 1996). Due to the statistically significant results from

this study, a decision was made to stop the trial. More recently, the

INTERHEART case-control study involving participants from 52 countries examined the relationship between protective and risk factors on acute myocardial infarction (Yusuf et al. 2004). Analysis of data identified 9 potentially modifiable risk factors that were associated to more than 90% of the risk of an acute myocardial infarction - eight of these 9 risk factors were strongly related to diet.

Dietary-patterning analysis is a method used to assess overall dietary patterns instead of single nutrients. The reason is that individuals consume a variety of foods, and the effects of a whole diet may be greater than the sum of its parts (Panagiotakos 2008). For example, the Mediterranean diet, in its entirety, has been recognized as a healthy diet that can offer protection against heart disease. The effect of the diet on mortality risk cannot be solely contributed to one component. Therefore, when taking a single- food or -nutrient approach, the synergistic and antagonistic effects of specific foods on investigated outcomes remain ambiguous. Principal component analysis, a type of dietary-patterning analysis, was used to examine INTERHEART data in order to define 3 major dietary patterns that were persistent across the different populations and geographic regions (Igbal et al. 2008). The following dietary patterns were identified: Oriental (high in tofu, soy and other sauces), Western (high in fried foods, salty snacks, eggs and meat) and the prudent (high in fruit an vegetables). The investigators found the Western pattern score to be significantly and

positively associated with increased risk of myocardial infarction, while the prudent diet score showed an inverse association to risk of myocardial infarction. The above-mentioned studies underline the incredible role of traditional dietary patterns such as the Mediterranean diet on the prevention of CVD.

#### 1.6. The Mediterranean Diet

The Mediterranean diet has been described as the dietary pattern found in the olive-growing regions of the Mediterranean, in the late 1950s and early 1960s. Appropriately, the essence of the Mediterranean diet, in all its cultural variations, lies in the ample use of olive oil – a product historically and presently abundant in the Mediterranean region. It is the principal source of added fat that promotes the consumption of vegetables and legumes in the form of salads, stews, or cooked dishes. The Department of Hygiene and Epidemiology of the University of Athens Medical School developed dietary guidelines for Greek adults represented as a food pyramid that depicts the Mediterranean diet.

The recommendations based on the traditional Mediterranean diet have been summarized as follows: Eight servings of cereals should be consumed daily, non-refined carbohydrates should be favored; potato intake should not surpass 3 serving weekly since potatoes have a high glycemic index; simple sugars are typically found in deserts, fruits or added to

beverages such as coffee or tea, average intake should not exceed half a serving per day; three servings of fruits should be consumed on average daily; on average, six servings of vegetables should be consumed per day; one serving of pulses should be consumed every other day; poultry, eggs and red meat should be consumed on average once daily (poultry should be favored over red meat and eggs); one serving of fish and seafood should be consumed daily; 2 servings of dairy products should be consumed daily; to achieve health benefits, daily alcohol consumption equivalent to 30 grams of ethanol is recommended for men and 15 grams for women. This diet has a high ratio of monounsaturated to saturated dietary lipids. Regular physical activity and afternoon naps should complement this diet (Greek Ministry of Health and Welfare 1999).



Figure 4. The Mediterranean Diet Pyramid

Source: Greek Ministry of Health and Welfare. (1999). Dietary Guidelines for Adults in Greece. Archive of Hellenic Medicine, 16, 515-24.

#### 1.7. The Nutrition Transition

The nutrition transition refers to a shift from traditional diets (high in complex carbohydrates and fiber) towards western diets (high in fats, saturated fats, and sugars), and has been associated with the demographic and epidemiological transition (Drewnowski and Popkin 1997). At a time when robust research from clinical and epidemiological studies demonstrate that dietary strategies can manage or prevent CVD, why are individuals adopting unwholesome diets? Of particular interest are countries such as Greece and Japan that were recognized in the early 1960s for their traditional, health-promoting diets and yet today, are abandoning them in place of western diets based on processed foods. In the Mediterranean region, several studies have shown changes in food composition and food consumption frequency (Tyrovolas et al. 2008, Polychronopoulos 2010). Kafatos and colleagues (1997) completed a follow-up study including elderly patients from Crete who took part in the Seven Countries Study in order to identify heart disease risk factor status and dietary changes. Data collected in 1999 was compared with data that had been collected in 1960. A significant increase was observed in serum total cholesterol concentrations (11.5%), body mass index, systolic and diastolic blood pressures, and central obesity was characteristic of all age groups. Furthermore, a 3-day weighed food record was used to assess food intake and composition of a

representative subsample of 21 men. Analysis of dietary data indicated a rise in the intake of saturated fat and a decline in monounsaturated fat (over the 30-year duration). Drewnowski and Popkin (1997) also highlight similar changes in the Japanese diet. Dietary data between 1955 and 1994 showed a decline in cereal consumption while the consumption of meat, chicken (35fold), milk (sixfold) and eggs (fivefold) increased. Certainly, the case of Greece and Japan underscores the modern-day phenomena of dietary modification where western diets are replacing traditional ones.

So the question remains, what factors drive dietary change? Grivetti (1978) suggests that the combination of culture and environment are two principle determinants of dietary development. He states, "man cannot eat what is not available, and items available are not always eaten." Thus, if this concept can be further elaborated, one can say that when aspects of culture or the environment change, a change in diet is to be expected. The process of westernization, industrialization and urbanization promotes the movement of ideas and goods around the world and has been tied to the epidemiological transition. By its very nature, it supports environmental and cultural modification in that foreign products, food eateries, and markets can gain access to, and therefore influence the local food supply. Choi and colleagues (2001) argue that chronic diseases can be communicable - CVD risk factors, such as diet can travel across borders causing epidemics in the same manner to that of infectious diseases. This seems to be the case of

Greece, where the adoption of a western diet produces an increase in CVD risk factors.

However, it seems that environment is more vulnerable to change and then the 'lagging' parts of culture follow. For example, when the cost of olive oil increased in Spain, consumption decreased only slightly and when prices of olive oil in Northern Europe reached prices similar to those found in Southern Europe, consumption did not increase (Gracia and Albisu 2001). Although certain products can be made available in the market it seems that culture can play a role in accelerating or delaying the adoption of certain dietary practices. Based on empirical research completed on the island of Crete, Terkenli, Bellas, and Jenkins (2007) suggest that cultural and social structures such as the dowry system and marital arrangements are more resistant to change compared with economic practices and lifestyles (i.e. hotel development, transportation). Such research needs to be further extended.

Although evidence suggests a shift in dietary patterns in many populations, less understood is the driving force behind dietary change. The environment can be a valuable tool used in dietary strategies, compared with culture that seems to be more resistant to change. For example, environment-based dietary strategies can include an increase in the number of food outlets that offer a variety of healthy, inexpensive options that would serve individuals of all ages groups. Of particular interest are older

populations that tend to maintain traditional diets more compared to their younger counterparts. To what extent are older populations adopting new food practices? What is the effect of dietary habits and behaviors on cardiovascular disease risk factors in older populations?

### II: LITERATURE REVIEW: DIETS ON CARDIOVSCAULAR DISESE RISK IN MIDDLE-AGED AND OLDER POPULATIONS

The greatest challenge facing a growing ageing population will be to maintain good health, even in advanced age. Hypertension, hypercholesterolemia, obesity and diabetes are all cardiovascular risk factors that are related to diet and are pronounced at older ages. Although, observations from several studies have shown that dietary modification can affect risk of heart disease in older populations, this issue must be studied more exhaustively. A search in available databases (PubMed and Scopus) was completed to identify studies that evaluated dietary modification on heart disease risk in middle-aged and elderly populations (defined as 65 years and older). Observational/epidemiological and clinical studies that evaluated dietary patterns were retrieved and summarized.

### 2.1. A summary of Observational Epidemiological Studies

Table 5: Studies	s examining dietar	y habits o	n heart disease	risk in middle-aged and
elderly subjects				
Study (authors,	Sample	Type of Study	Diet	Outcome

Observational /Epidemiological Studies					
The Seven Countries Study (Menotti et al. 1999)	12,763 men (aged 40 -59 years)	Cohort	European dietary patterns	Saturated fat is correlated with elevated incidence and mortality rates of CHD	
The Survey in Europe on Nutrition and the Elderly: a Concerted Action (SENECA) (Haveman-Nies, 2002)	1091 men and 1109 women (70– 75 years old)	Cohort	Mediterranean- type diet	Healthy lifestyle (high quality diet, physical activity, nonsmoking) is positively related to reduced mortality risk	
The European Prospective Investigation into Cancer and Nutrition Study (EPIC) (Trichopoulou, 2003)	22,043 participants aged 20 to 86 (5028, aged 55-64 years; 4369, aged >65 years)	Cohort	Mediterranean- type diet	Inverse association between Mediterranean diet score and CHD	
The INTERHEART study (Yusuf et al. 2004)	12,461 participants (median age, 58)	Case- control	Regular consumption of fruit and vegetables	Consistent fruit and vegetable consumption was associated with a 30% relative risk reduction	
The Healthy Ageing: a Longitudinal study in Europe (HALE) (Knoops et al. 2004)	1,507 men and 832 women	Cohort	Mediterranean- type diet	Mediterranean diet, moderate alcohol use, moderate to high physical activity, and nonsmoking is associated with a lower all- cause mortality, including CHD and CVD	
Framingham Heart Study and the European SENECA Study, (Haveman-Nies et al. 2001)	828 participants from Framingham, Massachusetts and 1282 participants from the Europe (aged 70 to 77 years)	Cohort	Diet Quality Index and Mediterranean Diet Score	High dietary quality is related to other healthy lifestyle factors (less body fat, nonsmoking and physical activity)	
The Health Professional Follow-up Study (HPS) (Van Dam et al., 2002)	42,504 predominately white US male professionals (40– 75 years of age)	Cohort	Prudent and Western dietary patterns	Increased risk of type 2 diabetes is associated with the western dietary pattern	

Clinical Trials				
Cardio2000	658 male (59.0 ±	Case-	Mediterranean-	Adherence to a
Study	10 years) and 190	control	type diet	Mediterranean-type diet
(Panagiotakos et	female (65.3 ± 9			can reduce coronary risk
al. 2002).	years) patients of			factors (in hypertensive
	which 526 adopted a Mediterranean- type diet. Controls include 830 males $(58.0 \pm 10 \text{ years})$ and 248 female $(64.8 \pm 9 \text{ years})$ of which 765 adopted a Mediterranean- type diet.			subjects)
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The Mediterranean Diet, Cardiovascular Risks and Gene Polymorphism Study (Medi-RIVAGE) (Vincent-Baudry et al. 2005)	88 subjects -Mediterranean group (42% were men and 58% were women; mean age, 50.8 ± 10.8 years) 81 subjects - low-fat group (39.5% were men and 60.5% were women; mean age, 51.6 ± 10.3 years)	Dietary intervention trial	Mediterranean- type diet and low-fat diet	A decline of 15% in CVD risk was predicted with this specific Mediterranean diet and a 9% decline with the low-fat diet - both diets displayed a measurable efficiency in reducing risk factors for CVD.
The Lyon Heart Study (de Lorgeril and Renaud, 1996; de Lorgeril et al. 1996, 1999)	302 patients in experimental group (Cretan Mediterranean diet) and 303 controls assigned (prudent diet)	Prospective single- blind, randomized prevention trial	Cretan Mediterranean diet and prudent diet	For primary and secondary end-points combined, 59 events occurred in the control and 14 in the study group - 76% reduction in risk.

### 2.1.1. The Seven Countries Study

In the mid 1950s, Ancel Keys observed high incidence rates of CHD in the United States. At that rate, Keys and associates (1963) postulated that a significant number of seemingly healthy, middle-aged men would develop CHD. To examine the etiology of the disease he conducted a study on 281 businessmen who resided in Minnesota, and found that serum cholesterol was associated with incidence of CHD. This observation, prompted the Seven Countries Study, which examined diet and lifestyle on heart disease. The study sample included 12,763 middle-aged men, from 16 cohorts, belonging to the following seven countries: USA, Finland, the Netherlands, Italy, former Yugoslavia, Greece and Japan. Ancel Keys' major findings from the Seven Countries study have been summarized: A close correlation existed between the percentage of dietary calories from total fats and 10-year coronary deaths per 10,000 men; median blood cholesterol values were highly correlated with CHD deaths; the mean concentrations of blood cholesterol of each group were highly correlated with the percentage of dietary energy derived from saturated fatty acids (Keys 1970). Menotti and colleagues (1999) examined the association of simple food-groups and their combinations with 25-year mortality from CHD. Diets rich in butter, dairy products and other animal products (usually rich in saturated fatty acids and cholesterol) were associated high rates of CHD while, food consumption patterns high in cereals, legumes, vegetable products, fish, oils and wine were associated with low or relatively low mortality rates from CHD. Greece and Japan experienced the fewest death rates caused by CHD; USA, Finland, and The Netherlands, experienced the most. Findings from the Seven Countries Study support the idea that dietary patterns are an important determinant of CHD risk, and may reveal the Mediterranean diet's cardioprotective effect.

#### 2.1.2. The SENECA Study

The Survey in Europe on Nutrition and the Elderly: a Concerted Action (SENECA) began with baseline measurements in 1988 and 1989, and consisted of a 10-year survival follow-up. Study participants were 70–75 years old (1091 men and 1109 women) from Belgium, France, Denmark, Italy, The Netherlands, Portugal, Spain, Switzerland and Poland. The study investigated the effects of nonsmoking, being physically active, and having a high-quality diet (a diet that adheres to healthy eating guidelines) on survival (Haveman-Nies, 2002). Data analysis revealed unhealthy lifestyle behaviors (smoking, adhering to a low-quality diet, and physical inactivity) were separately related to increased mortality rate. Risk of death increased when any two of these unhealthy lifestyle factors where combined.

# 2.1.3. The European Prospective Investigation into Cancer and Nutrition Study (EPIC)

The European Prospective Investigation into Cancer and Nutrition Study (EPIC) is a multinational, prospective cohort study that examines the role of biological, dietary, and environmental factors in cancer and other chronic diseases. Participants were enrolled in the Greek component of EPIC between 1994 and 1999. From all regions of Greece, 22,043 participants aged 20 to 86 (5028 aged 55-64 years; 4369 were >65 years) were recruited (Trichopoulou, 2003). A 10-point Mediterranean diet scale was developed to assess adherence to the Mediterranean diet (scale of 0-9,

minimal to maximal adherence, respectively). Data analysis showed an inverse association between Mediterranean diet score and CHD, and that a 25% reduction in total mortality was associated with a two-point increment in the Mediterranean diet score.

#### 2.1.4. The INTERHEART Study

The INTERHEART study is a multicenter case-control study that investigates the relationship of nine protective or risk factors (smoking, lipids, self reported hypertension or diabetes, obesity, diet, physical activity, alcohol consumption, and psychological factors) to acute myocardial infarction (Yusuf et al. 2004). Study participants (15,152 cases and 14,820 controls) were recruited from 52 countries in Asia, Europe, the Middle East, Africa, Australia, North America, and South America. The overall median age was 58 years. At minimum, one age-matched (±5 years) and sex-matched control was recruited per case. The same exclusion criteria applied to controls and cases, with the exemption that controls had no previous diagnosis of heart disease or history of chest pain. Information on demographic factors, socioeconomic status, lifestyle habits, history of CVD, psychosocial factors, anthropometrical measurements and non-fasting blood samples were obtained. Data analyses showed that all risk factors (smoking, diabetes, hypertension, abdominal obesity, psychosocial, vegetables and fruit daily, exercise, alcohol, apolipoproteins B and A1) were significantly

related to acute myocardial infarction, apart from alcohol that had a weaker association. Consistent fruit and vegetable consumption was associated with a 30% relative risk reduction and when combined with exercise and smoking avoidance it could lead to an approximate 80% lower relative risk of myocardial infarction. Overall, this study showed that nine potentially modifiable risk factors were associated to more than 90% of the risk of an acute myocardial infarction.

#### 2.1.5. The HALE Study

The Healthy Ageing: a Longitudinal study in Europe (HALE) comprised of individuals enrolled in the SENECA study and the Finland, Italy, the Netherlands, Elderly (FINE) study. Knoops and colleagues (2004) investigated the single and combined effect of dietary and lifestyle factors with ten-year mortality from all causes, CHD, CVD, and cancer. The study population consisted of 1,507 seemingly healthy men and 832 women, aged 70–90 years from 11 European countries. The low-risk group was defined as those who consumed low quantities of alcohol per day, never smoked or stopped smoking >15 years ago, are minimally active and adhere closely to the Mediterranean dietary pattern. Overall, 4 points could be obtained, 1 point for a Mediterranean diet, and 3 points for the other healthful lifestyle factors. Data analysis showed that northern Europe had a lower diet score than southern Europe; the mean alcohol consumption was 17.5 g/day and

5.5 g/day for men and women, respectively, in northern Europe, compared to 31 g/day for men and 6 g/day for women, in southern Europe. During the 10-year follow-up, the number of men that died was double in comparison to the number of women. Data analysis associated a Mediterranean diet, moderate alcohol use, moderate to high physical activity, and nonsmoking with lower all-cause mortality, including CHD and CVD. Overall, those who had a combination of all four healthful diet and lifestyle factors had less than half the mortality rate from all causes, CHD, CVD, and cancer than those who did not. These findings support that Europeans aged 70–90 who follow healthful diet (Mediterranean) and lifestyle practices may reduce CHD and CVD.

#### 2.1.6. Framingham Heart Study (USA) and the European SENECA Study

The Framingham Heart Study consisted of 828 participants from Framingham, Massachusetts and 1282 participants from the European SENECA Study, aged 70 to 77 years. Haveman-Nies and associates (2001) used diet scores and cluster analysis to relate dietary quality to nutrition and lifestyle factors. Two main macronutrient profiles were observed in Europe: in northern Europe, fat and carbohydrates contributed equally to total energy intake while in southern Europe, carbohydrates contributed more than fats to total energy intake (Framingham elders are comparable to the southern European profile). Overall, diet scores from southern European centers were more favorable compared to northern centers. Individuals with

diet scores depicting low dietary quality had the highest waist circumference, in which waist circumference was typically highest in the meat and fat cluster (northern Europe), and lowest amongst those in the fish and grain (southern Europe) cluster. Waist circumference was related to dietary quality – subjects with low-quality diets were more overweight compared with those who had a high-quality diet. Overall, high-quality diets were related to more healthful lifestyle factors.

#### 2.1.7. The Health Professional Follow-Up Study

The Health Professional Follow-up Study (HPS) examined the association between dietary patterns and risk for type 2 diabetes in 42,504 predominately white US male professionals (40–75 years of age). Van Dam and colleagues (2002) applied factor analysis to assess dietary patterns. Factor analysis revealed two dietary patterns: 1) the prudent dietary pattern, which was characterized by a high consumption of vegetables, legumes, fruit, whole grains, fish and poultry, and 2) the western dietary pattern characterized by red meat, processed meat, refined grains, french fries, high-fat dairy products, sweets and desserts, high-sugar drinks and eggs. The prudent pattern was associated with a modest risk reduction for type 2 diabetes (multivariate relative risk for highest vs lowest quintiles, 0.84; 95% CI: 0.70–1.00) whereas the higher western-pattern scores were associated with a considerable increased risk for type 2 diabetes (relative risk, 1.59). Moreover, when examining specific foods that characterized the

prudent diet, a strong inverse association existed with whole grains and risk for type 2 diabetes. Unprocessed meat, processed meat, refined grains and high fat dairy products were specific foods, with major contributions to the western pattern, that were positively associated with risk of type 2 diabetes. Lastly, obese men in the highest quintile of the western dietary-pattern score had the highest risk for type 2 diabetes. Study findings confirm that dietary patterns can predict risk for type 2 diabetes. Dietary intervention strategies may influence the incidence rates of CVD, as diabetes is a common risk factor.

#### 2.2. A Summary of Clinical Studies

#### 2.2.1. The Cardio2000 Study

The Cardio2000 study examined the effect of a Mediterranean-type diet on the risk of developing acute coronary syndromes in hypertensive patients (Panagiotakos et al. 2002). The study included 658 male ( $59.0 \pm 10$  years) and 190 female ( $65.3 \pm 9$  years) patients of which 526 adopted a Mediterranean-type diet. Controls included 830 males ( $58.0 \pm 10$  years) and 248 female ( $64.8 \pm 9$  years) of which 765 adopted a Mediterranean-type diet. A validated questionnaire was used to assess adherence to the Mediterranean diet. Risk analysis showed a reduction of risk of developing acute coronary syndromes in both, hypertensive and normotensive subjects, in addition to those subjects who were unaware of their condition or uncontrolled. Panagiotakos and associates (2002) observed that adoption of the Mediterranean diet reduced the risk of developing acute coronary syndromes by 17% in controlled hypertensive patients, 8% in unaware patients, 7% in acknowledged but uncontrolled subjects and 20% in normotensive subjects.

