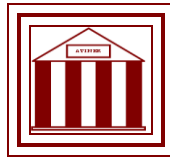


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**Depressive Symptoms and the  
Prevalence of Cardiovascular Risk  
Factors among Greek Australians:  
Preliminary Findings from the  
Mediterranean Islands (MEDIS-  
Australia) Study**

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Dr. Gregory T. Papanikos  
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### **Abstract**

The Australian arm of the Mediterranean Islands Study (MEDIS study) is a cross sectional survey of socio-demographic, medical history, lifestyle factors and dietary characteristics of elderly Greek Australians over 65 years of age originally from the islands of Crete and Cyprus. This study aims to explore and evaluate the relationships between cardiovascular disease risk factors and adherence to the Mediterranean diet (Med Diet) using a diet score to explain the persistent low coronary heart disease (CHD) mortality of Greek migrants to Australia. The preliminary findings from n=59 males and n=61 females born in Crete and Cyprus suggest that there are less signs of depressive symptoms with a higher adherence to the Med Diet. The elderly Greek Australians have a higher prevalence of self-reported cardiovascular risk factors namely hypertension, diabetes and hypercholesterolemia and are more overweight compared with the Australian-born population aged 65-74 years. Further analysis will be necessary to investigate the link between symptoms of depression and the prevalence of these cardiovascular risk factors and the impact of diet. We seek to explore whether a lower prevalence of cardiovascular risk factors is associated with a stronger adherence to the Med Diet and whether this positively impacts depression scores in this elderly Greek Australian population. The relationship between diet, cardiovascular risk and depression score may be mediated by lifestyle factors such as fasting practices, social networks, medications used, access to medical care and levels of physical activity which includes gardening and the maintenance of a home garden by this cohort. In the long term, the findings may be of practical use by both medical and allied health care providers of these elderly migrants to encourage and promote traditional eating patterns and behaviours which enable a greater adherence to the Med Diet and improved health and well-being in the elderly.

**Keywords:** MEDIS, Greek Australians, Greek migrants, culture, MedDiet Score, depressive symptoms.

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## Introduction

### *Background to the Australian arm of the MEDIS study*

Australian studies of Greek elderly migrants over the last three decades have shown that they appear to retain healthy aspects of their traditional diets post-migration such as the home garden and religious fasting practices which may in part explain the persistent low cardiovascular disease (CVD) risk and mortality rate (Kouris-Blazos, 1994, Kouris-Blazos, 2002, Itsiopoulos and Brazionis, 2011, Itsiopoulos, 2007). The retention of these practices some 50 years post-migration may continue to facilitate adherence to the Med Diet in the diaspora and may be linked to the health benefits which have been previously reported in terms of lower CVD risk and less depressive symptoms despite a higher prevalence of risk factors in these elderly Greek migrants. Australian mortality data by country of birth demonstrates that the Southern European migrants, including Greek-born migrants have lower mortality rates than the broad Australian population. Greek-born Australians consistently show lower rates of all-cause and CHD mortality over the last 50 years compared with Australian-born people. This “paradox” occurs in spite of a higher prevalence of CVD risk factors (ABS, 2008). The MEDIS study commenced in 2005 in Greece as a health and nutrition survey aimed at evaluating bio-clinical, lifestyle, behavioural and dietary characteristics of elderly people living in the Mediterranean islands of Greece including individuals from the Cyprus Republic and Crete (Panagiotakos, 2006). Researchers hypothesized that adherence to the traditional Greek Mediterranean diet was greater in islanders compared with Greeks in mainland Greece and that this may be key in a number of associations related to the health benefits of the Med Diet including decreased CVD risk (Panagiotakos, 2007, 2009). To evaluate the level of adherence to the Mediterranean diet in MedDietScore was used (Panagiotakos et al, 2006). The Australian MEDIS study commenced in 2011 to investigate dietary and lifestyle factors of elderly Greek-born Australians who originated from Greek islands. This cohort has not been previously studied in Australia and includes Greek Australians from Crete and Cyprus over 65 years using consistent methodology as in the Greek MEDIS study protocol. Over 100 participants have been recruited and the data collection is still in progress with n=150 the target sample size.