# 2.2.2. The Mediterranean Diet, Cardiovascular Risks and Gene Polymorphism Study

#### (Medi-RIVAGE)

The Medi-RIVAGE trial examined the effects of a Mediterranean-type diet compared to a low-fat diet on CVD risk in subjects at moderate CVD risk (Vincent-Baudry et al. 2005). Eighty-eight subjects were in the Mediterranean group (42% were men and 58% were women; mean age,  $50.8 \pm 10.8$  years) and 81 subjects (39.5% were men and 60.5% were women; mean age,  $51.6 \pm 10.3$  years) were in the low-fat group. As part of the three-month nutritional strategy, subjects were provided with information on the recommended Mediterranean diet (adapted from the traditional model) or the low fat-diet (the low-fat American Heart Association-type diet adapted by the CDPA). The two diets were similar in terms of overall nutrients, except for the quantity and quality of lipid intake,

which was greater in the Mediterranean-type diet. After 3 months, Vincent-Baudry and colleagues observed that BMI, total and triacylglycerol-rich lipoproteins lipoprotein (TRL) cholesterol, triacylgrlycerols, TRL triacylgrlycerols, apo-A-I and B, insulinemia, glycemia, and the homeostasis model assessment score were significantly decreased. A decline of 15% in CVD risk was observed with this specific Mediterranean diet and a 9% decline with the low-fat diet - both diets displayed a measurable efficiency in reducing risk factors for CVD.

#### 2.2.3. The Lyon Diet Heart Study

The Lyon Diet Heart trial compared the protective effect of a Cretan Mediterranean diet to the prudent diet (routinely prescribed to patients after a first myocardial infarction) on reducing the risk of cardiovascular complications after a first myocardial infarction (de Lorgeril and Renaud, 1994). This was a prospective single-blind, randomized prevention trial where 302 patients were assigned to the experimental group (Cretan Mediterranean diet) and 303 patients were controls assigned the prudent diet. The Mediterranean type diet tested supplied, <35% of energy from fat, and <10% of energy from saturated fat, <4% of energy from linoleic acid and <0.6% of energy from a-linolenic acid. After a mean follow-up of 27months, de Lorgeril and Renaud (1994) observed 16 cardiac deaths in the control compared to 3 in the experimental group, and 5 non-fatal myocardial

infarctions in the experimental group compared to 17 in the control.

De Lorgeril and associates (1996) compared primary and secondary end-points in the study and control groups. Cardiovascular death and nonfatal acute myocardial infarction were primary endpoints while major secondary endpoints were unstable angina and stroke, and minor secondary endpoints consisted of myocardial revascularization (bypass surgery). Analysis showed that for primary and secondary end-points combined, 59 events occurred in the control and 14 in the study group (risk ratio, 0.24). This was a 76% reduction in risk. For primary, major secondary and minor secondary end-points combined, 104 events occurred in the control group and 68 events in the study group (risk ratio, 0.63). Lastly, the final report of the Lyon trial presented a follow-up (mean of 46 months per patient) that dealt with the relationships of dietary patterns and traditional risk factors with reoccurrence (de Lorgeril 1999). Results examining the relationship of the Mediterranean dietary pattern and re-occurrence found that the rate of cardiac death and nonfatal infarction in the experimental group after 46 months (1.24/hundred patients/year) was similar to the observations made after 27 months (1.32) in the control group. Due to the statistically significant results from this study, a decision was made to stop the trial. This study supports that dietary modification, such as adopting a Cretan Mediterranean diet, can interfere with the occurrence of acute coronary events.

#### **III: AIM AND OBJECTIVES**

Although the issue of longevity has been the subject of several studies, the factors that promote longevity gain must be better understood. Certainly, longevity is a complex attribute synthesized by factors such as exposure to disease, sleeping patterns, physical activity and diet. These factors are further compounded by social and psychological dynamics that influence physiological pathways. As a result, there has been increasing interest in identifying factors that allow some individuals to enter old age free from major diseases. For the purpose of this work, data from the Mediterranean Island Study (MEDIS) was analyzed in order to explore various lifestyle and dietary characteristics of a healthy (participants did not have a clinical history of CVD or cancer) long-lived population residing on the Mediterranean islands. Furthermore, though the Mediterranean diet has been recognized for its health promoting virtues, abandonment of this traditional diet is a modern phenomenon – particularly throughout the countries of its origin. MEDIS data were also analyzed in order to determine the degree by which present food habits uphold past dietary traditions of the Mediterranean diet.

As globalization persists, ideas and goods will continue to move around the world, and therefore impact environmental and cultural settings that some argue are the key determinants of dietary development (Grivetti 1978). As a small part of the present work, research was carried out in the

isolated communities of Olymbos and Avlona on the island of Karpathos, Greece. Due to the villagers' traditional lifestyle and limited opportunities to access large food outlets and markets from their isolated villages, it was thought that the appearance of past traditional Mediterranean dietary habits would prevail. Therefore, as a reference of traditional lifestyle and dietary practices of the 21<sup>st</sup> century, data regarding the villagers' food supply was collected in order to document the core diet of a population that has been minimally eroded by industrialization and tourism, and to link these food patterns to the foods' historical roots and to the exploitation of natural resources available to the community.

The aim of the present thesis is to explore various lifestyle and dietary characteristics of a healthy long-lived population residing on the Mediterranean islands. More specifically, the study objectives include: 1) To evaluate various socio-demographic, clinical and lifestyle characteristics of elderly (i.e., >65 years) and very elderly (i.e., >90 years) individuals without known CVD. 2) To examine the degree by which present food habits of inhabitants residing in various Mediterranean islands uphold past dietary traditions of the Mediterranean diet. 3) To document the core diet of a population in a Mediterranean island that has been minimally eroded by industrialization and tourism, and to link these food patterns to the foods' historical roots and to the exploitation of natural resources available to the community.

### **IV: STUDY METHODOLOGY**

#### 3.1. The MEDIS Sample

A population-based, multi-stage (by region, sex and area) sampling method (i.e., selection of the island on a feasibility basis, then selection of men and women according to the population distribution, and selection of urban or rural areas according to the island's distribution) was used to voluntarily enroll 876 men (aged 75  $\pm$  7 years) and 936 women (aged 74  $\pm$ 7 years) from the following twelve Mediterranean islands: Malta (n = 250), Republic of Cyprus (n = 300) and the Greek islands of Mitilini (n = 142), Samothraki (n = 100), Cephalonia (n = 115), Crete (n = 131), Corfu (n = 149), Limnos (n = 150), Ikaria (n = 76), Syros (n = 151), Naxos (n = 145) and Zakynthos (n = 103). Individuals were not included in the survey if they resided in assisted-living centers, or had a clinical history of cardiovascular disease (CVD) or cancer, or had left the island for a considerable period of time during their life (i.e. >5 years). A group of health scientists (i.e., physicians, dietitians and nurses), with previous experience in field investigation, collected all the required information, using a quantitative questionnaire and standard procedures.

#### 3.2. Ethical Considerations (MEDIS)

The retrieved data are confidential, and the study followed the ethical considerations provided by the World Medical Association (52<sup>nd</sup> WMA General Assembly, Edinburgh, Scotland, October 2000). Moreover, the Institutional Review Committee approved the study aims, design and procedures. Participants were informed of the study aims and procedures and gave their written consent prior to enrollment.

#### 3.3. Evaluation of Dietary Consumption (MEDIS)

Dietary habits were assessed through a semi-quantitative, validated and reproducible food-frequency questionnaire (Tyrovolas et al. 2010). Frequency of consumption of various food groups and beverages (i.e. meat and products, fish and seafood, milk and other dairy, fruits, vegetables, greens and salads, legumes, cereals, coffee and tea and soft-drinks) on a daily, weekly or monthly basis was assessed. Furthermore, intake of various alcoholic beverages (i.e., wine, beer, etc.) was measured in terms of wineglasses adjusted for ethanol intake (e.g., one 100 ml glass of wine is considered to have 12% ethanol). To evaluate the level of adherence to the Mediterranean diet the MedDietScore (possible range 0-55) was used (Panagiotakos 2006). For the consumption of foods presumed to be close to this pattern (i.e., those suggested on a daily basis or more than 4 servings per week) scores 0 to 5 will be assigned when a participant reported no consumption to daily consumption, respectively. On the other hand, for the

consumption of foods presumed to differ from this pattern (like meat and meat products) the opposite scores will be assigned (i.e. 0 when a participant reports almost daily consumption to 5 for rare or no consumption). Regarding alcohol intake, score 5 will be assigned for consumption of less than 3 wineglasses per day, score 0 for no consumption or consumption of more than 7 wineglasses per day and scores of 4, 3, 2, and 1 for the consumption of 3, 4-5, 6, and 7 glasses, respectively. Higher values of this diet score indicate greater adherence to the Mediterranean diet. The level of adherence to the Mediterranean diet will be evaluated as the ratio of the mean diet score divided by 55, which is the total possible achievable score (i.e., MedDietScore / 55 x 100%).

#### 3.4. Clinical and Biochemical Assessment (MEDIS)

Clinical, biochemical, socio-demographic and lifestyle characteristics were collected. The evaluated clinical characteristics, as assessed by physicians, were history and management of diabetes, hypertension, hypercholesterolemia and obesity. Diabetes mellitus (type 2) was determined by fasting plasma glucose tests and were analyzed in accordance with the American Diabetes Association diagnostic criteria (i.e. fasting blood glucose levels >125mg/dl or use of special anti-diabetic medication); blood pressure levels > 140/90 mm Hg or use of antihypertensive medications classify the participants as hypertensive. Fasting blood lipid levels were

recorded, and hypercholesterolemia was defined as total serum cholesterol levels >200mg/dl or the use of lipid-lowering agents. Weight and height were measured to obtain body mass index (BMI) scores (in kilogram per square meter). Obesity is defined as BMI > 29.9 kg/m<sup>2</sup>, while underweight is BMI < 18.9 kg/m<sup>2</sup>. Characteristics of the participants were based on a clinical diagnosis made by a physician at hospital or private setting.

#### 3.5. Evaluation of Physical Activity (MEDIS)

Physical activity was evaluated using the shortened version of the selfreported International Physical Activity Questionnaire (IPAQ) (Craig 2003). Frequency (times per week), duration (minutes per time) and intensity of physical activity during sports, occupation and/or leisure activities were assessed. Participants were classified as inactive, minimally active and HEPA active (health enhancing physical activity; an elevated activity category). Participants were instructed to report only episodes of activities of at least 10 minutes, since this is the minimum required to achieve health benefit. The following classification criteria was used:

HEPA active classification was when any of the following
 criteria were met: i) vigorous-intensity activity on at least 3
 days achieving a minimum of at least 1500 MET minutes/week, or ii) 7 or more days of any combination of
 walking, moderate-intensity or vigorous intensity activity

achieving a minimum of at least 3000 MET-minutes/week.

- (b) Minimally active, the classification for sufficiently active, was when any of the following three criteria were met: i) 3 or more days of vigorous activity of at least 20 minutes per day, ii) 5 or more days of moderate-intensity activity or walking of at least 30 minutes per day, or iii) 5 or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving of at least 600 MET-min/week.
- (c) Finally, inactive classified an individual when no criteria were met to classify him or her in any of the other two categories.

3.6. Assessment of Behavioral and Socio-demographic Characteristics (MEDIS)

Current smokers are defined as those who smoked at least one cigarette per day or had stopped smoking cigarettes during the past 12 months. Former smokers are defined as those who previously smoked, but had not done so for a year or more (WHOSIS). Both former and current smokers constitute the group of ever smokers. The remaining participants are defined as rare or non-current smokers. Passive smokers are those exposed to environmental tobacco smoke (ETS), for example, at the workplace, at home or enclosed public areas, for more than 30 min/day. Occupational skills were assessed on a scale ranging from 1 to 4. Lower

values indicate manual labor, whereas higher values depict labor requiring greater training and theoretical insight. Good or high financial status is defined as an annual income greater than  $12,000 \in$ .

#### 3.7. Statistical Analysis (MEDIS)

Continuous variables were presented as mean ± standard deviation (SD), and categorical variables as frequencies. Comparisons of normally distributed continuous variables between groups were performed using Student's t-test, or one-way analysis of variance (ANOVA, with Bonferroni correction). Normality was tested using P-P plots. Independence between categorical variables was tested using the chi-square criterion. A p-value <0.05 was considered to be statistically significant. Principal component analysis was used to define individuals' dietary patterns (i.e. components) according to region. The number of the extracted components was defined according to the percentage of the explained variance in intake. Each component was interpreted ("defined") based on the foods that had absolute loadings greater than 0.40, which were considered as significantly contributing to the specific diet component (pattern). SPSS software (version 18) was used for all calculations (SPSS Inc., Chicago, II, USA).

#### 3.8. The Sample (Case Study in the Northern Villages of Karpathos)

The researchers conducted semi-structured interviews with residents

of Olympos and Avlona with the purpose of determining their core diet and how it relates to the use of natural resources available in the community. Convenience-based sampling was used to voluntarily enroll four men (aged  $73 \pm 10$  years) and eight women (aged  $71 \pm 8$  years). Participants were included in the study if they were permanent inhabitants of Olympos or Avlona and had resided on the island for most of their lives (having lived elsewhere no more than five years). Circumstantially, all participants included in the study were elders (over the age of sixty), as this age group was most characteristic of the permanent inhabitants. Moreover, women comprised a larger share of the sample because most men are employed elsewhere throughout the greater duration of the year (usually in construction). Therefore, middle-aged adults, notably men, were underrepresented. Interviews were conducted over a ten-day period in mid-August. The retrieved data are confidential. Participants were informed of the study aims and procedures and gave their written consent prior to enrollment.

3.9. The Interviews (Case Study in the Northern Villages of Karpathos)

A dietary and lifestyle structured questionnaire was used to gain an understanding of the food supply in both past and present times, cultivation activities, methods of food acquisition in addition to the driving factors that may encourage dietary modification. The issue of past and present meal composition was explored through questions that elicited responses on

frequency of consumption of various food types (Has consumption increased or decreased as compared with the past years (>30 years)?), methods of food acquisition (Were foods acquired from fields, gardens, orchards, livestock, fishing, gathering, the market?) and the role of dietary change (Has the participant's diets changed as compared to the previous generation. If yes, why?). Core foods consumed by Greek populations were included in the survey (i.e. bread, pasta, legumes, greens, goat, sheep, milk, cheese in addition to various beverages). Furthermore, composition of meals (breakfast, snacks, lunch and dinner) in past and present times was also discussed (see Appendix, section 7.1). The interviews were completed in the study area and lasted forty-five to seventy-five minutes. Additionally, a shepherd who permanently resided in Olympos guided the researchers throughout Avlona, and provided information on agricultural practices and products. His family's fields and homestead in Avlona were examined and these findings were triangulated with the findings from the interviews. Trends in the data were identified and compared for consistency with other studies completed in the area or comparable areas.

#### V: RESEARCH PUBLICATIONS

# 4.1. "The 'secrets' of the long livers in Mediterranean islands: the MEDIS study", in the *European Journal of Public Health*

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# The 'secrets' of the long livers in Mediterranean islands: the MEDIS study

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**Background**: The aim of the present work was to evaluate various socio-demographic, clinical, lifestyle and psychological characteristics of elderly (>65 years) and very elderly (>90 years) individuals without known cardiovascular disease. **Methods**: During 2005–7, 1190 elderly (aged >65) men and women (from Cyprus, Mitilini, Samothraki, Cephalonia, Crete, Lemnos, Corfu and Zakynthos) were randomly enrolled. Socio-demographic, clinical, psychological and lifestyle factors were assessed using standard questionnaires and procedures. **Results**: From all islands, the proportion of males aged 65–80, 80–90 and >90 years was 71.8, 24.8 and 3.4%, respectively. The proportion of women, for the same age categories, was 80.4, 17.9 and 1.7%, respectively. Walking and other activities significantly declined with age (P<0.001); however, nearly one in five participants over the age of 90 years remained physically active. Current smoking significantly declined in males as age increased (P<0.001). All participants above the age of 90 years reported sleeping at noon. The proportion of participants living alone differs significantly (P<0.001) across the three age groups. However, considerably more women live alone (men vs. women living alone: aged 65–80 years 12 vs. 37%; 80–90 years 16 vs. 55%; >90 years 52 vs. 55%). Dietary characteristics of The Mediterranean Islands Study (MEDIS) sample display a favourable adherence to dietary recommendations (Mediterranean diet). **Conclusion**: A favourable adherence to the Mediterranean diet, mid-day naps and smoking cessation with an increase in age was characteristic of our elderly population. Future research should further evaluate whether the aforementioned characteristics are associated with longevity beyond the average life expectancy.

Keywords: diet, elderly, long-lived, physical activity, vital status.

#### Introduction

is now evident from various socio-demographic studies that a greater portion of the population survives into old age (over seventh decade of life). However, the factors that promote living after the seventh or eighth decade of life remain unknown. Therefore, a question may arise: what is the 'formula' that allows some elders to thwart chronic diseases such as cancer and cardiovascular disease (CVD)? What factors contribute to their improved life expectancy and well-being? The oldest old ( $\geq 80$  years) in many countries are the fastest growing portion of the population. Due to these changes in demography, the United Nations' Global Population Pyramid is undertaking a shift-from pyramid to cube-as the proportion of children and young adults decline and proportion of elders increase.2 The resultant change in the age distribution of the world's population is partially attributed to medical advancements of the 21st century, including a decline in infectious and parasitic diseases, a reduction in maternal and infant mortality and improved nutrition.3

Clearly, longevity is a complex attribute determined by factors such as exposure to disease, variability in sleeping patterns, smoking habits, physical activity and diet that have a direct effect, in addition to their indirect emotional and cognitive influence on physiological pathways. Longevity gain marks a significant achievement in human history yet also comes with challenges. The concomitant decline in fertility and mortality rates produces a higher portion of older people, and, thus an increased number of deaths due to non-communicable diseases.<sup>4</sup> Thirty percent of the approximated 58 million global deaths from all causes were attributed to CVD-or, otherwise quantified, this proportion is equal to the combined deaths due to infectious disease, nutritional deficiencies and maternal and perinatal conditions.<sup>5</sup> Although medical advancements delay mortality, the same cannot be said for preventing disability before death. The World Health Organization reports that 10.3% of total disability-adjusted life years (healthy years of life lost) are lost due to CVD. Thus, surviving into old age is only half the battle.

Few epidemiological studies have addressed the question of which factors have the greatest effect on longevity. Trichopoulou *et al.*<sup>6</sup> examined, in a cohort study, the effects of the traditional Mediterranean diet (low in saturated fat, high in monounsaturated fat, high in complex carbohydrates and high in fibre) on health and survival of 182 elderly residents from three Greek villages. They found a one unit increase in diet score (an *a priori* defined nutritional patterns reflecting the traditional Greek Mediterranean diet) was significantly associated with a 17% reduction in overall mortality. Results of the European Prospective Investigation into Cancer and Nutrition (EPIC) study showed that a modified Mediterranean diet (where unsaturates were substituted for monounsaturates)

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was associated with increased survival among older people.<sup>7</sup> A recently published large longitudinal study showed that longevity was associated with activity, emotional stability and conscientiousness.<sup>8</sup> Longevity also seems to be a product of the interaction between physical, social, behavioural and demographic factors.<sup>9</sup>

The issue of longevity is complex. To begin to understand it one must, at minimum, explore the inter-relationships between factors and to what extent these factors are involved in the cause and prevention of ageing. The present article explores the issue of longevity by presenting a 'snapshot' of the various characteristics of this long-lived Mediterranean population. Thus, causal relationships cannot be examined. Under these concepts, it was interesting to evaluate various socio-demographic, clinical, lifestyle and psychological characteristics of old (>65 years) and oldest old (>90 years) individuals without known CVD who lived all their life in various Mediterranean islands and highlight further the concept of longevity on a known healthy European population.

#### Methods

#### Participants of the study

A random, population-based, multistage sampling method was used to select 553 men (76 $\pm$ 7 years) and 637 women (74 $\pm$ 7 years), from the Republic of Cyprus (n=300) and the islands of Mitilini (n=142), Samothraki (n=100), Cephalonia (n=115), Crete (n=131), Corfu (n=149), Lemnos (n=150) and Zakynthos (n=103) in Greece. Individuals residing in assisted-living centres, as well as those with a clinical history of CVD or cancer were not included in the survey. The participation rate varied according to island, from 75% to 89%. A group of health scientists (physicians, dietitians and nurses) with experience in field investigation collected all the required information, using a quantitative questionnaire and standard procedures.

#### *Clinical, biochemical, socio-demographic and lifestyle characteristics*

Study details have been published elsewhere.<sup>10</sup> Briefly, clinical, biochemical, socio-demographic and lifestyle characteristics were collected. The evaluated clinical characteristics, as assessed by participants' physicians, were history and management of diabetes, hypertension, hypercholesterolemia and obesity. Diabetes mellitus (type 2) was determined by fasting plasma glucose tests and was analysed in accordance with the American Diabetes Association diagnostic criteria (i.e. fasting blood glucose levels >125 mg/dl or use of special antidiabetic medication); blood pressure levels  $\geq$  140/90 mm Hg or use of antihypertensive medications classified the participants as hypertensive. Fasting blood lipid levels were also recorded and hypercholesterolemia was defined as total serum cholesterol levels >200 mg/dl or the use of lipid-lowering agents. Weight and height were measured to obtain body mass index (BMI) scores (in kilogram per square metre). Obesity was defined as  $BMI > 29.9 \text{ kg/m}^2$ , while underweight was  $BMI < 18.9 \text{ kg/m}^2$ . Characteristics of the participants were based on a clinical diagnosis made by a physician at hospital or private setting.

Dietary habits were assessed through a semi-quantitative, validated and reproducible food-frequency questionnaire. Intake of various alcoholic beverages was measured in terms of wine glasses adjusted for ethanol intake (e.g. one 100 ml glass of wine was considered to contain 12% ethanol). To evaluate the level of adherence to the Mediterranean diet, the MedDietScore (possible range 0–55) was used where higher

values indicate greater adherence to the Mediterranean diet.<sup>11</sup> Physical activity was evaluated using the shortened version of the self-reported International Physical Activity Questionnaire (IPAQ).<sup>12</sup> Frequency (times per week), duration (minutes per time) and intensity of physical activity during sports, occupation and/or leisure activities were assessed. For the purposes of this work, participants were classified as inactive (i.e. no physical activities during a day) or active. Participants were instructed to report only episodes of activity lasting at least 10 min, since this is the minimum time required to achieve health benefits.

Current smokers were defined as those who smoked at least one cigarette per day or had stopped smoking cigarette during the past 12 months. Former smokers were defined as those who previously smoked, but had not done so for a year or more. Both former and current smokers constituted the group of ever smokers. The remaining participants were defined as rare or non-current smokers. Passive smokers were those exposed to environmental tobacco smoke (ETS), for example, at the workplace, at home or enclosed public areas, for > 30 min/day. Occupational skills were assessed on a scale ranging from 1 to 4. Lower values indicate manual labour, whereas higher values depict labour requiring greater training and theoretical insight. Good or high financial status was defined as  $> \in 12\,000$  per year.

#### Assessment of depressive symptoms

Symptoms of depression during the past month were assessed using the validated Greek translation of the shortened, self-report Geriatric Depression Scale (GDS).<sup>13,14</sup> The GDS questionnaire included 'yes or no' items (for details, see Panagiotakos *et al.*<sup>15</sup>) where responses were coded one (for answers that indicate depressive symptoms) and zero (for answers that do not indicate depressive symptoms), yielding a possible total score between 0 and 15. Higher values indicate more severe depressive symptomatology.

#### Statistical analysis

Continuous variables are presented as mean  $\pm$  standard deviation (SD), and categorical variables as frequencies. Gender-specific comparisons of continuous variables between the three groups (65–80, between 81 and 90 and >90 years) were performed using the Analysis of Variance (for normal distributions) and the Kruskal–Wallis (for skewed distributions). Associations between categorical variables were tested using the Pearson's chi-square test. All tested hypotheses were two-sided. A *P*-value <0.05 was considered to be statistically significant. SPSS version 14 software was used for all calculations (SPSS Inc., Chicago, IL, USA).

#### Results

In table 1, the frequency of males and females of each island, according to age groups (65-80, 80-90, >90 years) is presented. It should be mentioned that during the random sampling procedure the only factor that has been pre-set was the men to women ratio for each island according to the National Statistical Services (varied between 0.95:1.05 and 1.01:0.99 from island to island). Thus, the frequency of males and females between 80 and 90 years or >90 years is not biased due to sampling procedures.

The distribution of various socio-demographic and behavioural characteristics by age group, are given in table 2. Frequency of physical activity varied with age and gender. Men compared with women were more physically active; almost half of the male participants aged 65–90 years were physically active compared with one in four women. Although walking and other activities significantly declined with age (P < 0.001), nearly one in five participants above the age of 90 years was still physically active. The aged-based differences for years of school and occupational skills in men and women were not significant (table 2). Years of school was higher among younger participants and with the exception of women aged 80–90 years, the disparity for occupational skills was slightly higher for men across all age categories. Overall, current smoking significantly declined in males as age increased (P < 0.001). Very few women were current smokers. None of the women over the age of 80 years were current smokers. The number of participants who had ever smoked also declined with age. Men, exceedingly more than

 Table 1
 Prevalence of age groups in males and females

 residing in the Mediterranean islands (%)
 \$(%)

Island	65-80 years		80–90 years		>90 years	
	Male	Female	Male	Female	Male	Female
Samothrace	64.4	80.0	31.1	16.4	4.4	3.6
Mitilini	81.5	88.6	16.7	11.4	1.9	0.0
Limnos	92.0	95.0	8.0	5.0	0.0	0.0
Crete	76.8	81.3	19.6	18.7	3.6	0.0
Cephalonia	71.7	77.4	24.5	19.4	3.8	3.2
Corfu	78.7	65.5	19.1	34.5	2.1	0.0
Zakynthos	78.8	83.8	19.7	16.2	1.5	0.0
Cyprus	52.6	72.1	40.7	23.6	6.7	4.2
Overall	71.8	80.4	24.8	17.9	3.4	1.7

women, were ever smokers. For all age categories, nearly one in two men ever smoked, compared with less than 1 in 10 women. Conversely, ETS exposure was more common in women, except in the age category over 90, where 17% of men compared with 0% of women were exposed. Strong associations exist between smoking habits and age categories in men.

Depressive symptomatology as assessed by the GDS scores slightly increased with age, women having slightly higher scores. Nearly all participants, in all age categories reported napping regularly (among men aged 65-80, 80-90 and >90 years, napping rates were 86, 83 and 100%, respectively; among women of the same age categories, rates were 79, 80 and 100%, respectively). Slightly more men than women napped; ultimately, all participants above the age of 90 years reported sleeping at noon. The proportion of participants living alone differ significantly (P < 0.001) across the three age groups, in both men and women. However, considerably more women live alone (men vs. women living alone: 65-80 years 12 vs. 37%; 80-90 years 16 vs. 55%; >90 years 52% vs. 55%). Approximately 50% of all participants lived in urban areas and nearly one in five males reported good or high financial status. More men than women reported a high financial status; 21% of men compared with 0% of women aged >90 years. The age of mothers' death was slightly higher than the age of fathers' death for both, men and women aged 65-90 years. The only exception was for participants above the age of 90, where the father outlived the mother (age of father vs. mother, men: 82 vs. 76 years; women 85 vs.

Table 2 Socio-demographic and behavioural characteristics of the MEDIS study participants according to age category and sex

Males ( <i>N</i> = 553)	65–80 years ( <i>n</i> = 397)	80–90 years ( <i>n</i> = 137)	>90 years ( <i>n</i> = 19)	P-value
Physical activity (%)	45	43	16	0.04
Walking and other activities (min./day) (mean $\pm$ SD)	$156\pm68$	$103\pm 66$	$63\pm23$	0.001
Years of school, mean $\pm$ SD	$\textbf{6.8} \pm \textbf{3.5}$	$\textbf{6.0} \pm \textbf{2.9}$	$\textbf{4.7} \pm \textbf{3.7}$	0.008
Occupation skills (1–4) (mean $\pm$ SD)	$1.8\pm0.9$	$1.7\pm0.8$	$1.5\pm0.7$	0.50
Current smoking (%)	30	14	11	0.001
Ever smoking (%)	64	52	37	0.004
Exposed to ETS (%)	35	17	17	0.004
GDS (0–15) (mean $\pm$ SD)	$7\pm4$	8±4	$10\pm3$	0.19
Sleeping at noon (%)	86	83	100	0.98
Living alone (%)	12	16	52	0.001
Members of family (mean $\pm$ SD)	$2.2\pm1.0$	$2.0\pm0.8$	$1.6\pm0.8$	0.002
Good, very good financial status (%)	21	15	21	0.33
Living in urban areas (%)	63	51	63	0.04
Age of parents' death (median for all age groups combin	ned)			
Father	80			
Mother	80			
Females ( <i>N</i> = 637)	<80 years ( <i>n</i> = 512)	80-90 years ( <i>n</i> = 114)	>90 years ( <i>n</i> = 11)	<i>P</i> -value
Physical activity (%)	29	26	18	0.63
Walking and other activities (min/day) (mean $\pm$ SD)	$138\pm 64$	$94\pm28$	$46\pm15$	0.001
Years of school (mean $\pm$ SD)	$5.5\pm3.0$	$\textbf{4.8} \pm \textbf{2.9}$	$3.0\pm2.1$	0.004
Occupation skills (0–4) (mean $\pm$ SD)	$1.7\pm0.8$	$2.7\pm0.9$	$1.3\pm0.5$	0.25
Current smoking (%)	5	0	0	0.04
Ever smoking (%)	8	3	0	0.08
Exposed to ETS (%)	45	35	0	0.14
GDS (0–15) (mean $\pm$ SD)	$9\pm4$	$8\pm4$	$11\pm3$	0.19
Sleeping at noon (%)	79	80	100	0.98
Living alone (%)	37	55	55	0.001
Members of family (mean $\pm$ SD)	$1.8\pm0.8$	$1.6\pm0.8$	$1.8\pm1.0$	0.03

	<80 years	80–90 years	>90 years	<i>P</i> -value
Males				
MedDietScore (0–55)	$33\pm4$	$33 \pm 4$	$34\pm3$	0.76
Consumption of (dietary recommendations) <sup>a</sup>		Times/w	eek <sup>b</sup>	
Cereals (20–30 times)	$29\pm13$	$26\pm13$	$14\pm14$	0.26
Fruits (3–4 per day)	$4.6 \pm 1.8$	$5.0 \pm 1.7$	$5.4 \pm 1.1$	0.36
Vegetables and salads (35–60 times)	$56 \pm 38$	$59\pm41$	$60\pm37$	0.51
Fish (2–3 times)	$2.3 \pm 1.2$	$2.1 \pm 1.3$	$1.9 \pm 1.1$	0.002
Red meat and products (0–1 times)	$2.7\pm1.0$	$2.7 \pm 1.3$	$2.4 \pm 1.1$	0.59
Olive oil (daily)	$\textbf{5.0} \pm \textbf{1.8}$	$5.1\pm1.7$	$\textbf{5.1} \pm \textbf{1.9}$	0.26
Females				
MedDietScore (0–55)	$34\pm4$	$34 \pm 4$	$33 \pm 3$	0.76
Consumption of (dietary recommendations) <sup>a</sup>		Times/w		
Cereals (20–30 times)	$27\pm14$	$24\pm14$	$28\pm18$	0.26
Fruits (3–4 per day)	$4.9 \pm 1.6$	$5.1 \pm 1.4$	$4.6 \pm 2.4$	0.37
Vegetables and salads (35–60 times)	$55\pm35$	$58\pm40$	$64\pm33$	0.51
Fish (2–3 times)	$2.0\pm1.1$	$1.8 \pm 1.1$	$1.1\pm0.7$	0.002
Red meat and products (0–1 times)	$2.7\pm1.0$	$2.8\pm1.0$	$2.7\pm1.1$	0.59
Olive oil (daily)	$5.1\pm1.8$	$5.3\pm1.2$	$\textbf{4.7} \pm \textbf{1.8}$	0.26

a: Dietary intakes as per food-based Mediterranean diet recommendations have been included in parenthesis as a point of reference to achieved consumption

b: Food consumption refers to times/week unless otherwise noted

79 years). Men reported a slightly higher number of members in the family than women (table 2).

Dietary characteristics of The Mediterranean Islands Study (MEDIS) sample display a favourable adherence to dietary recommendations (the Mediterranean diet) (table 3). Overall, slight differences exist in the MedDietScore between sex and age categories. Among the men, in the following age categories, 65-80, 80-90 and >90 years, the MedDietScore was  $33 \pm 4$ ,  $33 \pm 4$  and  $34 \pm 3$ , respectively. For the same age categories in women, the MedDietScore was  $34 \pm 3$ ,  $34 \pm 3$ and  $33\pm3,$  respectively. Significant differences between sex and intakes (cereals, fruits, vegetables and salads, fish, red meat and products and olive oil) did not exist. At this point, it should be reported that the study population, almost entirely, met dietary recommendations. Cereal intake among men and women differed slightly and met dietary recommendations, with the exception of men in the >90 age category. All participants reported a substantial intake of fruits, meeting and surpassing recommendations (table 3). Frequent consumption of vegetables and salads met recommendations and followed a steady increase with age. Women above the age of 90 years exceeded vegetable recommendations. Dietary recommendations for fish intake are two to three times per week. Younger participants met these recommendations although consumption declined with age. Intakes of red meat and products differed only slightly between men and women; however, all participants, across all age groups exceeded the recommended allowance (table 3). Although a substantial amount of olive oil was consumed by both men and women in all age groups, participants consumed slightly less than the recommendations.

An inverse association was observed between anthropometric indices and age category. However, it should be mentioned that these associations were significant, in women, but not in men (table 4). Almost none of the men were underweight; however, 29% aged 65–80 years, 25% aged 80–90 years and 10% aged >90 years were obese. In women, a significant direct association was observed between underweight and age group (P < 0.001). In particular, 0.4% of women aged 65–80 years, 3.7% aged 80–90 years and 10% aged >90 years were underweight. Similarly, a significant association was found between obesity and age category (P < 0.001), where 44, 33 and 10% of women aged 65–80,

 Table 4
 Anthropometric and clinical characteristics of the

 MEDIS study male and female participants according to age

	<80	80-90	>90	P-value
	years	years	years	
Males				
N	397	137	19	
BMI (kg/m²) (mean $\pm$ SD)	$28.1\pm4.1$	$\textbf{27.4} \pm \textbf{4.1}$	$26.6\pm2.9$	0.09
Waist circumference (cm) (mean $\pm$ SD)	$105\pm13$	$103\pm11$	$99\pm9$	0.19
Underweight (%)	0.8	0	0	0.29
Obesity (%)	29	25	10	0.16
Hypertension (%)	59	71	74	0.03
Hypercholesterolemia (%)	48	42	39	0.41
Diabetes (%)	22	18	26	0.59
Females				
N	512	114	11	
BMI (kg/m²) (mean $\pm$ SD)	$\textbf{29.7} \pm \textbf{5.2}$	$\textbf{28.2} \pm \textbf{5.0}$	$\textbf{23.8} \pm \textbf{4.5}$	<0.001
Waist circumference (cm) (mean $\pm$ SD)	$103\pm13$	$104\pm12$	$93\pm12$	0.02
Underweight (%)	0.4	3.7	10	<0.001
Obesity (%)	44	33	10	<0.001
Hypertension (%)	72	70	82	0.67
Hypercholesterolemia (%)	66	52	11	0.001
Diabetes (%)	24	19	9	0.32

80–90 and >90 years, respectively, were obese. Most of the study sample was hypertensive—three out of five participants (table 4). Hypercholesterolemia was prevalent in nearly half the male participants. Moreover, one in five men was diabetic. Strong associations were found regarding hypercholesterolemia and diabetes in women. Hypercholesterolemia was substantially more prevalent in women aged 65–80 and 80–90 years compared with those aged >90 years, 66% and 52% compared with 11% (P < 0.001), respectively. An inverse relationship was also found with the prevalence of diabetes in women where 24, 19 and 9% of women aged 65–80, 80–90 and >90 years, respectively, were diabetic.

#### Discussion

The present work investigated 'healthy ageing' of long-lived individuals, who are free of CVD, in order to identify sociodemographic, clinical, lifestyle and psychological characteristics that encourage longevity gain, and, more importantly, quality of life. It is of major interest, nowadays, to study characteristics of people living over the expected life span. Projections for Europe estimate that in 1995, 13.3% of the population was above the age of 65 years, and in 2015, this figure is expected to rise to 16.3%.<sup>1</sup> Impressively, in comparison, the present study population included 28.2% and 19.6% of men and women, respectively, who were above the age of 80 years. Data analysis of the MEDIS Study revealed that modifiable risk factors, such as physical activity, diet, smoking cessation and mid-day naps, might depict the 'secrets' of the Mediterranean long livers. Similar findings were reported by Knoops *et al.*<sup>16</sup> in the Health Ageing: a Longitudinal study in Europe (HALE) study where lower mortality rates from all causes-coronary heart disease, CVD and cancer-were associated to a Mediterranean diet, moderate alcohol consumption, moderate to high physical activity levels and non-smoking. In addition, one study found regular activity to be associated with reduced overall mortality.<sup>17</sup> Rowe and Kahn<sup>18</sup> postulate that disability and disease is not an inevitable consequence of ageing-common ageing characteristics are due to lifestyle and other factors that may be age related but are not age dependent. For example, heart disease and type II diabetes may develop in childhood and culminate in later life. This progression occurs over time; however, it can be interceded early in life.

We used a special diet score to estimate the level of adherence to the Mediterranean diet as well as its association with CVD risk factors. Only slight differences in MedDietScore exist in our sample; the scores ranged from 33 to 34 (a fact that may be considered as moderate to good adherence to the traditional Mediterranean diet). Longer survival associated with closer adherence to the Mediterranean diet pattern has been reported by many studies.<sup>19–21</sup> High fruit and vegetable consumption, often exceeding dietary recommendations, was a characteristic of this study population. This finding reflects a typical feature of the Mediterranean food culture. For example, green vegetables eaten not only as a salad dish, but also as the main dish of the meal cooked in olive oil. Moreover, wild plants that are frequently collected and utilized as source of food are a widely accepted means of daily living on the Greek islands. Wild greens, more so than red wine or black tea, have exceptionally high flavonoid content-one of the most important categories of antioxidant in the human diet.<sup>21</sup> Olive oil, consumed roughly on a daily basis, remained a stable component of the diet across all age groups. Tuck and Hayball<sup>22</sup> conclude in their review that olive oil and its major phenolenic constituents are strong antioxidants and good radical scavengers. Consumption of red meat and products surpassed the recommended guidelines (0-1 times/week). It is unclear what effect red meat intake had on clinical variables, though the prevalence of hypercholesterolemia has been related to high intakes of red meat. Frequent consumption of animal products has been directly correlated with mortality from coronary heart disease<sup>23</sup> yet, evidence suggests, lean red meat, if consumed in a diet low in saturated fat-the presumed diet of the present populationis associated with reductions in low density lipids cholesterol in both healthy and hypercholesterolemic subjects.<sup>24</sup> Dietary recommendations for fish were largely met, predominantly by men. Consumption of fish declined with age and financial status. Fish is often an expensive commodity, and thus its consumption may be limited.

increased, particularly in women. Ten percent of women aged 90 or above were underweight. The relationship between optimal BMI for longevity remains unclear. Although one cohort found that the leanest women (BMI < 19.0) had the lowest mortality,225 results from a population-based study including Italian elders aged 65-95 years found no relationship between BMI and overall mortality in women.<sup>26</sup> This change in weight and height is expected because after the age of 60 years, body weight, on average, tends to decline. Furthermore, Seidell and Visscher<sup>27</sup> report that anthropometric data are poor indicators of changes in body composition and fat distribution that accompanies ageing. This may clarify why the relationship between high BMI and mortality is more pronounced in younger populations than older populations. For example, when weight is within the acceptable range or even slightly above, lower rates of mortality are observed in the elderly; whereas, in young or middle-aged populations weight slightly above the acceptable range is associated with higher rates of mortality. Among all participants, the prevalence of hypertension increased with advanced age, whereas an opposite trend was observed for hypercholesterolemia and diabetes. Moreover, almost 9 out of 10 men and all women above the age of 90 years reported no smoking habits. Results from the Cancer Prevention Study II, an ongoing prospective study, suggest that irrespective of age, quitting smoking substantially extends life years.<sup>28</sup> Longevity gain for smokers who quit at the age of 65 years was 1.4-2.0 years and 2.7-3.7 years for men and women, respectively. The majority of the participants also took mid-day naps (siesta) almost everyday in the week. In a sample of 23 681 residents from Greece with no history of heart disease, stroke or cancer, Naska et al.<sup>29</sup> recently suggested that a mid-day siesta may reduce a person's risk of death from heart disease, possibly by lowering stress levels. Also, characteristic of the present population was living together with another person (mostly husband and wife, or other family member), which may minimize feelings of loneliness. Work by Arthur,<sup>30</sup> on older adult populations in a secondary prevention setting, found a consistent relationship between social support, social isolation and CVD.