### *The Greek Australian migrant population*

The migration journey by Greeks to Australia occurred between 1945 and 1982 with many residing in Melbourne. In the early years post-migration they created language schools, churches, Greek media, community clubs and organisations and some 50 years later, they are the elders of the community (Wahlqvist et al, 1995, Kouris-Blazos et al, 1996, Avgoulas and Fanany, 2012). Studies of Greek Australians have reported that elderly people retain their cultural habits and adhere to a traditional cuisine (Wahlqvist et al, 1995, Kouris-Blazos et al, 1996).



### *The Mediterranean Diet*

The archetypal traditional Mediterranean diet (Med Diet) first described by Ancel Keys and co-workers in the prospective 7-countries study included cohorts from Crete and Corfu (Keys et al., 1980) and was predominantly a plant-based diet, abundant in edible wild leafy green vegetables with a high ratio of dietary monounsaturated fats to saturated fats. The main fat was olive oil rather than animal fats such as meat, lard, butter. The diet also includes consumption of tomatoes, onions, garlic, herbs as well as wholegrain cereals, legumes and nuts and moderate amounts of fermented dairy foods such as feta cheese and yoghurt, fish and seafood and smaller quantities of red meat and sweets (Willett et al., 1995; Trichopoulou et al., 1997; Kouris-Blazos et al., 1996). Alcohol intake, particularly homemade wine was consumed in moderation with meals (Simopoulos and Sidossis, 2001). At the 15 year follow-up, the Cretan cohort (mostly men) had the lowest mortality rate from CHD, certain types of cancer and a long life expectancy compared with the other cohorts despite having the highest fat intake. Unlike the cohorts from Northern Europe who had high CHD mortality rates, the Cretans consumed most of their fat as olive oil rather than butter or animal fats like the Northern Europeans. It was of interest to investigate a Cretan cohort in this current study given the findings of the 7 countries study and the popularity of the traditional Cretan Mediterranean diet. The Australian MEDIS study provides an opportunity to examine traditional diet and lifestyle practices of this migrant group who have lived away from their homeland for over 50 years yet have resisted dietary acculturation. The aim of this paper is to report the preliminary findings in regards to diet and lifestyle, cardiovascular risk factors and depressive symptoms in a cohort of elderly Greek-born Australians who have originated from the islands of Crete and Cyprus.

### **Methodology**

Cretan and Cypriot Greek Australians in Melbourne have community links and elderly citizens' community groups in Melbourne were contacted for the recruitment of participants during 2011-2012. There were also participants who were referred to the study via the media and from friends and family who were recruited. The Lifestyle Questionnaire (LQ) and the semi-quantitative Food Frequency Questionnaire (85 item-FFQ) was translated into Greek and administered by Greek speaking dietitians and research assistants by phone call and face to face interview. The researcher also took anthropometric measurements of height, weight, and neck, waist and hip circumferences using standard techniques. Body Mass Index (BMI) was calculated as weight (in kg) divided by height (in metres)<sup>2</sup>. A BMI of 20-25 was considered normal, 20-30 as overweight, 30-35 as obese and > 35 as morbidly obese. Additional questions in the LQ regarding fasting practices, church frequency and keeping a home garden were asked to identify whether these practices enable a greater adherence to the traditional Med Diet. The FFQ included additional food items

such as herbs, types of fruits and vegetables as well as portion size estimations and cooking methods to obtain further information regarding the dietary intake of elderly Greek Australians from Crete and Cyprus. A Participant Information Statement in Greek was provided and participants signed informed consent. Separate signed consent was requested to enable the release of medical data from the participants' nominated General Practitioner to enable screening for clinical evidence of CVD. Individuals with heart disease were excluded. A question was included regarding current medications used. Participants self-reported in the LQ whether they had been told by their Doctor that they have hypertension, diabetes and/or hypercholesterolemia and this was verified with results received from the General Practitioner. The study was approved by the Human Research Ethics Committee of Latrobe University, Australia.

*The MedDietScore, assessment of dietary intake and depressive symptoms*

The diet score developed by MEDIS researchers in Greece follows the principles of the Mediterranean dietary pattern and the dietary guidelines for adults in Greece (Tyrovolas et al, 2008, Supreme Scientific Health Council, 1999). This same score was applied in the Australian MEDIS study to assess level of adherence to the Med Diet pattern in elderly Greek Australians from Crete and Cyprus. Food groups included non-refined cereals, fruit, vegetables, legumes, potatoes, fish, meat, poultry, full fat dairy products, olive oil and alcohol. Participants report a frequency from "no consumption" through to "daily consumption" and are scored accordingly. Scores are assigned from 0-5 for the frequency of consumption close to the traditional Mediterranean pattern. The opposite scores are assigned when the consumption of foods presumed not to be part of this diet are reported. For example, a score of 5 is assigned when an individual reports daily consumption of vegetables but a zero score for meat is assigned when a participant reports daily consumption and increases to 5 for rare or no consumption. Alcohol intake was assessed as 100ml being equivalent to 12g ethanol concentration (e.g. wine). A score of 5 is assigned for the consumption of < 3 wine glasses per day and a score of 0 for no consumption or consumption of > 7 wine glasses per day. Scores from 4 to 1 are assigned for the consumption of 300, 400-500, 600 and 700 ml per day. A total score between 0-55 is given. Higher values indicate greater adherence to the Med Diet pattern. The level of adherence to the Med Diet was evaluated as the ratio of the mean diet score divided by 55 (i.e.,  $\text{MedDietScore} / 55 \times 100\%$ ). The Geriatric Depression Scale (GDS) was applied to assess depressive symptoms. Positive answers score '1' and negative answers score '0' (Panagiotakos et al, 2008). Depressive symptoms were categorized into three groups as per the method of Fountoulakis et al (1999). A score of 0-5 suggests no signs of depression, 6-10 mild depression and 11-15 severe depression. The 15 questions are related to quality of life such as spirit, fears, boredom, energy levels, memory and social interactions (refer to Appendix 1).

## Results

Continuous variables are presented as mean ( $\pm$ SD) and categorical variables as frequencies. Comparisons of continuous variables between genders were performed using one-way ANOVA, and categorical variables using Chi-squared analysis,  $p$ -value  $< 0.05$  considered statistically significant. SPSS version 21 software was used for calculations.

### *Demographics of the sample (n=120)*

The mean age of participants was 74 years ( $\pm 6$  years) (range 54-92 years) and consist of equal proportions of males (49.2%) to females (50.8%). There are more participants originally from Cyprus 60.8% ( $n=73$ ) than from Crete 39.2% ( $n=47$ ). The mean years since migration to Australia are 50 years ( $\pm 7$  years) (range of 22-64 years) with the most common year of migration in 1962.

### *Socio-demographic factors*

The highest level of education reported by 95% of the sample is primary school with a mean of 5.3 years ( $\pm 1.53$ ). A smaller proportion (32.5%) attended secondary school for 1.5 years ( $\pm 2.3$ ). Of  $n=120$ , 77% reported being married and 15% widowed, 3% never married and 4% reported being divorced.

The household living situation indicated that 75% of participants reported they live with their spouse. Those who reported living alone (14.2%) were either widowed or divorced. In all cases where participants reported living with family (29%) several generations lived together i.e. with their adult child and grandchildren.

### *Social activities*

Participants reported fasting between zero to 182.5 days per year; the mean was 41.5 ( $\pm 55.3$ ) days per year and 44% reporting that they attend church weekly.