The presented findings together with previous works suggest that interplay of genetic, environmental, behavioural and clinical characteristics determine how long an individual lives. This is a widely accepted concept that must be further explored in order to understand how these factors relate and which are most important in shaping longevity. This study cannot fully explain the good health and longevity of these Mediterranean people. However, our observations suggest that modifiable risk factors such as physical activity, diet, smoking cessation and mid-day naps may depict the secret formula of the Mediterranean long livers.

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#### **Key points**

- Modifiable risk factors such as physical activity, diet, smoking cessation and mid-day naps might depict the secret formula of the Mediterranean long livers.
- Longevity gain should comprise, in itself, not merely the absence of disease and disability, but the maintenance of high physical and cognitive function, and sustained engagement in social and productive activities.
- Public health policy and practice must focus on reducing mortality in addition to preventing morbidity in advanced old age to protect the health and livelihood of oldest old.

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Are current dietary habits in Mediterranean islands a reflection of

the past? Results from the MEDIS Study

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## Abstract

In the 1960s, the recorded dietary pattern of Southern European populations was typical of the traditional Mediterranean diet. However, diets have been rapidly changing. The aim of the current work was to primarily examine the extent by which present food habits of inhabitants residing in various Mediterranean islands uphold past dietary traditions of the Mediterranean diet. A population-based, multi-stage sampling method was used to voluntarily enroll 876 men and 936 women (aged >65 years) from twelve Mediterranean islands (10 Greek, and Republic of Cyprus and of Malta). Demographic, behavioral, clinical and dietary data were collected. Adherence to the traditional Mediterranean diet, as measured using the MedDietScore, was moderate  $(31.7 \pm 5.0 / 55)$ . Macronutrient intake as a percentage of total energy, amongst all regions, was within the Acceptable Macronutrient Distribution Ranges (AMDR), with the exception of the Aegean and Ionian Islands where fat exceeded AMDR (i.e. fats 20-35% of total energy) emerging at 38%±6.0 and 36%±6.4, respectively. Principal component analysis showed fruits, vegetables and greens as the main dietary pattern across most Mediterranean regions. However, further analysis revealed a high consumption of potatoes (approximately five servings/week as compared with the three servings/week, which is recommended by the Ministry of Health and Welfare for adults in Greece). Surprisingly, Crete had the highest frequency of fast food and sweet consumption. Malta had the

lowest frequency of fish and vegetable consumption and the lowest MedDietScore. As Mediterranean populations gradually move away from traditional dietary patterns, public health efforts to preserve these diets are needed.

Key words: diet; Mediterranean; elderly

# Introduction

The Mediterranean diet, characterized by a low intake of animal products, frequent fruit and vegetable consumption and the abundant use of olive oil, is a composite of the traditional cuisines derived from the Mediterranean basin and its civilizations (Willet et al., 1995). The diet has long been associated with lower risks of cardiovascular disease and cancer mortality (Keys, 1980, de Lorgeril, 1996, Trichopoulou et al., 2000). However, today, increasingly more countries are undergoing the nutrition transition, and southern Mediterranean countries are no exception. The nutrition transition refers to a shift from under-nutrition, marked by limited food availability and expendable income, towards malnutrition, distinguished by low-quality foods associated with increased quantities of dietary sugars and fats (Drewnowski and Popkin, 1997). In recent years, several studies have focused on changes in the frequency and composition of food consumption throughout the Mediterranean region (Kafatos et al., 1997, Tessier and Gerber, 2005, Tyrovolas et al., 2008, Polychronopoulos et al., 2010). Less explored has been the driving force behind the move towards a more westernized diet

(Piscopo, 2005). The diet that reflected food patterns typical of the Greek island of Crete and southern Italy in the early 1960s, is being abandoned – ironically, possibly at the fastest pace in the countries of its origin, but also in other islands such as Malta (Piscopo, 2004). Though Ancel Keys (1980) was the first modern researcher to document this traditional dietary pattern in the 1960s and later, it is well-accepted that the Mediterranean diet has been shaped across past centuries by influences of ancient trade, culture and landscapes.

The olive was, and remains, a chief agricultural product of the Mediterranean region. Historically, the Romans used the olive tree to reclaim land, and together with the vine and domesticated wheat, the olive supported the development of civilization in areas of the Aegean (Firestone, 2005). For example, the olive has been a vital aspect of daily living for the early Minoan or Cretan civilization, which dates back to 2800 B.C. Stoned-lined boxes and huge jars found in the store rooms of the Minoan Palace of Knossos were used to store olive oil - an estimated capacity of more than 240,000 gallons (Willets, 1977). Evidence of olive cultivation in Greece dates back to 3,500 years ago, and today the Mediterranean basin produces 99% of the world's olive oil of which people of the region consume 87% (Loumou and Giourga, 2003). The Mediterranean trinity of bread, oil and wine - core components of the traditional Mediterranean diet – has been deeply rooted in ancient Christian traditions, and even today, these foods are utilized in

most sacraments (Strong, 2002).

Large quantities of vegetables and fruits supplement this diet. Southern Mediterranean cuisines have been known for their distinctive flavors found in lemon, garlic, tomato and a mixture of herbs including oregano, thyme and basil (Farb and Armelagos, 1980). Most importantly, the consumption of vegetables extends beyond the use of cultivated plants to the use of wild flora. Dietary guidelines for adults in Greece that have been based on the traditional Mediterranean diet, explicitly state that wild greens should be included as part of the recommended daily servings of vegetables (Ministry of Health and Welfare, 1999). Traditionally, gathered wild greens were consumed with olive oil, and provided an adequate means for overcoming famine (Matalas, 2006). Wheat, olive and wine, together with other foods such as a diversity of non-cultivated and cultivated wild greens have been featured strongly in the rich history of the region, and today form an integral part of Mediterranean dietary traditions. The aim of the present work was to identify the dietary patterns of elders (> 65 years old) in the Mediterranean islands region (Aegean islands, Crete, Ionian islands, Cyprus and Malta) and to explore the extent to which present food habits have been a continuation or an expansion of past cultural and lifestyle practices, amongst people living in these Mediterranean islands.

## Methodology

The MEDIS Study's sample

A population-based, multi-stage (by region, sex and area) sampling method (i.e., selection of the island on a feasibility basis, then selection of men and women according to the population distribution, and selection of urban or rural areas according to the island's distribution) was used to voluntarily enroll 876 men (aged 75  $\pm$  7 years) and 936 women (aged 74  $\pm$  7 years) from the following twelve Mediterranean islands: Republic of Malta (n = 250), Republic of Cyprus (n = 300) and the Greek islands of Mitilini (n = 142), Samothraki (n = 100), Cephalonia (n = 115), Crete (n = 131), Corfu

(n = 149), Limnos (n = 150), Ikaria (n = 76), Syros (n = 151), Naxos (n = 145) and Zakynthos (n = 103). These twelve islands were then grouped together according to the following five Mediterranean regions: Aegean islands (Samothraki, Ikaria, Limnos, Syros, Naxos, Mitilini), Crete, Ionian Islands (Zakynthos, Corfu, Kefalonia), Cyprus and Malta. Individuals were not included in the survey if they resided in assisted-living centers, or had a clinical history of cardiovascular disease (CVD) or cancer, or they had left the island for a considerable period of time during their life (i.e. >5 years). A group of health scientists (physicians, dietitians, public health nutritionists and nurses), with experience in field investigation, collected all the required information using a quantitative questionnaire and standard procedures. The collected data were confidential and the study follows the ethical considerations provided by the World Medical Association (52<sup>nd</sup> WMA General Assembly, Edinburgh, Scotland, October 2000). The Institutional

Ethics Board of Harokopio University approved the study design. Participants were informed about the aims and procedures of the study and gave their consent prior to being interviewed.

Evaluation of dietary habits and clinical, socio-demographic, lifestyle characteristics

Dietary habits were assessed through a semi-quantitative, validated and reproducible food-frequency questionnaire (Tyrovolas et al., 2010). The frequency of consumption of various food groups and beverages (i.e. meat and meat products, fish and seafood, milk and milk products, fruits, vegetables, greens and salads, legumes, cereals, coffee, tea and soft-drinks) was assessed on a daily, weekly or monthly basis. Furthermore, intake of various alcoholic beverages (i.e. wine, beer, etc.) was measured in terms of wine glasses adjusted for ethanol intake (e.g. 100 ml of wine was considered to contain 12 g of ethanol).

To evaluate the level of adherence to the Mediterranean diet, the MedDietScore (possible range 0-55) was used (Panagiotakos et al., 2006). Scores from 0 to 5 were assigned for the consumption of foods presumed to be close to this pattern (i.e. a score of 5 when a participant reported daily consumption or more than 4 servings, thus, consistent with Mediterranean diet recommendations, and decreasing to 0 for rare or no consumption). On

the other hand, for the consumption of foods presumed not to be part of this diet (like meat and meat products), the opposite scores were assigned (i.e. 0 when a participant reported almost daily consumption increasing to 5 for rare or no consumption). Regarding alcohol intake, 5 was assigned for consumption of less than 3 wineglasses per day, 0 for none or for consumption of more than 7 wineglasses per day and scores of 4, 3, 2, and 1 for the consumption of 3, 4-5, 6, and 7 glasses, respectively. This classification follows the Mediterranean dietary pattern that suggests an intake of 15 and 30 g of ethanol per day for women and men, respectively. Higher values for this diet score indicate greater adherence to the Mediterranean diet. Participants were encouraged to report the duration of their dietary habits (i.e. the number of years for which they had followed this dietary pattern).

Although education, income, occupation or a combination of all three are common measures used to indicate socioeconomic status, there is still little agreement as to which measures are the best indicators of socioeconomic status. Basic socio-demographic characteristics such as age, gender, annual income (i.e., low and moderate (< $8.000,00 \in$ ), as well as good and very good (>= $8.000,00 \in$ ); this classification does not hold for the Maltese population), and lifestyle characteristics, such as smoking habits and physical activity status were also collected. Current daily smokers were defined as those who smoked at least one cigarette per day, or had stopped

cigarette smoking during the past 12 months. Former smokers were defined as those who previously smoked, but had not done so for a year or more. The remaining participants were defined as occasional or non-current smokers (WHOSIS). Physical activity was evaluated using the shortened version of the self-reported International Physical Activity Questionnaire (IPAQ) (Craig et al., 2003). Frequency (times per week), duration (minutes per session) and intensity of physical activity during sports, occupation and/or leisure activities were assessed. Participants were instructed to report only episodes of activity lasting at least 10 minutes, since this is the minimum required to achieve health benefits. For the purposes of this study, participants were either classified as inactive, or as minimally or HEPA active (heart enhancing physical activity).

This work has some limitations. First, recall bias is common in crosssectional surveys, especially when the population studied is of an advanced age. Second, the present work is not a formal longitudinal analysis, since dietary 'past' habits were not recalled by the participants, but retrieved through reference to historical documents. However, it should also be acknowledged that the studied sample consisted of subjects living permanently in a geographically defined area; in other words, an entry criterion was that participants would have lived in the same region for most of their lives. Third, the dietary guidelines used as a reference criterion for recommended number of servings were those produced by the Greek
Ministry of Health and Welfare. Their applicability to Maltese and Cypriot adults cannot be guaranteed; yet since no recommendations for servings are available specifically for Maltese and Cypriot elderly adult populations, using a common reference was seen as the best way to facilitate comparison of results.

#### Data analysis

Continuous variables are presented as mean  $\pm$  standard deviation (SD) and categorical variables as frequencies. Comparisons of normally distributed continuous variables between groups were performed using Student's t-test, or one-way analysis of variance (ANOVA, with Bonferroni correction). Normality was tested using P-P plots. Independence between categorical variables was tested using the chi-square criterion. A p-value <0.05 was considered to be statistically significant. Principal component analysis was used to define individuals' dietary patterns (i.e. components) according to region. The number of the extracted components was defined according to the percentage of the explained variance in intake. The first three components, explaining at least 40% of the variance in intake, were retained and are discussed below. Rotation was not performed as the dietary patterns were easily identified. Each component was interpreted ("named") based on the foods that had absolute loadings greater than 0.40, which were considered as significantly contributing to the specific diet component

(pattern). SPSS software (version 18) was used for all calculations (SPSS Inc., Chicago, II, USA).

# Results

Demographic, behavioral and clinical characteristics of the sample are summarized in Table 1. Exceedingly more males than females were current smokers (1 in 4 males compared to 1 in 20 females). Annual income was generally low, with fewer than 2 out of 10 participants exceeding the basic income of 8,000€ per year (by the exception of Maltese participants where 6.8% reported low income). Although participants did not have a history of CVD or cancer, both sexes displayed a high prevalence of CVD risk factors.

Table 1: Demographic, Behavioral and Clinical Characteristics of the MEDIS Study Sample								
	Male	Female	P <sup>†</sup>					
Ν	876	936						
Age (mean $\pm$ S.D.)	75 ± 7	74 ± 7	<0.001					
Age $>$ 90 years old (%)	4	1.9	< 0.001					
Urban Area of the islands (%)	31	35	0.26					
School years (mean $\pm$ S.D.)	7 ± 4	6 ± 3	< 0.001					
Annual Income >= 8,000 euro	21	17	0.01					
(%)								
Current Smoker (%)	25	5	<0.001					
Former Smoker (%)	62	9	<0.001					
Minimally or HEPA active (%)	54	41	<0.001					
Body Mass Index (mean ±	28 ± 4	29 ± 5	<0.001					
S.D.)								
Obesity (%)	26	40	<0.001					
Hypertension (%)	60	71	< 0.001					
Diabetes Mellitus (%)	27	27	0.82					
Hypercholesterolemia (%)	40	58	<0.001					

<sup>†</sup> P-values derived using the independent samples t-test for the normally distributed continuous variables (i.e., age, school years and Body Mass Index) and the chi-square test for the categorical ones (i.e., age>90 yrs old, urban area, annual income>8,000 euro, current and former smoker, minimally or HEPA active, obesity, hypertension, diabetes mellitus and hypercholesterolemia).

Weekly food intakes of various foods and food groups of the MEDIS sample according to region are presented in Table 2. To facilitate comparison across the island regions, the guidelines for adults in Greece (Ministry of Health and Welfare, 1999) were used. Comparisons with dietary recommendations (Guidelines for Adults in Greece, Ministry of Health and Welfare, 1999) showed the following: amongst all regions, reported intakes of poultry, meat and meat products, fish, cereals, milk and milk products, and sweets (apart from Crete) were below dietary recommendations, whereas vegetables, potatoes, fruit (apart from Crete) and olive oil intake met and exceeded recommendations. Across all regions, sweet and fast food intakes were low (apart from Crete). Throughout all regions, leafy green plants (consumed roughly 3 to 4 times weekly) and alcohol (consumed daily by 35 to 60% of the sample) played an essential role in the diet. The MedDietScore ranged from 30 to 34, whereby adherence to the traditional Mediterranean diet can be considered as moderate to good. Macronutrient intake as a percent of total energy, in most island regions, was within the Acceptable Macronutrient Distribution Ranges (AMDR). However, it should be noted that fat as a percentage of total energy approached the upper limits of AMDR in all regions, and in the case of the Aegean and Ionian islands values exceeded AMDR (i.e. fats 20-35% of total energy) emerging at 38%  $\pm$  6.0 and 36%  $\pm$ 6.4, respectively. Throughout all regions, olive oil was a main source of fat whereby olive oil was consumed 3 to 6 times daily. Further post-hoc analyses showed that the greatest differences in weekly consumption existed between Malta, followed by Crete, as compared to the Aegean Islands (reference group).

Table 2: Dietary Habits (ser According to Region of reside	vings per v ence	week, me	an ± SD) (	of the ME	DIS Study	Participants				
Weekly Consumption	Aegean	Crete	Ionian	Cyprus	Malta	P for				
(dietary recommendations*	Islands		Islands			regional				
for servings/week)						differences				
5, ,						**				
Poultry, Meat and Meat	2.3 ±	2.7 ±	2.4 ±	2.9 ±	2.2 ±	< 0.001				
Products (4-5 servings)	1.3	1.2 <sup>×</sup>	1.1	1.0 <sup>×</sup>	1.3					
Fish (5-6 servings)	1.9 ±	1.8 ±	2.6 ±	1.7 ±	1.3 ±	< 0.001				
	1.2	1.2	1.1 <sup>¥</sup>	1.1	1.1 <sup>¥</sup>					
Vegetables (42 servings)	51 ± 30	72 ±	44 ± 37	67 ±	39 ±	0.001				
		38 <sup>¥</sup>		36 <sup>¥</sup>	22 <sup>¥</sup>					
Greens	3.5 ±	4.0 ±	3.7 ±	3.3 ±	3.6 ±	0.022				
	2.1	2.0	1.7	1.4	2.4					
Cereals (56 servings)	28 ± 36	32 ±	30 ± 12	19 ±	38 ±	< 0.001				
		14		13	32 <sup>¥</sup>					
Legumes (3-4 servings)	2.3 ±	3.2 ±	2.4 ±	3.0 ±	3.3 ±	< 0.001				
	1.3	1.5 <sup>×</sup>	1.1	1.2 <sup>×</sup>	2.4 <sup>×</sup>					
Milk and products (14	2.9 ±	1.3 ± .	2.0 ±	2.9 ±	3.7 ±	< 0.001				
servings)	2.5	52 <sup>¥</sup>	2.0 <sup>×</sup>	2.4	2.8 <sup>¥</sup>					
Potatoes (3 servings)	5.1 ±	5.3 ±	5.0 ±	5.4 ±	4.8 ±	0.08				
	2.9	2.3	2.2	2.1	3.7					
Fruit (21 servings)	23 ±	20 ±	21 ± 1.8	23 ±	29 ±	< 0.001				
	2.0	1.9		1.8	$1.6^{+}$					
Sweets (3 servings)	1.8 ±	3.2 ±	1.2 ±	2.3 ±	2.4 ±	0.009				
	8.6	2.3	1.7	2.1	2.6					
Olive Oil (daily use)	6.0 ±	3.2 ±	5.7 ±	4.5 ±	4.2 ±	< 0.001				
	1.5	1.6 <sup>×</sup>	1.0 <sup>¥</sup>	2.1 <sup>¥</sup>	2.7 <sup>¥</sup>					
Fast Food	0.1 ±	3.0 ±	0.2 ±	0.2 ±	0.4 ±	< 0.001				
	0.5	2.8 <sup>¥</sup>	0.6	0.5	2.5					
Soft Drinks (servings/day)	0.6 ±	1.0 ±	1.3 ±	1.1 ±	1.2 ±	< 0.001				
	0.7	0.2	0.6 <sup>¥</sup>	0.5 <sup>×</sup>	1.4 <sup>¥</sup>					
Alcohol (1-2 wine	35%	38%	40%	60%	60%	< 0.001				
glasses/day), % of										
participants										
MedDietScore (0-55)	30 ±	32 ±	33 ±	34 ±	29	< 0.001				
	5.6	4.0	4.6 <sup>¥</sup>	3.8 <sup>¥</sup>	±3.9 <sup>×</sup>					
Macronutrients as a Percent	of Total E	nergy (as	per Accept	able Macr	onutrient	Distribution				
Ranges)										
Carbohydrates % of Total	47 ±	55 ±	46 ± 8.2	50 ±	56 ±	< 0.001				
Energy (45-65%)	7.5	7.7×		7.3 <sup>×</sup>	7.0 <sup>×</sup>					
Fats % of Total Energy (20-	38 ±	30 ±	$36 \pm 6.4^{\circ}$	34 ±	32 ±	< 0.001				
250()	6.0	6 F¥		E 7¥	7 6¥					

\*Dietary guidelines for adults in Greece, Ministry of Health and Welfare, 1999 \*\* Comparisons were performed using one-way analysis of variance (post-hoc analyses, all other islands vs. Aegean islands, were performed with Bonferroni correction, <sup>\*</sup>p<0.05)

Three major dietary patterns, explaining 41.6% to 58.2% of total diet variation, were derived from the principal component analysis. Results have been displayed in Table 3, and presented in detail in the Appendix. For the Aegean Islands, the first component was heavily loaded by fruits, greens, potatoes and vegetables intake, together with olive oil use; for the Ionian Islands, the first component was characterized by greens and cereals intake; for Crete the first component was characterized by meat and products, vegetables, fruits intake and olive oil use, and inversely by fish, greens, and sweets intake; for Cyprus, the first component was characterized by fish, greens, cereals, intake and inversely by meat and products and olive oil use; and, finally for Malta, the first component was characterized by greens and vegetables intake. Thus, for the Aegean Islands the dominant, first component could be defined as a "healthy eating pattern"; for the Ionian Islands, Cyprus and Malta Republic the dominant component could also be defined as a "healthy eating pattern", but with less food items included and with absence of olive oil use; whereas for Crete the dominant component could be described as "mixed" by meat, vegetables, fruits intake and olive oil use, and inversely by fish, greens, and sweets consumption. Moreover, the data analysis also revealed a great variety of food groups amongst all regions, for component 2 (14.1% to 16.8% explained variation) and

component 3 (10.1% to 14.1% explained variation), defining a "mixed" diet, by the exception of Crete where the 2nd component could be characterized as "healthy eating pattern".

Table 3: Food Groups Consumed by Region from Principal Component Analysis									
Region	Component 1	Component 2	Component 3						
Aegean	↑Greens,	↓Greens, ↑Pasta,	↓Meat, ↑Fish,						
	↑Vegetables,	↑Potatoes	↑Legumes,						
	↑Potatoes, ↑Fruit,		↑Cereals,						
	↑Olive Oil		↑Sweets						
Explained	22.0	14.0	11.9						
variability, %									
Ionian	↑Greens, ↑Cereals	↑Meat, ↑Pasta,	↑Fish, ↑Milk and						
		↑Potatoes, ↑Fruit,	milk products,						
		↑Sweets	↓Legumes,						
			√Pasta						
Explained	16.0	15.1	10.3						
variability, %									
Crete	↑Meat, ↑Vegetables,	↑Fish, ↑Greens,	↑Milk and milk						
	个Fruit, 个Olive oil,	↑Legumes,	products,						
	↓Fish, ↓Greens,	↑Cereals, ↓Milk	↑Pasta,						
	√Sweets	and milk products	↑Potatoes						
Explained	31.2	16.8	10.1						
variability, %									
Cyprus Republic	↑Fish, ↑Greens,	↑Sweets,	↑Legumes,						
	↑Cereals, ↓Meat,	↓Vegetables,	↑Pasta, ↑Olive						
	↓Olive oil	↓Cereals	oil						
Explained	17.9	16.3	14.1						
variability, %									
Malta	↑Greens,	↑Meat,	↑Milk and milk						
	↑Vegetables,	↑Potatoes, ↓Olive	products,						
	个Legumes	oil	↑Pasta, ↑Fruit,						
			√Fish						
Explained	18.8	15.9	10.7						
variability, %									

Arrows define the direction of the nutrition behavior and not frequency of consumption; i.e., opposite arrows display an inverse behavioral pattern.

# Discussion

Abundant plant foods, fruits as the typical daily desert, olive oil as the main source of fat, low to moderate intake of dairy products, fish, poultry, wine, and low red meat consumption are characteristic of the Mediterranean diet (Willet et al., 1995). Results from the statistical analyses suggested an overall regional heterogeneity in consumption, though, clear similarities amongst regions do exist. Daily use of olive oil was typical amongst all regions, and nearly half of the sample consumed 1-2 serving of alcohol daily. Moreover, across all regions, milk and milk product intake was extremely low as compared to dietary recommendations. The greatest deviation from traditional products was displayed by Crete. Crete had the highest frequency of consumption of fast food (consumed 3 times weekly compared to less than once a week for all other regions) and sweets. Across all regions, greens (apart from Crete) and vegetables (apart from the Ionian Islands and Cyprus) were the main food groups characterizing component 1. Across all regions, potatoes were the main food characterizing component 2 (except Crete and Cyprus), whereas pasta (apart from the Aegean and Ionian Islands) and milk and milk products (apart from the Aegean Islands and Cyprus) characterized component 3.

The purpose of this work was to examine the extent to which present food habits of elderly inhabitants residing on various Mediterranean islands exhibit characteristics of a traditional Mediterranean diet. Elderly islanders

have been targeted as they tend to maintain more traditional eating habits and may act as a marker of local culture. Results describing present consumption were interpreted by linking them to behaviors and food culture that have been handed down throughout history. A clear outcome from the applied multivariate analysis was that traditional Mediterranean elements, such as vegetables, cultivated and non-cultivated greens and olive oil are still abundantly present in the diet. Mainly due to climatic conditions, the Mediterranean basin is known to harbor a high biodiversity. As a result, in past and present times, plant foods predominate in the Mediterranean diet. Several studies have shown that non-cultivated, wild gathered greens in particular play a distinct role in supplying food throughout rural Mediterranean communities (Leonti, 2006, Forbes, 1976, Tardio et al., 2005). Olive oil is also an essential source of calories. Olive growing reached Cyprus and the Aegean area around the sixteenth century B.C. and in Crete oil production and trade played a vital role in the Minoan-Mycenaean economy during the Bronze Age (Firestone, 2005). Similarly, based on archaeological and historical findings, one can say that during the Roman occupation of Malta, which started in the third century B.C., production of olive oil was an important part of daily living (Ashby and Rushforth, 1915, Bonanno, 2005). Today, the Mediterranean region has the highest production and consumption of olive oil and Crete's share of Greek national production is 46% (in 2004) (OECD, 2005). Consequently, physical

availability and local production favors the consumption of plant foods amongst Mediterranean inhabitants. Local production coupled with wine's long-standing sanctioned role in the Mediterranean cultures promotes social drinking during meals and in traditional cafeterias and may also explain the persistent daily use of wine in the present sample (intakes of 1-2 glasses daily were in the range of 30 to 60% across all regions).

In contrast, despite a long culinary history, some food practices are changing amongst Mediterranean islanders. For example, sweet intake exceeded recommendations amongst the Cretan sample. Although, sweets were available in the past, (e.g. spoon sweets which consisted of fruit and vegetables cooked with sugar to create a syrupy sweet) they were considered an occasional treat, mostly served to guests as a gesture of hospitality (Kenna, 2001). Legume intake, across all regions, was below recommendations compared to potato intake that surpassed recommendations. Dry legumes, unlike potatoes, have been a core product of the traditional Greek peasant diet throughout the early 1900s (Matalas, 2006). However, according to this study's results, potatoes seem to have taken the place of legumes in the diet. This is also evident for Malta and Cyprus, where perhaps the influence of two centuries of British colonization has played a significant role: potatoes were a staple in the diets of the colonizers and potato production and export became integral to the local (Busuttil, 1993; Markou and agricultural systems Kavazis, 2006).

Additionally, fast food and soft drinks that are not in line with the traditional Mediterranean diet were consumed in moderate amounts throughout all regions (apart from Crete where fast food consumption was very high). Today, the process of globalization has promoted the movement of ideas and goods around the world. As locals are increasingly exposed to new products, principally through travel, the mass media and local availability, the between food and region becomes eroded, relationship and new commodities transform to locally meaningful products (for a detailed explanation of the domestication of foreign foods see, in Watson, Caldwell, 2005). In fact, throughout the Mediterranean islands, the effects of globalization may have been further compounded by tourism, a persisting occurrence in this region of the globe. For example, in Crete tourism is the main economic sector; in 1999 32.3% of Greek guest beds were found in Crete (OECD, 2005). Tourism that resulted in a rapid financial and economic development had an important impact on economic practices and lifestyles, while cultural and social roles, structures and values were more resistant to change according to empirical research (Terkenli, Bellas and Jenkins 2007). Certainly other social indexes have been also deteriorated in the Cretan population, and they can be triangulated with the findings on dietary habits of this study.

In Malta, a nation of about 400,000 inhabitants, over 1 million tourists visit annually (National Statistics Office, Malta). This would suggest that

tourism facilitates assimilation of non-native foods, either by mere exposure to the foreigners and their conversations about their food culture, or by actual provision in the local catering establishments of foods which the visitors are familiar with back home. Such facilitation has been seen as influencing food gatekeepers in Malta (Piscopo, 2004).

Yet, although some may feel that the relationship between food and region has become eroded, a growth of interest in food and origin has recently been restore. This is evident through campaigns around the Mediterranean islands promoting local and seasonal foods. Moreover, the tourism sector may in itself be helping revive local, traditional dishes through provision of such dishes on restaurant menus and organization of special public food festivals and events.

Another result of the present work was that the majority of the studied sample was of low socioeconomic status. This could be partially explained by the applied selection criteria of the study: Respondents were all >65 years and advancing age is often connected to poverty since many elders depend on pensions as their main or only source of income; and study volunteers had to be permanent inhabitants of the islands which meant that those who had immigrated to live and work in large urban areas and had then returned to their hometown after some years were excluded from the sample. Furthermore, results indicated that most participants had attained an average of only about 6 years of schooling, which is also in line with results

from EPIC-Greece; of the 11,645 participants (men aged 55.4  $\pm$ 13.3 years; women aged 54.2  $\pm$  12.9 years), 65% were classified as low education (6 years of education or less) (Benetou et al. 2000). Given the age factor and since both parameters of socioeconomic status were low, it is accepted and expected that the majority of the participants be of low socioeconomic status. This low socioeconomic status may have also played a role in the composition and distribution of the participants' dietary habits.

### Conclusion

Although the Mediterranean diet has been a product of accumulated social and ecological wisdom that has withstood the test of time, study results suggest that new food products and habits are increasingly challenging dietary traditions, even amongst the elderly population. Whilst, on the one hand, the presence of plants in the diet is holding strong and regular consumption of these products has been upheld, fast food, soft drink and sweet consumption have increased. This shift away from traditional diets towards western diets has been partly responsible for the unfavorable changes in disease patterns observed amongst Mediterranean populations (Kafatos et al. 1997). Convenience, availability and heavy advertising are amongst the barriers to healthy eating. As such, interventions must be competitive and innovative. On a positive note, eating locally grown food has become trendy. Health professionals and policy makers must further

encourage and facilitate the labeling of locally grown traditional products in markets and the distribution of local fruits and vegetables in schools, which can improve public health while supporting regional producers. Transgenerational education initiatives supporting dissemination of knowledge and practices about healthy traditional dishes should be implemented. Although foodways will continue to evolve through travel, modern technology and trade, traditional diets that have been recognized for their healthy attributes, such as the Mediterranean diet, should be comprehensively promoted at different levels, in different regions and in different settings.

# Appendix

Table 4: Results from the Principal Component Analysis that was applied on the Food Groups, by Region of residence															
	Aege	Aegean Islands Ionian Islands				Crete				Cyprus		Malta			
	Co	mponer	nt	Co	mpone	ent	Component			Component			Component		
Food Groups	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Poultry, meat	.360	.240	40	08	.	.340	.732	.103	.133	55	.333	13		.632	.031
and meat															
products			7	6	524					8		8	312		
Fish	.338	.057	.470	.166	·	.550	44	.458	.238	.644	.378	28	•	.214	46
					176		7					9	184		7
Greens	.579	55	.218	.823		11	63	.532	.011	.643	.180	36		28	21
		C C			0.02		2						015	_	2
Vagatablag	760	0	001	000	062	2	3	121	24	00	02	4	812	/	3
vegetables	.760	37	.091	.099	•	.047	.000	.131	34	09	83	23	•	06	23
		3			374				7	4	6	1	859	3	1
Legumes	.211	.203	.509	.359	•	40	19	.724	.145	.314	.349	.647	•	31	.176
					293	6	5						680	4	
Cereals	.247	.386	.404	.768	•	.068	.387	.755	.104	.496	52	.074		38	.315
					297						1		028	5	
Milk and	.027	.048	37	01		.554	10	48	.471	.270	26	.324		.283	.424
products			5	6	044		0	4			6		277		
Pasta	.395	.706	.023	38		47	.396	14	.575	.343	.242	.520		.379	.520
					<b>_</b>								077		
Detetees	124	654	12	0	523	17	227	0	(20	222	1 Г	207	0//	(72)	00
Polaloes	.434	.054	13	34	· ·	1/	.337	.040	.038	.333	15	.307	•	.672	00
			8	1	587	0					5		282		9
Fruit	.743	24	14	.342	•	10	.721	.268	.029	30	.357	21	•	15	.548
		0	2		416	0				9		3	147	3	
Sweets	025	.025	.527	31		.259	84	.154	.159	.283	.507	39	•	.380	.207
				6	545		1					4	229		
Olive oil	.696	03	33	.072		.106	.705	.226	07	42	.223	.560		53	.231
		3	8		326				1	9			160	9	

Loading with bold font indicate values > 0.4, which was considered as the critical value for the interpretation of the components.

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4.3. <u>"Cultural, Social, and Environmental Influences on Surviving Dietary</u> Patterns of the Past: A Case Study from the Northern Villages of Karpathos", In *Nature and Culture* 

# Cultural, Social, and Environmental Influences on Surviving Dietary Patterns of the Past: A Case Study from the Northern Villages of Karpathos

Eleni Tourlouki, Antonia-Leda Matalas, Demosthenes Panagiotakos

#### ABSTRACT

The present work documents the core diet of a population in a Mediterranean island that has been minimally eroded by industrialization and tourism, and links present food-consumption patterns to the foods' historical roots and to the exploitation of natural resources available to the community. Demographic, behavioral, cultivation, and food-intake information were collected among inhabitants of the isolated northern villages of Karpathos. The core diet of the elderly village inhabitants was found to be based on wheat, barley, legumes, and olive oil. Inhabitants in the northern villages of Karpathos rely on local resources for most of their food. Absence of mechanized farming, the social role of women, and customs of inheritance are factors that have contributed to the preservation of traditional food-related practices.

#### **KEYWORDS**

Aegean, agriculture, culture, food, landscape, Mediterranean, Olympos

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#### Introduction

Throughout the twentieth century, food and food systems have undergone major changes. Populations worldwide are shifting from wholefood diets based on traditional food systems to refined-food diets established by the food industry. Traditional food systems are composed of items from the local, natural environment that are culturally acceptable (Kuhnlein and Receveur 1996). Only subsistence farmers still "eat from their land" and sustain their nutritional needs based on the available resources of their environment. However, the environment represents one of the components expressed in food habits.

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### INFLUENCES ON SURVIVING DIETARY PATTERNS OF THE PAST

Food consumption gives meaning to people's lives through its active incorporation in daily activities. Culture, then, can be regarded as a basic factor in determining the position of foods in one's diet. The British anthropologist E. B. Tylor was among the first to define "culture"; in 1874 he suggested that culture is "that complex whole which includes knowledge, belief, art, morals, law, custom, and any other capabilities and habits acquired by man as a member of society" (quoted in Hamilton 1987: 3). Culture and environment are complementary in determining food habits. Grivetti (1978: 171) underlines these two principles as core determinants of dietary development: "man cannot eat what is not available, and items available are not always eaten." The first part of the statement can be linked to environmental factors, while culture can determine the latter. Unlike most domains of contemporary life, food is still connected to its natural and historical roots. Historians, archaeologists, and botanists have long studied Mediterranean foods, as have geographers interested in the history and evolution of foods (e.g. Dalby 1996). More recently, Mediterranean foods have been examined for the health consequences of human food-related behavior. During the past four decades, traditional Mediterranean diets have been mentioned with positive overtones in medical literature, to note that they represent a dietary model that is health-promoting and limits the incidence of certain chronic diseases (Nestle 1995). The Survey of Crete, conducted from 19 May to 15 November 1948 (Allbaugh and Soule 1953), was the first investigation of food practices and dietary patterns in the Aegean region. Specifically, the study examined the feasibility of raising the standard of living in an undeveloped area, and explored ways in which knowledge and skills from industrialized countries could assist underdeveloped areas such as Crete. In 1948, seventy-seven percent of rural household heads were engaged in agriculture, forestry, fishing, or agriculture and some other occupation. Dietary data showed that the basic Cretan diet consisted of olives, cereal grains, pulses, wild greens and herbs, and fruits, combined with limited quantities of goat meat and milk, game, and fish. It thus appears that between the fourth century B.C. and the 1950s, the diet in the Aegean changed very slowly, as did other aspects of culture. The most visible changes relate to the introduction of new crops and new technologies. Changes, however, sped up during the course of the second half of the twentieth century. Matalas et al. (1999) studied the impact of affluence and urbanization on diet and health among a Mediterranean population, the residents of the island of Chios in the eastern Aegean Sea. The investigation

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showed that peasants living in the poor and mountainous villages in the north of the island followed a diet that included less beef, fewer seed oils—other than olive oil—and more wheat products compared to the diets followed either in the southern, more affluent part of the island or in the island's urban center, the town of Chios. Northern Chian villages also exhibited significantly lower prevalence of diabetes among their inhabitants. Similarly, Tessier (2004) compared the food habits and meal practices among women belonging to two different generations on the islands of Sardinia and Malta. Her results showed that compared to Maltese mothers and daughters, the mothers and daughters in Sardinia (isolated and much less affected by tourism) adhered more to practices and meal patterns characteristic of the Mediterranean way of life. In addition, only fifty-four percent of the women in Sardinia reported that they obtained food solely by buying it, as opposed to of the Maltese participants. 98% of the Maltese women purchased their food compared to 54% of women in Sardinia. Therefore, it seems that more women in Sardinia used traditional methods of food acquisition such as cultivation and gathering compared to the Maltese.

The present article aims to document the core diet of a population in a Mediterranean region that has been minimally eroded by industrialization and tourism, and to link present food consumption patterns to the foods' historical roots and to the exploitation of natural resources available to the community. Olympos and Avlona, two rural villages on the Greek island of Karpathos in the Aegean Sea, were selected for this study.

Studies conducted in the same area are few, and date back as far as the nineteenth century. Bent (1885) completed research on the dialect spoken on Karpathos and examined the ancient artifacts, such as pottery and tombs, found on the island. He described the typical layout of a homestead and the type of livestock found in Avlona, making connections with the dialect's ancient origin. Almost two decades later, Dawkins (1902) completed his own survey on Karpathos, with a similar scope. He described the antiquities of the island, and the mode of life and customs. He found that in the village of Olympos most of the area was uncultivated, the ground was typically covered with arbutus scrub or pine trees, fields were usually in nooks among the hills at some distance from the village, and most fields and vineyards belonging to the villagers were in the valley of Avlona. More recently, Greuter et al. (1983) completed an inventory of the vascular flora found on the islands of Karpathos, Kasos, and Saria, pulling to-

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gether previously published information and new records based on their fieldwork. One new species (*Trifolium praetermissum*) was identified (p. 43). Halstead and Jones (1989) completed a botanical study on the islands of Karpathos and Armogos, which provided details of crop-processing activities and some information on the wider agricultural economy. They found that farmers operate under considerable time stress (particularly when labor is scarce, the area to be sown is large, and stores are low), and that flexibility in cultivation practices can limit the risk of failed harvests, food shortage, and hunger.

## The Study Area

Karpathos is the southernmost in the chain of the Dodecanese islands, at the southeastern edge of the Aegean Sea between Europe and Asia. Figure 1 shows Greece and the island of Karpathos. The Dodecanese, one of the three island complexes in the Aegean sea, contains 74 municipalities and communities, and has a total area of 2,714.3 square kilometers, of which 15.7 percent is either area under crops or fallow land and 46.6 percent is pasture (ELSTAT 1997). Forests cover 24 percent of the area, 2 percent is covered by water, and 6.6 percent is covered by localities such as streets, squares, etc. According to the National Ministry of Environment, Energy, and Climate Change (MEECC), the climate of Greece can be described as Mediterranean, with hot, dry summers, and winters that are mild and wet in the southern lowland and island regions and cold with heavy snowfalls in the mountainous central and northern areas (MEECC 2010). The mean temperature during summer (April to September) is approximately 24° C in Athens and southern Greece, while temperatures are lower in the north (MEECC 2010). The Greeks, Persians, Turks, Romans, and Ottoman Turks have influenced Karpathos's history. More recently, in 1912, it became an Italian territory, then was occupied by Germany from 1943 to 1945, and officially became Greek in 1948. As a result of the war-scarred economy, most of its residents left Karpathos to settle in Maryland, U.S.A., Pireaus (the port of Athens), or Rhodes (the largest island of the Dodecanese).