Questions were asked in the LQ regarding how often they went out with friends, frequency of visits with family, the number of close friends they have and attendance at clubs or community groups and 67% reported going out with friends 1-2 times per week compared with 19% who reported never going out with friends. Visiting with immediate family  $> 5$  times per week was reported by 37% and 5% never visited family, 54% had  $> 5$  close friends and 3% reported having no close friends. In addition, 88.5% attended a club or community group.

Of the 11% who reported that they didn't attend a club or community group, a higher percentage (53%) never went out with friends but 38% still reported going out with friends 1-2 times per week and 53% visited with family  $> 5$  times per week. Having  $> 5$  close friends was reported by 38% of this group.

**Table 1.** Mean measures of weight, height in elderly Greek Australians from Crete and Cyprus

Variable	Males (n=66)	Range	Females (n=63)	Range
Weight (kg)	81.5 (±9.9)	51-103kg	75.8 (±13.7)	47-112kg
Height (cm)	165.3 (±6.2)	153-184cm	155.5 (±6.9)	139-182cm

Females had a mean body mass index (BMI) of 31.4kg/m<sup>2</sup> and males 29.9kg/m<sup>2</sup>. The prevalence of CVD risk factors self-reported by participants was evaluated by gender. Of n=58 males, 47% reported having been diagnosed with hypertension by their Doctor, 37% diabetes mellitus and 45% hypercholesterolemia. Of n=61 females, 46% reported hypertension, 28% diabetes mellitus and 52% hypercholesterolemia. A higher proportion of males (73%) reported being past smokers compared with females (20%) than current smokers 16.9% and 4% respectively. The most commonly reported types of daily physical activity were housework (54%) followed by walking (34%) and gardening (26%).

**Table 2.** Mean MedDietScore and level of adherence to the Med Diet and mean total intake in grams/day (g/day) from food groups in the FFQ by elderly Greek Australians from Crete and Cyprus

Variable	Males (n= 39)	S.D (±)	Females (n= 51)	S.D (±)
MedDietScore (range 0-55)	34	11.72	35	9.61
Level of adherence	61%		63%	
Meat	90	50.9	78	38.4
Fish	38	29.8	34	25.3
Dairy products	109	118.9	123	134.1
Dark, leafy green vegetables	42	48.2	30	36.6
Legumes	26	21.2	31	32.0
Fruits	541	495.4	503	306.2
Vegetables	293	207.1	214	131.5
Non refined cereals	163	71.8	172	72.7
Olive oil	50	36.6	42	34.2
Ethanol Consumption > 6g/day, %)	46%		29.4%	

Of the participants who reported keeping a home garden as asked in the FFQ, the following frequencies were reported; 46% grew garlic and onions, 56% tomatoes, 34% green leafy vegetables for e.g. chard and 28% grew broccoli/cauliflower. Cultivation of fruit trees in the garden was asked with 51% reporting citrus fruit trees (oranges, lemons or mandarins), 27% stone fruit (peaches, nectarines or apricots) and 20% apple or pear trees. All participants reported that they consumed over 50% of their home produce.

*Preliminary findings using the Geriatric Depression Scale (GDS)*

The mean GDS for males (n=59) was 6.3 (±1.59, range 1-10) and females (n=61) 6.9 (SD±1.96, range 4-13). These scores are within the “mild depression” category (6-10). The relationship between GDS and diet score was

evaluated in n=85 participants. Those who scored between 0-5 were found to have a mean diet score of 35 ( $\pm 6.0$ ), those who scored between 6-10 (mild depression) and 11-15 (severe depression) had a mean diet score of 37 ( $\pm 3.9$ ) and 36 ( $\pm 4.6$ ) respectively. The difference was not statistically significant between the groups (*p value 0.402*), however the small sample numbers in each category (n=21 for no signs of depression, n=51 for mild depression and n=13 for severe depression) may partly explain this.