The area of study is concentrated around the isolated villages of Olympos and Avlona. These northern villages are set apart from the southern capital of Karpathos, Pigadia. In the present day, Olympos does not belong to the municipality of Karpathos, but constitutes a separate community. Olympos is a mountain village that lies north of Mount Kymaras, and therefore has limited opportunities for irrigated

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land use. Due to water shortage, farming in the village of Olympos consists of few gardens which produce minimal yields. As a result, any fertile land is exploited for the purpose of cultivation; even fields far from the village are utilized. Most of the fields, vineyards, and livestock belonging to Olympos are kept in Avlona, a valley north of Olympos. As one shepherd explained, unlike the terrain of Olympos which is no longer suitable for crop production, the fields of Avlona are fertile due to a groundwater source. Greuter et al. (1983) also acknowledged a groundwater source during their exploration of Karpathian flora; they interpreted the presence of thickets on the bare, dry land as an indication of groundwater on Karpathos. At present, crops continue to be cultivated in Avlona. The village consists of small homesteads, each with its own stable (stavlos) and stone threshingfloor (aloni) (see Bent 1885: 240 for an annotated diagram); still today, some are standing and in use. Today, the villages of Olympos and Avlona can be accessed by an unpaved mountain road or by boat, following the construction of the harbor of Olympos, named Diafani, in 1995. Electricity reached the village only in 1982.

The northern village inhabitants of Karpathos have been described as "a wild, uncultured race of shepherds" (Bent 1885: 240), and over a century ago, in Dawkins's 1902 account, Olympos was described as "another world." Life for these villagers is demanding. The two most prominent hardships are infertile land that makes crop production extremely difficult, and the isolation from the southern part of the island. The inhabitants' determination and vigorous ways allow them to adapt and prevail over the harsh demands of the land. Though today the village supports tourism, strong remnants of pastoral life are ubiquitous in the land and people.

According to official statistics, the populations of Olympos and Avlona are 395 and 16, respectively. Mostly elderly inhabitants reside in these villages throughout the year. The demographics show that no individuals in Avlona are less than fifteen years old, and seven are over the age of 60 (ELSTAT 2001).

## Methods

The present case study is based on the researchers' observations and interviews conducted with permanent residents of Olympos and Avlona. A population-based sampling method was used to voluntarily enroll four men (aged  $73 \pm 10$  years) and eight women (aged  $71 \pm 8$  years). Our research was conducted in mid-August, and interviews

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were accomplished over a ten-day period. Participants were included in the study if they were permanent inhabitants of Olympos or Avlona and had resided on the island for most of their lives (having lived elsewhere no more than five years). Circumstantially, all participants included in the study were older (over the age of sixty), as this age group was most characteristic of the permanent inhabitants. The dietary and lifestyle questionnaire used included questions on socioeconomic status, physical activity, and anthropometry, as well as domestic cultivation, cooking equipment, use of wild herbs and greens, seasonal variation of produce, meal composition, and meal patterns. Participants were also asked to describe typical eating habits and the changes they have undergone over time. Traditional foods and methods of preparation were also discussed. The interviews were completed in the field and lasted between forty-five and seventy-five minutes. Additionally, a shepherd (aged forty-nine) who was a permanent inhabitant of Olympos guided the researchers throughout Avlona and provided information on agricultural practices and products. His family's fields

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and homestead in Avlona were examined, and the types of crops cultivated and methods of harvest and preparation were discussed.

## Findings

## Agricultural Food Production and the Landscape

Due to the mountainous landscape of Karpathos, terracing is a common feature found throughout the island, and it plays a significant role in the creation of new agricultural land. Terraces are generally constructed in order to facilitate the management of soil, water, crops, or microclimate (Halstead and Frederick 2000). On the Aegean islands, terraces support cereals, vegetables, legumes, vines, and trees (orchards, chestnuts, nuts, and olives) (Kizos 2008, Kizos and Koulouri 2006). During our field investigation, the mountain slopes of Olympos showed the presence of terraces, though today most are bare and abandoned. The abandonment of terraced land can cause land degradation, and in some Aegean islands animal husbandry has begun to dominate as traditional land management systems have collapsed (Margaris 1992). Kizos and colleagues examined the processes of landscape change in terraced fields on the island of Lesvos, and found that the abandonment of terraces was due to outmigration, lack of motivation amongst the young to become farmers, and the fact that olive-oil cultivation is less profitable nowadays as a result of an increased labor cost and declining olive-oil prices. However, throughout the Mediterranean, olive plantations and vineyards are not abandoned as frequently as terraced arable cultivation, because olives and vines require a significant investment in time and money, and can still provide products of high value and domestic usefulness (Kizos et al. 2010). This corresponds with our observations, in that the few terraces in Olympos that are still in use contain olive trees. The abandonment of terraces can affect both the environment and the diet: not only can it lead to soil degradation, but a decline in local cultivation can intensify market participation, so that new food products challenge traditional ones.

Additionally, the sloping mountain environment of Olympos makes access for tractors difficult, and the absence of farming technology places great emphasis on long-established knowledge that guides methods of food harvesting, storage, and preparation. During a botanical study of crop processing on the islands of Karpathos and Amorgos, the authors noted that farming was apparently completely unmechanized

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in Olympos (Halstead and Jones 1989). Two decades later, during our field research we also observed that farming in the agricultural village of Avlona is a manual process, carried out by human and animal labor. As a result, farming involves traditional knowledge, developed over the years, that allows individuals to exploit their environment's resources.

As reported by a permanent inhabitant of Olympos, the processing of wheat based on a form of nonscientific knowledge is worth describing. Mackinson and Nottestad (1998) argue that nonscientific knowledge is one of the richest, most often overlooked sources of information, and can offer immense potential. For example, they suggest that fishers' knowledge is a compiled information source that is based on not only their own experience, but that of their parents, grandparents, and others with whom they have fished (Mackinson and Nottestad 1998: 483). The technical knowledge of rural farmers in the northern villages of Olympos is a noteworthy resource of local, traditional, nonscientific knowledge.

Wheat is usually harvested with a sickle, and subsequently left to dry in the stone threshing-ground. Next, the process of threshing is completed during the heat of the day when crops are the driest, and the seed can be separated easily from the chaff. Cows, donkeys, or mules are led around the threshing-floor, trampling on the crop, to release the seed from the chaff. Winnowing follows the threshing process, and is completed on days when a breeze is present. Inhabitants wait for days until the wind blows in the direction of the "gathering ground," located next to the threshing-floor. During this process, the threshed crop is thrown into the air, so that the wind separates the chaff and straw. Inside the threshing-ground, a stick is placed to isolate a quarter of the circular space. The chaff is collected in this designated quarter, the seeds in the remaining area, and the straw in the "gathering ground" to be used as animal feed—an effective means of utilizing all the organic material. If the remaining seeds still contain straw, another round of threshing and winnowing will follow, and any remaining large straw fragments are sorted out. Upon completion, in past times the seeds were carried in sacks, by mule or donkey, to the windmills in Olympos for subsequent milling, although today a household, hand-crank model is used. As a means of replenishing the soil and sustaining the land, cereal/pulse rotation was practiced (means of nitrogen fixation), and every few years fields were left fallow to control weeds (Halstead and Jones 1989). Halstead and Jones (pp. 43-46) have previously described the rotation process as practiced on the

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island of Karpathos. The processing of crops, as well as the gathering of noncultivated plants (to be discussed later), are forms of knowledge passed down through generations, and provide a means for the members of this society to exploit their environment and secure an adequate food supply.

# Social Organization of the Community: The Role of Women

Women are arguably the most important segment of this society, playing a crucial role in domestic and economic life. Middle-aged and elderly women, due to the absence of men for the greater part of the year, are largely responsible for the agricultural tasks. As one local woman explained, Olympos is a matriarchal society—the women rule. During our visit, women's participation in domestic activities was considerable: they were found caring for the village and tending the fields. In contrast, the male niche, with respect to the participants interviewed, was construction. A century ago, Dawkins wrote, "I saw comparatively few men: nearly all were in foreign lands working as masons and stone-cutters. Many go to Athens to work in marble quarries" (1902: 183). The lack of men in the village throughout the year reinforced the role of women. During our fieldwork, it became apparent that women have the technical knowledge needed for their subsistence. This claim can be supported by the case of an eighty-fiveyear-old woman farmer who was interviewed and permanently resides in Avlona. In past times, she and her mother lived alone, and performed all the farming and livestock activities. At the time this survey was conducted, she lived on her own in her homestead in Avlona, but due to old age and the increased availability of goods in the village she no longer grew all of her own food. Her goats still supplied her with milk, and her orchards with olives and olive oil. She relied on neighbors for fresh vegetables grown in their fields, and the market to purchase flour and pasta products. During ethnographic research in the rural village of Methana, Forbes (1976a) found that women usually did more of the gathering of wild pants because men were expected to do more of the heavier agricultural tasks. This is not the case in Olympos and Avlona, where women have always been responsible for both domestic and agricultural work.

Women are also associated with the customs of inheritance. The inheritance of land in Karpathos is of considerable importance, since local land is highly valued by inhabitants. On Karpathos, particularly

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in Olympos, customs of inheritance were the most significant factors influencing social relations (Patsiada et al. 2006). Land is seldom sold, but instead forms a vital component of the family's dowry (the order of precedence is based on age). Dawkins explained this system of inheritance in detail: Property brought to the marriage by the husband goes to the eldest son when he marries, whereas property brought by the wife as her dowry is passed on to the eldest daughter (protokori). Any property the father has acquired by his own labor is divided equally among his younger, unmarried children. In the event that an heiress has no daughter, the second son takes the wife's property, so that his eldest daughter is then dowered with the property, and thus the land reverts back to the female line (Dawkins 1902). As a result, the law of inheritance generally leads to a great increase in land ownership among women. In these arrangements, it seems that the eldest daughter belongs especially to the mother, and the eldest son to the father, while the mother takes the second son and the father the second daughter. The kanakara is the special title given to an heiress (eldest daughter), and seems to be used only in the case where a large amount of property is inherited, whereas kanakaris is the eldest son. These words (kanakara, kanakaris) mean "favorite" (p. 199). Up until the year 1922, the kanakarides (eldest sons) had private pews at the Feast of Dormition church, and the women had private benches on the floor of the narthex (Patsiada et al. 2006).

The rationale behind this law of inheritance is that land is needed more in settling the daughter. The son can marry on his trade, whereas a daughter will need land to find a suitable husband (Dawkins 1902). Moreover, it is thought that those in the prime of life should posses the most valuable items, although Dawkins argues that the absence of men for the greater part of the year may also contribute to the survival of female succession. McNall (1976) noted that in some regions of Greece, land is sold in order to build a cash dowry, to support the young bride and groom's move to urban areas. This is not the usual case in Olympos. Still today, it is common practice for the eldest daughter to have priority in the inheritance of land, and a level of shame is connected to the selling of family land. For example, as one local family explained, German investors had offered to restore some of the homesteads in Avlona. In exchange, for a ten-year period the investor would send German visitors on holiday to these homesteads. Locals refused this offer, as every effort is made to keep land within the family unit. As a result, these arrangements can affect land use, since foreign investors may have difficulty gaining access to land.

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## **Traditional Core Diet of Olympos and Avlona Inhabitants**

Bread is made from wheat, barley, or a combination of both. It is eaten fresh or in the form of a crisp, twice-baked "rusk." The rusks are baked twice, so that most of the water is dried out, making it possible for the bread to keep for several months. When the rusk is to be eaten, it is dipped in water or milk to restore its moisture and palatability. All respondents reported baking their own bread and rusks. They obtain flour from the store, although some assert that this is a recent practice that has replaced domestic production. Particularly noteworthy is the absence of food markets in the villages. In Olympos, the only "bakery" is a local home that has been temporarily transformed into a bakery serving fresh-baked bread to tourists during the summer months, and a mini-market supplying a small number of goods. In Avlona, the only commercial building in the village is a small coffee shop. In our survey, only two of the twelve participants reported the cultivation of wheat and barley in their own fields in Avlona-the processed grain was stored, and subsequently milled throughout the year as needed. A variety of homemade pasta products are also common elements of the local diet. They are made from finely ground wheat and water, and formed into different shapes. The ground wheat and water mixture can be cut finely into *hondros* (bulgur), or take on a hollow, thick noodle shape (*makarounes*). *Makarounes*, the village delicacy, is served dressed with fried onion and fresh Karpathian cheese. Today, wheat is still grown in mountainous areas throughout Greece. According to the Statistical Authority's report on Production of Agriculture and Livestock Products: 2006-2007 (ELSTAT 2007), which divided total production into three communities (level, semimountainous, and mountainous), production of cereals for grain in mountainous communities as compared to total production was 12.0 percent for soft wheat, 6.8 percent for hard wheat, and 17.6 percent for barley.

After bread, all participants identified olives and olive oil as the most important food commodities. In past times, olives were paired with bread to form a common quick meal. Bronze-age botanical and archaeological evidence reveals the importance of the olive tree and its products as food and nonfood commodities in the Aegean. Remains from the Palace at Knossos, on the island of Crete in the southern Aegean, suggest that as much as 16,000 gallons of oil were stored in the *pithoi* (earthenware jars) there, while Mycenaean-era houses outside the citadel were found to have been devoted to the production of olive oil, which must have played a central role in the state

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economy (Boardman 1976). Consumption of olive oil in Greece is still high today, amounting annually to 20 kg per capita, and Greek production is the third largest worldwide, after Spain and Italy (Galanos and Manasis 2010).

Apart from bread and olives, pulses have also been an integral part of the traditional diet, being considered primarily a winter food. Still today, a substantial number of our participants reported the cultivation of pulses in their fields in Avlona. During our summer visit, fava beans had already been harvested and were set in the sun to dry. The most common pulses identified by participants were the fava bean (Vicia faba), the lentil (Lens esculenta), the chickpea (Cicer arietinum), and the common bean (Phaseolus/Vigna species). Similarly, during their botanical research Halstead and Jones (1989) found that autumn-sown crops in Olympos included the fava bean and lentil, in addition to field bean (V. faba minor), pea (Pisium sativum), grass pea (L. sativus), and arakas (Lathyrus clymenum), while summer crops consisted of chickpea and Phaseolus/Vigna bean species. In mountainous communities throughout Greece, production of legumes is moderately high. According to the data published in the report of Production of Agriculture and Livestock Products: 2006–2007 (ELSTAT 2007), production of edible pulses in mountainous communities of Greece as compared to total production was 40.6 percent for beans, 17.5 percent for broad beans, 5.5 percent for lentils, and 14.7 percent for chickpeas.

Intake of meat was low in past years, though present consumption has increased due to increased availability and affluence. In our survey, sheep and goat were identified as the main types of meat consumed, followed by pork. Pork held a place of primary importance in the diet during past years, but its consumption has recently declined. A variety of preserved pork products were domestically produced on Karpathos in past years, the most important among them being the kavroumas, which consisted of high-fat strips of pig meat fried and stored in lard. The meat could thus be preserved for a whole year. A spoonfull of this pork-lard mixture would be fried and served with bread. According to data available for the Dodecanese prefecture (Karpathos is the second-largest island within this prefecture), the number of cattle was 7,512, compared to 124,649 goats, 77,154 sheep, and 8,168 pigs (ELSTAT 2000). In terms of holdings and numbers, goats and sheep dominate the livestock sector in the Dodecanese prefecture. Goat products, such as milk and cheese, have been significant features of the diet, in both past and present. Almost all (11 of 12) par-

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ticipants reported consuming goat's milk, either drunk fresh or eaten in the form of a soft, fresh cheese. According to the report on Production of Agriculture and Livestock Products, 2006–2007, national production of livestock products for mountainous communities in 2007 as compared to total production was 25.4 percent for milk, 21.8 percent for meat, 22.7 percent for soft cheese, 26.4 percent for hard cheese, and 10.6 percent for lard (ELSTAT 2007).

Wine is an essential element of the traditional Mediterranean diet; our study showed, however, that wine was seldom produced and consumed in Olympos and Avlona. In past years (over thirty years ago), families produced small quantities of wine that were consumed by the family members. All female participants reported rare (only on special celebrations) or no consumption of alcohol. Occasionally, women make liquor from fruits such as orange, fig, or prickly pear (nowadays it is generally purchased from the market), to be drunk at celebrations. On the contrary, male participants reported daily consumption of alcohol. Today, whiskey is frequently consumed, while *raki* (a type of eau de vie) was consumed in the past.

Fruit and vegetable consumption was found to be moderate and based on seasonal availability. Summer vegetables include tomatoes, cucumber, peppers, zucchini, okra, and eggplant, while squash was a common winter vegetable. Vegetables consumed during winter months include summer produce that can be preserved (for example, grape leaves and capers stored in brine), and wild greens that mainly grow during the cooler periods of increased rainfall (October through April). Subsistence based on the foraging of noncultivated plants is an important element supplementing the diet of northern village inhabitants. Throughout Greece, wild plants have long been recognized for their medicinal properties and as a healthy and adequate means of overcoming food shortages due to crop failure and financial distress (Leonti et al. 2006). Moreover, a refined knowledge of edible wild plants increases the efficiency with which the farmer exploits the resources within his "effective" environment (Forbes 1976a). Since the primary growing season for wild greens is during the cooler periods of increased rainfall, these food resources hold an essential position in the diet throughout the winter months when vegetable availability is limited. During this period, wild greens and mushrooms offer variety to a monotonous diet of bread, olive oil, and legumes (p. 253). The gathering of wild plants is generally considered the women's area of expertise. Typical wild food resources that were gathered on Karpathos include wild greens (horta), though wild mushrooms and fruit such as

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the prickly pear were also consumed. Participants noted chicory (*Ci-chorium intybus*) and amaranthus (*Amaranthus viridis*) as examples of wild greens that are commonly gathered, boiled, and eaten with olive oil, lemon, and bread. The herbs wild dill, basil, oregano, mint, and rosemary were gathered and used in cooking. Fruits consumed throughout the summer months included peaches, apricots, figs, grapes, and prickly pear, while dried fruits such as figs, grapes, and apricots as well as nuts were eaten throughout the winter.

On the whole, the diet of the northern village inhabitants was based on wheat, barley, pulses, and olive oil. New-World foods such as tomato, potato, pepper, and squash appeared in the diet in the nineteenth and early twentieth centuries, when cultivation of these products reached gardens in the eastern Mediterranean (Matalas and Grivetti 1994), having been introduced from the Americas. Meat is eaten infrequently, but milk and milk products are consumed more frequently.

## Discussion

In past times and to a lesser extent today, small-scale and subsistence farming has been a considerable means of support for the inhabitants of Olympos and Avlona. As a result, the core diet is a product of the synergies between crop and livestock husbandry. The core diet consists of wheat, barley, olives, and legumes. Wheat is an old crop that expanded from the Fertile Crescent to central Asia and westward to Europe and the islands of Cyprus, Crete, and Malta in the sixth and fifth millennia B.C. (Kislev 1984). Moreover, remains of wild oats and barley discovered in the Franchthi Cave (in the southern Argolid, Greece) in levels dated to about 10,000 B.C. have spurred questions on whether agriculture was indigenous or introduced to Greece (Hansen and Renfrew 1978). Certainly, wheat agriculture has had a long history in Greece. In 1892, Menetes and Olympos were the largest settlements of Karpathos, making Olympos a vital production center particularly for breadstuffs (Patsiada et al. 2006). This is evident from the large number of windmills found in Olympos, several still standing today. Then as now, bread is a staple, and a key component of the Karpathian diet. Similarly, data from the Survey of Crete showed that no meal was complete without bread (Allbaugh and Soule 1953). Dairy products (milk, yogurt, and cheese) are also common components of the diet, which is supplemented by vegetables, fruit, and meat when they are available.

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The prevailing dietary pattern is similar to what Forbes observed 40 years ago (1976a). Forbes completed botanical and ethnographic research on the peninsula of Methana, Greece, which in terms of geology, social interaction, and political administration is comparable to an island. The major crops grown on Methana were wheat, olives, wine grapes, almonds, and figs, while other crops of economic and dietary importance include chickpeas, broad beans, yellow split beans, a variety of summer and winter vegetables, and some tree fruits (pears, plums, citrus, pomegranate) (p. 252). Leafy, green, wild vegetables such as chicory, mustard, black nightshade, and amaranthus were commonly collected, and were probably the most important wild resource supplementing the diet of Methana villagers (Forbes 1976b). Throughout rural communities in Greece, wild greens form a significant part of the diet, as is also proven by the present study findings.

Moreover, fasting rules of the Eastern Orthodox Church, which have been observed for more than 1700 years, prescribe fasting for a total of 180 to 200 days per year, during which meat and meat products are prohibited (Sarri et al. 2004). The duration of fasting periods can range from seven weeks to a single day. Though fasting is not observed as strictly nowadays, during fasts wild greens are an invaluable food supplementing the diet. Greek Orthodox fasting practices, especially in past times, may have indirectly promoted the use of wild plants. Similarly, fasting practices may have played a distinct role in regulating exposure to certain foods throughout the year, and thus establishing a familiarity with other foods. For example, though olive oil is now available in Northern European countries at similar prices to those in Mediterranean countries, intake has not increased, because of differences in taste and preference (Gracia and Albisu 2001). Likewise, when the price of olive oil rose sharply in Spain due to harvest scarcity, consumption there decreased only slightly, considering that olive oil is a traditional ingredient in Spanish cooking (p. 481). Throughout Greece, noncultivated plants have become culturally acceptable food resources that contribute to dietary variety and food subsistence and efficiently exploit the environment. Beyond their use in cooking, in the present day herbs such as oregano can serve an economic purpose, as they are sold at a flat rate by weight in the village tourist shops.

Observations from a botanical study on crop processing undertaken on Karpathos and Armogos found that pulses and wheat were commonly grown for human consumption (Halstead and Jones 1989). Wheat and pulses, as well as olives, are traditional crops cultivated in

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the Mediterranean region since time immemorial. The cultivation of cereals and pulses dates back to the early Neolithic period (7,000 B.C.) (Kizos 2008), and olives have been cultivated in Greece for over 3,500 years (Loumou and Giourga 2003). There has been an ongoing discussion of whether cultivated products are selected on the basis of the pressures imposed by temporal and spatial conditions of the physical environment, or are chosen as cultural factors deemed these products acceptable. In past and present times, bread is abundantly present in the Greek diet. Kislev (1984) states that the simplicity of growing wheat, its capacity for high yield, and the ease of handling, transport, storage, and processing, as well as its palatable taste and satiating quality at meals, have all contributed to its sustained popularity through the ages. Arguably, both environment and culture can influence cultivation.

In the present study area, the agricultural landscape is changing. Terraces are abandoned, and cultivation and crop variety has declined. Kizos and Koulouri (2006) report that for most of the Aegean islands, population increased at a slow and steady rate until the first quarter of the twentieth century, when there was rapid expansion into many parts of available areas. Following this population increase, a rural exodus followed, which resulted in the abandonment of agriculture on terraces and the slow but steady degradation of their quality (Kizos and Koulouri 2006). This seems to be the case in the villages of Olympos and Avlona, where most terraces as well as windmills have been abandoned if not destroyed. Moreover, as individuals age, cultivation activity tends to decline. Abandonment can affect soil quality and land use. In their study of changes in land use and landscape elements and the reasons behind them on the island of Lesvos, Kizos et al. (2010) reported that abandonment was clearly the most common land-use change. Abandonment was defined as the stopping of all cultivation practices, followed by the intrusion of shrubs or forest, and consequently the conversion of a low-input traditional plantation to a neglected and eventually abandoned one, or from cultivated arable land on terraces to grazing land. As preindustrial societies gradually accept modern foodways, dietary patterns will inevitably change, leading to the extinction of traditional diets and agricultural practices. This can lead to an increased reliance on the market to meet dietary needs. Currently, most participants in the present study area still rely considerably on agricultural activities close to home to secure their dietary needs. However, as agricultural practices decline throughout these northern villages, diets and traditional food systems will change, and the ways of life that rely on them will dwindle.
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### Conclusion

In the northern villages of Olympos and Avlona, the traditional occupations of farming and livestock breeding are most representative of the villagers' way of life. In past and present times, crop and livestock production were not recognized as a source of income, but rather a means of directly sustaining the dietary needs of the household. Today, some cultural factors contribute to changes in the landscape and the diet. Is the present study a *final* snapshot of traditional food patterns in the northern villages of Karpathos? The prevailing dietary pattern, which is a product of cultivation and livestock potential, may serve as a reference to past dietary patterns in the Aegean islands. Research is needed to facilitate an understanding of the role of culture and environment in the process of dietary and landscape change.

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#### VI: CONCLUSION AND FURTHER RESEARCH

### 5.1. Conclusion

Populations are living longer, but are individuals living these extended years of life with disability? Epidemiological data suggests that the prevalence of chronic disease increases with advancing age, yet some populations display low rates of chronic disease and enjoy a good quality of later life. Data from the Mediterranean Island Study (MEDIS) were used to investigate "healthy ageing" in a European population, who are free of CVD, in order to identify characteristics of elderly (>65 years) and very elderly (>90 years) that promote longevity (Tourlouki et al. 2009). Data results suggest that modifiable characteristics including physical activity, smoking cessation, mid-day naps and diet may encourage healthy ageing. Moreover, several studies have reported that the Mediterranean diet, observed in Crete circa the 1960's, can prevent or protect against certain heart disease. Of particular interest are older populations because they tend to maintain their traditional eating habits more. Consequently, the present thesis also aims to examine the extent by which present food habits of inhabitants residing in various Mediterranean islands uphold past dietary traditions of the Mediterranean diet (Tourlouki 2012, in print). The author is unaware of any other single study that has collected dietary data on a representative sample from various Mediterranean islands. Data analysis revealed that dietary modification is occurring at varying rates throughout the Mediterranean

area. The Maltese sample showed great variation in food intakes (vegetable intakes were below dietary recommendations; intakes of milk and products and fruit were highest as compared with the other Mediterranean study regions; the mean MedDietScore was low as compared with the other study regions). Dietary data from Crete also displayed great variations. The Cretan sample had the lowest intakes of olive oil. An unexpected finding considering that olive oil has been an important aspect of the Cretan diet and economy since time immemorial. Moreover, dietary data from Crete indicated increased consumption of fast foods (intakes of 3 times weekly) as compared with the other study regions. Other disparities that exist in the dietary data include: cereal intake is extremely low in Cyprus as compared with the other study regions; potato intakes amongst all regions are below dietary recommendations and legume intakes amongst all regions are above the dietary recommendations. It seems that dietary modification is occurring throughout these regions, but what are the factors that contribute to these dietary changes. Findings from the small case study complete on the island of Karpathos suggest that the role of women in agricultural activities, the landscape and customs of inheritance are all themes that may indirectly impact food habits. New findings have emerged from the above-mentioned studies, which have been summarized below (in bullets).

- 5.2 Bullet Summary of Thesis Findings
- Analysis of MEDIS data suggests that physical activity, smoking cessation, mid-day naps and adherence to the Mediterranean diet (discussed below in detail) are modifiable characteristics that may encourage healthy ageing.
  - In our sample, exceedingly more men than women were eversmokers, which may have implications on smoking cessation policy development.
  - $\circ$  1 in 2 males were ever smokers compared with 1 in 10 females.
  - Exceedingly more men than women were current and eversmokers.
  - Current smoking in men significantly declined with age.
  - Nearly 1 in 2 men were active in the age categories 65 79 years and 80 - 89 years while for the same age categories, almost 1 in 3 women were active.
  - Men were more active than females, except in the over 90-age category where gender differences were negligible (Individuals in the >90 age-category who were unable to walk are underrepresented seeing that an elder who is bed-ridden could not be randomly selected and therefore included in the survey).
  - Walking and other activities significantly declined with age in both

genders.

- Midday napping (siesta) was common in our sample. Amongst both genders and all age categories, 8 out of 10 participants reported sleeping at noon while all participants in the over 90 years age category reported napping at noon.
- Less than 1% of men were underweight amongst all age categories,
   while a significant association exists between underweight and age
   category in women.
- As age increased, the percent of women who were underweight increased from 0.4% to 10% (65-79 years compared with >90 years age category).
- Obesity was more prevalent in females compared with males where nearly 1 in 2 females were obese compared with nearly 1 in 3 males. However, obesity in females significantly declined with age.
- Hypertension and hypercholesterolemia characterized most of the study sample across all age categories. Interestingly, in women, hypercholesterolemia significantly declined with age, from 66% in the age category 65-79 years compared to 11% in women over 90 years.
- Diabetes was less prevalent in the sample population. Still, 1 in 5 participants, aged 65-80 had diabetes.
- Although the present sample demonstrates an unfavorable CVD risk

profile the prevalence of cardiovascular disease remains

impressively low.

- Dietary data derived from the food frequency questionnaire revealed the following:
  - Amongst all regions, intakes of poultry, meat and meat products, fish, cereals, milk and milk products, and sweets (apart from Crete) were below dietary recommendations.
  - Intakes of vegetables, potatoes, fruit and olive oil intake met and in some cases exceeded recommendations.
  - Across all regions, sweet and fast food intakes were low, apart from
     Crete where fast food was consumed frequently an average of 3
     times weekly.
  - Throughout all regions, greens were an important part of the diet consumed roughly 3 to 4 times weekly.
  - $_{\odot}~$  Alcohol was consumed daily by 35 to 60% of the sample.
  - The MedDietScore ranged from 29 to 34, wherein adherence to the traditional Mediterranean diet can be considered as moderate.
  - Throughout all regions, olive oil was consumed frequently from 3 to
     6 times weekly.
- Principal component analysis (PCA) derived three major dietary patterns, explaining 41.6% to 58.2% of total diet variation in the Mediterranean islands (Malta, Republic of Cyprus, and the Greek islands of Mitilini,

Samothraki, Cephalonia, Crete, Corfu, Limnos, Ikaria, Syros, Naxos and Zakynthos) included in our sample.

- For the Aegean Islands, the first component could be defined as a "healthy eating pattern" in which the first component was heavily loaded by fruits, greens, potatoes and vegetables intake, together with olive oil use.
- For the Ionian Islands (the first component was characterized by greens and cereals intake), Cyprus (the first component was characterized by fish, greens, cereals and inversely by meat and products and olive oil use) and Malta (first component was characterized by greens and vegetables intake) the dominant component could also be described as a "healthy eating pattern", but with fewer food types and with the absence of olive oil use.
- In Crete, the first component was characterized by meat and products, vegetables, fruit intake and olive oil use, and inversely by fish, greens, and sweet intake; a dietary pattern that can be defined as "mixed".
- For component 2 (14.1% to 16.8% explained variation) and component 3 (10.1% to 14.1% explained variation), PCA derived a variety of food groups amongst all regions representing a "mixed" diet, apart from Crete where the second component was characterized by fish, greens, legumes and cereal intakes and

inversely by milk and products and can be defined as a "healthy eating pattern".

- Post-hoc analyses showed that the greatest differences in weekly consumption existed between Malta, followed by Crete, as compared to the Aegean Islands (reference group).
- Analysis of the present dietary information suggests that certain features of the traditional Mediterranean dietary pattern remain; data analysis also reflects a shift in food intake.
- Dietary habits that still persist include:
  - Vegetables are still consumed in large quantities, frequent use of olive oil is characteristic of all regions and nearly half of the sample consumes 1-2 serving of alcohol daily.
- In contrast, despite a long culinary history certain food practices are changing:
  - Legume intake, across all regions, was below recommendations compared to potato intake that surpassed recommendations.
  - Fast food and soft drinks are modern food products that were unavailable in during past times. They are consumed in moderate amounts throughout all regions, apart from Crete where fast food consumption is high.
- Data from the small case study completed on the island of Karpathos, in the northern isolated villages of Olympos and Avlona suggests that the

absence of mechanized farming, the social role of women and customs of inheritance are factors that can contribute to the preservation of traditional food-related practices.

- Dietary data that indicates that wheat and barley remain as dietary staples while legumes, olive oil, and milk and products supplement the diet in varying amounts.
- Participants identified bread as the most important food items.
   None of the participants reported purchasing bread or rusks, but assert that it is made fresh at home. Most participants buy flour from the store, yet a few rely on their annual harvest of wheat and barley.
- After bread, olives and olive oil were identified as the most important component of the diet.
- Goat products, such as milk and cheese are significant features of the diet. Consumption seems to still be based on local production wherein goats followed by sheep are the most common livestock on the Dodecanese islands.
- Fruit and vegetable consumption is still based on seasonal availability, and therefore consumption increases throughout the summer months when these foods are available.
- In past years, meat was seldom consumed although today, meat consumption (goat and sheep) has increased.

- Farming is unmechanized and still today some inhabitants engage in subsistence farming to secure their food needs.
- The social role of women can inhibit dietary change since the women in these villages possess the traditional and technical knowledge required to secure food without a heavy reliance on the market.
- The customs of inheritance are important factors that influence social relations and landscape use in which land is rarely sold, but instead forms a vital component of the family's dowry (the order of precedence is based on age).

# 5.1.1. Modifiable Cardiovascular Disease Risk Factors: Physical activity, Smoking cessation, Mid-dap Napping and Diet

Our analysis suggests that physical activity, smoking cessation, mid-day naps and a Mediterranean diet are modifiable characteristics that may encourage healthy ageing. The present elderly sample engaged in regular physical activity. Men were generally more active than females, except in the over 90-age category where gender differences were negligible. The World Health Organization's (2010) recommended levels of physical activity for adults >65 years old are a minimum of 150 minutes per week of moderateintensity aerobic physical activity, 75 minutes per week of vigorous-intensity aerobic physical, or a combination of both. Walking and other activities (minutes/week) were  $156\pm 68$  and  $138\pm 64$  minutes for male and female participants aged 65 to 80 years, respectively. Male participants met and surpassed WHO (2010) recommendations, whereas females, for the same age group, almost met recommendations. Walking and other activities significantly declined with age (p< 0.001) in both genders.

Regular physical activity is fundamental for the prevention of disease. Van Dam and colleagues (2008) used data from the Nurses' Health Study (77,782 women; aged 34 to 59 years) and estimated that the population attributable risk (PAR) for lack of physical activity was 16.5% of deaths from any cause and 27.7% of cardiovascular deaths. In the INTERHEART study in 52 countries, PARs for risk of acute myocardial infarction for lack of exercise in men and women, across all regions, was 22.9% and 37.3% respectively. Our results and others suggest that physical activity is a factor that can reduce CVD risk. However, as age advances physical activity levels tend to decline. Promotions strategies that promote physical activity during later life are necessary to promote wellbeing.

Concerns have been raised over the accuracy of physical activity measurements based on self-reports, particularly when working with older populations. Incomplete recall and impaired cognitive abilities may hinder an individual's ability to provide precise information on frequency, duration and intensity of physical activity, especially over a 7-day period. Furthermore, intensity levels are open to interpretation; disabled or depressed elders may

rank the intensity level of a specific activity higher compared to their healthy counterpart. However, strategies to increase precision and accuracy amongst older populations can include clearer instructions, repeated cuing, enhanced motivation and/or an increased number of trials (Rikli 2000). Additionally, accelerometers provide an objective method of motion sensing for population studies (Westerterp 2009).

The World Health Organization estimates smoking prevalence in the WHO European Region at roughly 29%, wherein vast gender differences exist between males (40%) and females (18.2%). According to figures from The Tobacco Atlas, amongst all EU countries, Greece has one of the highest rates of smoking, 63.6% of males smoke cigarettes and 39.8% of females (The Tobacco Atlas 2012). Similar results were observed in the MEDIS sample, where exceedingly more men than women were ever-smokers (roughly 1 in 2 men vs. less than 1 in 10 women), even though current smoking significantly (p< 0.001) declined with age in men. Women were more commonly exposed to environmental tobacco smoke (ETS) across all age groups, except in the >90 age category where 17% of men compared to 0% of women were exposed to ETS.

Results from the INTERHEART Study suggest that current smoking and raised apolipoproteins B and A1 were the two strongest risk factors related to acute myocardial infarction (Yusuf et al. 2004). A 50-year prospective cohort study of British doctors highlighted the benefits of smoking cessation

on longevity; participants who quit smoking at around the age of 60, 50, 40, or 30 gained, respectively, 3, 6, 9, or 10 years of life expectancy compared with those who continued smoking (Doll et al. 2004). It has been well understood that cigarette smoking and exposure to cigarette smoke can affect the circulatory system and contribute to coronary heart disease and stroke (U.S. Department of Health and Human Services 2010). The next step is to establish strategies for smoking cessation, which target all age groups.

Midday napping (siesta) was common in our sample. Amongst all gender and age categories, 8 out of 10 participants reported sleeping at noon. The effect of napping on CVD risk has been the subject of several epidemiological studies, however conflicting results have been generated. Studies of older adults did not find an inverse association between napping and total mortality (Bursztyn et al. 1999) and risk of CVD mortality (Tanabe et al. 2010). Data from a large case-control study in Costa Rica suggested a positive association between siesta and myocardial infarction (Campos and Siles 2000). However, these findings are in contrast to those provided by two studies in Greece. Kalanidi et al. (1992) reported a weak negative association between napping and CHD. Amongst participants in the Greek European Prospective Investigation into Cancer and Nutrition (EPIC) cohort, Naska and colleagues (2007) reported that those who napped regularly had a 37% lower risk of coronary mortality. Naska et al. (2007) suggest that

midday napping may have similar effects on the body, as morning awakening in which increased blood pressure and heart rate are likely to contribute to a temporary increased risk of a cardiovascular event, yet, afternoon siestas may also lower stress levels that have been positively associated with CHD mortality. The hypothesis that midday siestas may reduce CVD and CHD mortality must be further explored, as results provide inconsistent evidence. Studies may need to examine afternoon napping in greater detail by considering factors such as duration of sleep, time of day and frequency per week.

#### 5.1.2. Dietary Change in the Mediterranean Region

Several studies have reported on the Mediterranean diet's role in primary and secondary prevention of CHD, and today, the Mediterranean diet forms the basis of several national nutrition guidelines. The present samples' adherence to the Mediterranean diet was considered favorable and Mediterranean dietary guidelines established by the Greek Ministry of Health and Welfare (1999) were almost entirely met. Consequently, diet may explain, in part, this population's good health. However, our analysis also suggests that certain aspects of traditional eating patterns are changing throughout the Mediterranean region. Post-hoc analyses showed that compared to the Aegean Islands (reference group), the greatest differences in weekly consumption existed between Malta, followed by Crete.

Principal component analysis (PCA) derived three major dietary

patterns, explaining 41.6% to 58.2% of total diet variation (Table 6). At this point, it should be noted that PCA defines patterns in nutrition behavior and not food intake frequency. For the Aegean islands, greens, vegetables, potatoes, fruit and olive oil heavily loaded the first component which can be defined as a "healthy eating pattern"; for the Ionian islands, greens and cereals characterized the first component; for Cyprus Republic, the first component was characterized by fish, greens and cereals, and inversely by meat and olive oil, while for Malta, the first component was characterized by greens, vegetables, and legumes. As such, for the Ionian Islands, Cyprus Republic and Malta the dominant component could be described as a "healthy eating pattern", in which the dietary pattern found for the Ionian Islands and Cyprus consists of fewer food types and with the absence of olive oil use. On the contrary, in Crete, the first component was characterized by meat and products, vegetables, fruit intake and olive oil use, and inversely by fish, greens, and sweet intake, a dietary pattern that can be defined as "mixed". For component 2 (14.1% to 16.8% explained variation) and component 3 (10.1% to 14.1% explained variation), PCA derived a variety of food groups amongst all regions representing a "mixed" diet, apart from Crete where the second component is characterized by fish, greens, legumes and cereal intakes and inversely by milk and products and can be defined as a "healthy eating pattern".

Table 6: Food Groups and Defined Eating Patterns for the Dominant Component According to Region

Region	Component 1*	Defined Eating Pattern			
Aegean Explained variabili 22.0%	个Greens, 个Vegetables, y, 个Potatoes, 个Fruit, 个Olive Oil	"Healthy Eating Pattern"			
Ionian Explained variabili 16%	↑Greens, ↑Cereals y,	"Healthy Eating Pattern", but consisting of fewer			
Cyprus Republic Explained variabili 17.9%	↑Fish, ↑Greens, ↑Cereals, ↓Meat, ↓Olive oil	food types and with the absence of olive oil use.			
Malta Explained variabili 18.8%	个Greens, 个Vegetables, y, 个Legumes				
Crete Explained variabili 31.2%	<ul> <li>↑Meat, ↑Vegetables, ↑Fruit,</li> <li>↑Olive oil, ↓Fish, ↓Greens,</li> <li>↓Sweets</li> </ul>	"Mixed Diet"			
*Each component was interpreted ("named") based on the foods that had absolute loadings greater than 0.40, which were considered as significantly contributing to the specific diet component (pattern).					

Although, analysis of the present dietary information suggests that certain features of the traditional Mediterranean dietary pattern remain, data analysis also reflects a shift in food intake. Large quantities of vegetables (in particular wild greens), fruit and olive oil are still present in the diet. In past and present times, mainly due to climatic conditions, plant foods have been most abundant throughout the Mediterranean area, and therefore comprise a dominant component of the diet. Contrastingly, despite a long food history, certain dietary practices are changing. For example, the dominant nutrition behavior observed in Crete deviated from traditional Mediterranean eating pattern in which fish seemed to be replaced by meat. Additionally, as a result of rising incomes and persisting tourism in the region, new food commodities such as fast foods, sweets and soft drinks are challenging Mediterranean dietary traditions. Consequently, refined carbohydrates present in sweets and soft drinks, in addition to high amounts of saturated fat that have been associated with fast foods are now finding a place within the diet. Such dietary changes seriously impact CVD risk.

For example, in a follow-up study, data were collected in 1991 from the original male participants who took part in the Seven Countries Study in 1960, in which comparison of dietary data indicated an increase in meat and cheese consumption (Kafatos et al. 1997). Additionally, over the last 31 years, a significant increase in serum cholesterol concentration, systolic and diastolic blood pressure, weight and BMI was also reported (Kafatos et al. 1997).

Similarly, MEDIS participants also had several CVD risk factors; 60 and 71% of men and women respectively were hypertensive, and hypercholesterolemia characterized 40 and 58 percent of males and females, respectively. It seems that throughout the last half century, changes in eating patterns have occurred that may be partially responsible for the high prevalence of risk factors observed throughout the study region.

5.1.3. Factors that contribute to the preservation of traditional food- related practices amongst individuals living in the isolated northern villages of Karpathos

Our work and research by other authors suggests that diets are rapidly changing, but less is understood about the push factors that bring about these changes. The small case study that was completed as part of the present work, set out to identify the core diet of a population residing in a Mediterranean island that has been minimally eroded by industrialization and tourism, and the factors that promote or oppose dietary change. The study was completed on the island of Karpathos, which is southernmost in the chain of Dodecanese islands, in the northern isolated villages of Olympos and Avlona. The dietary staples were wheat, barley, legumes, olive oil, but the diet was also supplemented with milk and products in varying quantities. None of the participants reported purchasing bread or rusks, but assert that it is made fresh at home. Most participants buy flour from the store, yet a few rely on their annual harvest of wheat and barley. After bread, all participants identified olives and olive oil as the most important food commodities that were paired with various foods, such as wild greens, to form a meal. In past years, meat was seldom consumed although today, meat consumption (goat and sheep) has increased due to increased incomes and availability. Goat products, such as milk and cheese are significant features of the diet. Lastly, fruit and vegetable consumption was moderate and based on seasonal availability. In past times and to a lesser extent today, subsistence farming has been a considerable means of securing food for the inhabitants of Olympos and Avlona.

Due to the sloping mountain environment, farming in these northern villages of Karpathos was unmechannized, and therefore individuals were dependent on traditional knowledge of small-scale subsistence farming that had been refined over years. However, by 2050, over 70% of the global population is expected to be urban (FAO 2009). On the island of Karpathos, younger generations are abandoning rural life to find work in urban areas. Older generations cannot keep up with the physical demands of farming, and younger generations have a dwindling interest in acquiring traditional knowledge on cultivation activities. Urbanization can be seen as a factor driving dietary change amongst this community since the abandonment of traditional land management systems leads to a decline cultivation and crop variety. This intensifies market participation, and further facilitates reliance towards mass industrial food production.

On the contrary, the social role of women can inhibit dietary change. Women are arguably the most important segment of this society. Middleaged and elderly women, due to the absence of men for the greater part of the year, are responsible for most agricultural and domestic activities. Value-added processed products are rarely procured. Instead, women principally rely on the natural resources available to the community. For example, olive trees provide an annual supply of olives and olive oil; wild greens and herbs are collected and supplement meals; vegetables and fruits collected throughout the summer are preserved, stored and provide a viable

food source throughout the winter months. As a result, women have the technical knowledge required to secure food without heavy reliance on the market.

Additionally, the customs of inheritance are important factors that influence social relations in which land is rarely sold, but instead forms a vital component of the family's dowry (the order of precedence is based on age). The law of inheritance generally leads to an increase in land ownership amongst women as it is thought that land is needed more in settling the daughter. Dawkins (1902) suggests that the rationale behind these arrangements is that the son can marry on his trade, whereas a daughter will need land to find a suitable husband (Dawkins 1902). As a result, it is common practice for the eldest daughter to have priority in the inheritance of land, and a level of shame is associated with the selling of family land. These arrangements can affect landscape use, since foreign investors may have difficulty gaining access to land. Although the abandonment of agricultural practices may speed up dietary changes, the absence of mechanized farming, the social role of women, and customs of inheritance are factors that have contributed to the preservation of traditional foodrelated practices in these isolated villages of Karpathos.

### 5.2. Concluding Remarks and Future research

As rapid ageing continues on a worldwide scale, there will be an

increased need to address CVD that is pronounced at advanced ages. Although many factors relating to diet have been shown to protect or potentially prevent CVD, dietary trends suggest that populations are adopting unhealthy diets. As populations become more urban and affluent, fast-paced working individuals will continue to modify their diet and choose convenience foods over better-quality products. An expert FAO panel (2009) reports that the rising demand for semi-processed or ready-to-eat foods will place an even greater emphasis on the consolidation of supermarket chains. In 2006 alone, U.S. food manufacturers introduced 20,031 new products of which 23% were candy, gum, and snacks and 26% were beverages (U.S. Department of Agriculture 2007). In Europe, the dairy sector (including cheese production) led in new product introduction followed by ready-made frozen meals, frozen products and soft drinks (http://www.ciaa.be). These new, heavily processed, products developed by large-scale food manufacturers will compete will local goods sold at small-scale markets, and consequently impact the world food supply. For example, throughout Europe, food retail markets are extremely concentrated wherein the top three retailers have 30 to 50% of the market share (CIAA 2010). In Greece, the top three retailers (Sklavenitis, Carrefour, AB (part of Delhaize Group) have 53% of the market share (CIAA 2010).

Additionally, value added foods are saturating the market. Work by Elitzak (1996) estimates that 80% of the 530.8 billion dollars spent by U.S.

consumers on farm foods went to marketing costs such as labor, packaging, transportation, energy and advertising. Consumers are spending more money on food processing rather than on the actual food item itself. For example, the farm value of an 18 oz. box of Cornflakes is .10 U.S. dollars (USD) yet its retail price is 1.54 USD (Elitzak 1996). A similar trend is underway in Europe where value added in the oils and fats sub-sector increased by 48.4% (2000-2002) and the beverage sector increased by 3.4% (2000-2003) (CIAA 2010). As consumers accept to pay higher prices for prepared foods, there should be a move towards value-added marketing of fruits and vegetables. Pre-washed, pre-cut, or pre-cooked vegetables and salads can encourage consumption, not only for fast-paced working individuals who struggle to eat well, but also amongst elders with physical or cognitive impairments that have limited abilities in the kitchen. Similarly, dehydrated fruits are a great way to provide essential nutrients to a diet. Moreover, national guidelines and policies should encourage the use of frozen and canned foods. Although rich in vitamins and nutrients, and typically cheaper than their fresh counterpart, frozen and canned foods are a commonly overlooked food source. Rickman and colleagues (1997) point out that although processing can lower the nutrient value of fruits and vegetables, nutrient loss may be minimal compared with the losses during the storing and cooking of fresh foods.

Findings from the present thesis can be used to support further

research in identifying dietary patterns, characteristics and behaviors associated with longevity gain. Furthermore, to what extent can older populations benefit from the modification of dietary and lifestyle practices? Although, the benefits of the Mediterranean diet have received worldwide publicity throughout the past decades, individuals in the Mediterranean area are abandoning their traditional wholesome diets and are adopting westernized eating habits that have been associated with ill-health. As a result, driving factors that contribute to dietary change need to be further explored. Results from this piece of work can be used as groundwork for future longitudinal studies that explore a variety of factors to longevity gain and how they affect health status.

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# VIII. APPENDIX

### 7.1 Case Study in Karpathos Interview Guide

# Ερωτηματολόγιο Διαιτητικών Συνήθειων: Κάρπαθος

### <u>1. Γενικά Στοιχεία</u>

Ονοματεπώνυμο Περιοχή μόνιμης διαμονής	
🗌 (1) Αγροτική περιοχή 🗔 (2) Αστική τ	τεριοχή
Έτος γέννησης	
🗌 (1) Άνδρας 🗌 (2)Γυναίκα	
<u>2. Κοινωνικοοικονομικό Επίπεδο</u>	
Συνταξιούχος: (1)ΝΑΙ 🗌 (2)ΟΧΙ 🗍 Επάγγελμα	
Έτη σπουδών (π.χ. 6 για Δημοτικό, 12	για Λύκειο, 16 για Α.Ε.Ι.)
<u>3. Σωματική Άσκηση</u>	
Σε μια συνήθη εβδομάδα πόσες φορές	ασκείστε (έχετε φυσική δραστηριότητα);
<ul> <li>Καθόλου</li> <li>1 – 2 φορές / εβδομάδα</li> <li>3 - 5 φορές / εβδομάδα</li> <li>&gt; 5 φορές / εβδομάδα</li> </ul>	
Ποιο είδος σωματικής φυσική δραστηρ	ιότητας προτιμάτε;
Βάδισμα ή τρέξιμο, ποδήλατο Κολύμπι Χορός Άλλο Χρόνια σωματικής άσκησης	□NAI □OXI □NAI □OXI □NAI □OXI □NAI □OXI
Πόσο περπατάτε καθημερινά για τις συ	ινήθεις ασχολίες σας (σε λεπτά)
<u>4. Ανθρωπομετρικά Στοιχεία</u>	
Βάρος (Kg)	
Ύψος (cm)	

# 5. Κατανάλωση Τροφίμων (άνα άτομο)

	Είδος διατροφής (πρώην: ζυμαρικά – τραχανά, μακαρόνια)	Συχνότητα κατανάλωσης σε σχέση με το παρελθόν(>30 έτη πριν)		Τρόπος προετοιμασίας σε σχέση με το παρελθόν (>30 έτη πριν)		Διαθεσιμότητα ειδών διατροφής (Food Supply)		
	Προσδιορίστε τα τρόφιμα	Διαφορετική (+,-)	Παρόμοια	Διαφορετικό ς (+,-)	Παρόμοιο ς	Διαφορε τική	Οικιακή παραγωγή	Αγορά
Ψωμί				<b>, , , ,</b>	-			
Ζυμαρικά								
Σούπα								
Όσπρια								
Λαχανικά								
Χόρτα								
Πατάτες								
Φρούτα								
Μοσχαρίσιο								
κρέας - beef								
Κρέας-χοιρινό								
Κοτόπουλο								
Κουνέλι								
Κατσίκι-γίδα								
Αρνάκι								
Αλλαντικά								
Ψάρια								
(φρέσκα)								
Ψάρια (παστά,								
καπνιστά κ.α.)								
Σαλιγκάρια								
Γάλα								
Μαλακό τυρί								
(π.χ.								
ανθότυρος,								
ξινοτύρι)								
Σκληρό τυρί								
(πχ: γραβιέρα)								
Δλλο είδος								
λαδίου								
Λαοδί				ł				
Κοάσι								
Ρακί								
Άλλο								
αλκοολούνο								

### Ποια τρόφιμα

ροτιμάτε; ατί;	
οια τρόφιμα τρώτε	
υχνότερα;	
ατί;	

Ποια τρόφιμα δεν τρώτε άλλο, αλλά το τρώγατε στο
παρελθον;
Ι ιατί;
<u>6.Οικιακή Παραγωγή</u>
Παράγετε κάποια τρόφιμα αυτή τη στιγμή;□ΝΑΙ (1)□ΟΧΙ (2)
□Χωράφι (1) □Κήπος (2) □ Οπωρώνας (κήπος με δέντρα) (3) □Ζωική παραγωγή (4)
Διευκρινίστε τα προϊόντα που παράγετε
 Πώς χρησιμοποιείτε τα προϊόντα; □ Τα καταναλώνετε (1) □ Τα πουλάτε (2)□ Τα ανταλλάσσετε (3)
Παρήγατε κάποια τρόφιμα στο παρελθόν;⊡ΝΑΙ (1) ⊡ΟΧΙ (2)
□Χωράφι (1) □Κήπος (2) □ Οπωρώνας (κήπος με δέντρα) (3) □Ζωική παραγωγή (4)
Διευκρινίστε τα προϊόντα που παρήγατε
······
Πώς χρησιμοποιούσατε τα προϊόντα; □ Τα καταναλώνετε (1) □ Τα πουλάτε (2)□
Τα ανταλλάσσετε (3)
Γιατί σταμάτησε η
παραγωγή
<u>Αλιεία, Κυνήγι, Συλλογή, Συλλογή αλατιού, Παραγωγή Μελιού</u>
Αυτή τη στιγμή: □Αλιεία (1) □ Κυνήγι (2) □Συλλογή (3) □Συλλογή αλάτιου(4) □ Παραγωγή
Μελιού (5)
Διευκρινίστε τα προϊόντα

 Πά (3)	 ος χρησιμοποιείτε τα προϊόντα; □ Τα καταναλώνετε (1) □ Τα πουλάτε (2)□ Τα ανταλλάσσετε
 Στα (5) Διε	 <b>ο παρελθόν</b> : ⊡Αλιεία (1) □ Κυνήγι (2) □Συλλογή (3) □Συλλογή αλάτι(4) □ Παραγωγή Μέλι υκρινίστε τα προϊόντα
 Πú αν	ος χρησιμοποιούσατε τα προϊόντα; □ Τα καταναλώνετε (1) □ Τα πουλάτε (2)□ Τα ιαλλάσσετε (3)
	Προσοιοριστε ποια τροφιμα συντηρειτε σε -
1.	
	ψυγειο
2	
2.	Σε καταψυκτη
2	
3.	Αποζηραμενα
1	Σε
ч.	κονσέρβες
	котосррсу
5	Παστά
6.	Σε Άλμη (αλάτι και νερό)
7.	Σε
	λάδι

. . . . . . . . . . . . . . . .

8. Σε ξύδι.....

.....

### <u>8. Εξοπλισμός για Μαγείρεμα</u>

Κουζίνα αερίου □Παρελθόν (1) □ Παρόν (2) Φούρνος με Ξύλα □Παρελθόν (1) □ Παρόν (2) Ηλεκτρικός φούρνος Παρελθόν (1) Παρόν (2) Άλλος □Παρελθόν (1) □ Παρόν (2)

Τύπος και συχνότητα μαγειρέματος (0 – ποτέ, 1 – σπάνια, 2 – μερικές φορές, 3 - συχνά, 4 - πάντα)

	Φούρνος	Ψητό στη σχάρα	Τηγανιτό	Βραστό/ στον ατμό	<b>Μαγειρεμένο</b> (Stewed)
Κρέας	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
Ψάρι	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
Λαχανικά	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
Πατάτες	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

### Διευκρινίστε ποιο λίπος χρησιμοποιείτε για τηγάνισμα

Ελαιόλαδο (1) Άλλο είδος λαδιού (2) Μαργαρίνη (3) Βούτυρο (4) Άλλο ζωικό λίπος

(5) \_\_\_\_

**Συχνότητα κατανάλωσης λαχανικών** (0 – ποτέ, 1 – σπάνια, 2 – μερικές φορές, 3 - συχνά, 4 - πάντα)

Στο Παρόν	0	1	2	3	4
Στο Παρελθόν	0	1	2	3	4

Συχνότητα κατανάλωσης φρούτων (0 –ποτέ, 1 – σπάνια, 2 – μερικές φορές, 3 - συχνά, 4 -

πάντα)

Στο Παρόν	0	1	2	3	4
Στο Παρελθόν	0	1	2	3	4

### 9. Μυρωδικά και Μπαχαρικά

Χρησιμοποιείτε συνήθως **μυρωδικά και μπαχαρικά**; ΠΝΑΙ (1)ΟΧΙ (2)

Κάποια από αυτά τα παράγετε;  $\square$ NAI (1) $\square$ OXI (2)

Διευκρινίστε ποια:

.....

Κάποια από αυτά τα συλλέγετε; ΟΝΑΙ (1)ΟΧΙ (2)
σπίτι.....

## 10. Αλλαγές Συνηθειών Διατροφής

Έναντι της προηγούμενης γενεάς (π.χ. ΤΟΥΣ ΠΑΤΕΡΑΔΕΣ ΤΟΥΣ) είναι οι συνήθειες σας διαφορετικές; ΠΝΑΙ (1)ΠΟΧΙ (2)

Εάν ναι, πείτε το λόγο (1, 2, 3 δείξτε τη σημασία – 3 σημαντικότερος)

Οικονομικοί λόγοι

Βελτιωμένη γνώση της σχέσης διατροφής με την υγεία

Αλλαγή στις προτιμήσεις τροφίμων

Βελτιωμένη διαθεσιμότητα στην αγορά

Διαφορετικός τρόπος ζωής

Τρώτε έξω από το σπίτι

Άλλος

**Πως διαφέρουν οι συνήθειες διατροφής;** Σύνθεση γευμάτων...... Ωρα των γευμάτων......

Τρόπος μαγειρέματος
 Χρήση λίπους Πρόσθετη διατροφή για ένα από τα μέλη της οικογένειας (π.χ. υπερχολεστερολημία, διαβήτη)
 Άλλος λόγος
<u>11. Σύνθεση Γεύματος Παρελθόντος και Παρόντος</u> Προσδιορίστε ποια και πόσα πιάτα αποτελούν το κάθε γεύμα σήμερα και στο παρελθόν. Αναφερθείτε και στα ποτά.
1 <b>. Πρόγευμα</b> Συνήθεις παρευρισκόμενοι (στο παρόν)
Συνήθεις παρευρισκόμενοι (στο παρελθόν)
Σύνθεση γεύματος (στο παρόν)
Σύνθεση γεύματος (στο παρελθόν)
Χρόνος και Τόπος 2 <b>. Πρωίνο Σνακ</b> Συνήθεις παρευρισκόμενοι (στο παρόν)
Συνήθεις παρευρισκόμενοι (στο παρελθόν)
Σύνθεση γεύματος (στο παρόν)
Σύνθεση γεύματος (στο παρελθόν)
Χρόνος και Τόπος
3 <b>. Μεσημεριανό</b> Συνήθεις παρευρισκόμενοι (στο παρόν)
 Συνήθεις παρευρισκόμενοι (στο παρελθόν)
Σύνθεση γεύματος (στο παρόν)

 Σύνθεση γεύματος (στο παρελθόν)
Χρόνος και Τόπος
4. <b>Απογευματινό</b> Συνήθεις παρευρισκόμενοι (στο παρόν)
 Συνήθεις παρευρισκόμενοι (στο παρελθόν)
Σύνθεση γεύματος (στο παρόν)
Σύνθεση γεύματος (στο παρελθόν)
Χρόνος και Τόπος
5. <b>Δείπνο-βραδυνό</b>
Συνήθεις παρευρισκόμενοι (στο παρόν)
Συνήθεις παρευρισκόμενοι (στο παρελθόν)
Σύνθεση γεύματος (στο παρόν)
Σύνθεση γεύματος (στο παρελθόν)
Χρόνος και Τόπος
Ποιο <b>γεύμα</b> είναι το πιο σημαντικό, γιατί;
 Ποιο <b>φαγητό</b> είναι το πιο σημαντικός, γιατί;
Διαφορές στη προετοιμασία των γευμάτων σε σχέση με το παρελθόν

## <u>12. Εποχικές Αλλαγές</u> Χειμερινά

Χειμερινα φαγητά;..... 

Καλοκαιοινά	
ωανητά.	
φαγι[τα,	•••

Εν συντομία, περιγράψτε την προετοιμασία των φαγητών για μια γιορτή

Εάν κάποια φαγητά δεν προετοιμάζονται πλέον, παρακαλώ προσδιορίστε ποια είναι και γιατί;

## <u>13. Ποτά</u>

Προσδιορίστε τη συχνότητα κατανάλωσης ανά ημέρα και/ή εβδομάδα

	Καθημερινά	Εβδομαδιαία			
Νέρο					
Πλήρες Γάλα					
Γάλα (1,5%)					
Καφέ					
Τσάι βουνού ή άλλο ρόφημα					
τύπος:					
Ανθρακούχα ποτά					
Χυμοί					
Κρασί					
Ρακί					
Μπύρα					
Άλλο οινοπνευματώδες ποτό,					
τύπος:					
Πίνετε πάντα πολύ (οινόπνευμα) για τις πρόσθετες περιπτώσεις (πανιγίρι);					
□ Πότε (1) □ Μία φορά την εβδομάδα (2) □ Μια φορά το μήνα (3) ΄΄□ 'Αλλος(4)					
Διευκρινίστε					

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