## **Discussion**

The population of elderly in Australia is increasing as are rates of depression with higher rates noted in the elderly (WHO, 2001). It is not clear whether co-morbidities (or CVD risk factors) pre-dispose to depression or whether depression leads to the development of these co-morbidities due to deleterious changes in diet and lifestyle and a move away from the traditional Mediterranean diet. Therefore it is of interest to investigate the associations between diet, lifestyle, social and psychological factors and CVD risk factors which may impact on healthy ageing. The Greek Australian cohort of elderly islanders from Crete and Cyprus who have migrated 50 years ago present an opportunity to investigate these relationships. The dietary intake of this migrant cohort may be consistent with the traditional Cretan Mediterranean pattern identified by Keys et al (1980) which may uncover associations between diet and lifestyle factors in this cohort which contribute in part to the positive health profile observed in elderly Greek Australians. The characteristics of elderly Greek Australian islanders in this study appear to be consistent with known demographics for years of migration, education level (Fakiolas, 2002) and marital status, and consistent with mean ages (males 76 years and females 74 years) of participants in the Greek MEDIS study (Tyrovolas et al 2009). In this study, there were more participants of Cypriot origin consistent with these community groups in Melbourne having more members than the Cretan groups contacted. Family ties and connection with family, religion and fasting practices are prevalent in this elderly cohort. Participants who were not recruited from a community group also reported a higher frequency for visiting family (> 5 times a week) and having close friends. Rizzuto et al (2012) identified that personality traits such as being outgoing and having an active social network were linked with healthy ageing. Lifestyle factors which were strongly associated with survival included physical activities such as walking and behaviours such as not smoking. The benefit of these behaviours remained as people were in the older years (>85 years). The GDS was found to be reliable and valid in older populations (Yesavage et al, 1983, Sheikh & Yesavage, 1986) and validated in the Greek population (Fountoulakis et al 1999) and was used in this study. Panagiotakos et al (2008) assessed depressive symptoms in a cohort of Greek older men and women living in Cyprus and reported that a relationship between CVD risk factors and depressive symptoms exists. Very few participants in this current

study scored in the severe depression category, the majority scoring no depression or mild depression. This warrants further investigation particularly in terms of the association between depression and factors such as obesity and hypercholesterolemia and lifestyle behaviours such as smoking and alcohol consumption which negatively impact on health by increasing CVD risk (Ariyo et al, 2000). These conditions are important in an ageing population given the impact upon quality of life. Mamplekou et al (2012) also reported that physical inactivity and unhealthy dietary habits correlate to the depression among elderly Greeks living in the Mediterranean islands (The MEDIS study). Further analysis will evaluate the impact of physical activity levels on depression and CVD risk but the early findings suggest that this cohort are participating in some form of physical activity and are not sedentary. Gardening was frequently reported over other types of activity and suggests that the elderly prefer and enjoy this activity. This is linked to dietary intake and may be described as a marker of adherence to the Med Diet with a large proportion of participants growing their own fruit and vegetables. The mean MedDietScore (Table 2) indicates a moderate level of adherence by both males and females compared with the Greek MEDIS study (Panagiotakos et al, 2009). Participants with higher scores have increased frequency of consumption of certain key foods such as legumes, green leafy vegetables and fruits and vegetables on a weekly to daily basis and may be related in part to the keeping of a home garden by the majority of participants. Growing fruit and vegetables significantly increases dietary intake of these foods. Kouris-Blazos et al (1996) identified the dietary intake and lifestyle factors of elderly Greek Australian migrants aged over 70 years and compared to this to elderly Greeks living in a semi-rural area of Spata, near Athens. Over 70% of the Greek Australians reported growing a variety of vegetables in home gardens such as tomatoes, dark green leafy vegetables, fresh herbs, legumes and olives. Legume intake can also be described as a marker of adherence. Darmadi-Blackberry et al (2004) reported a higher legume intake was a predictor of survival amongst elderly independent of ethnicity although a Greek elderly cohort was included in the study. The early findings in this Australian MEDIS study suggest that elderly Greek Australian islanders are continuing to consume legumes regularly. The FFQ has been validated and found to be reproducible within the elderly Greeks living in the Mediterranean islands (Tyrovolas et al, 2010). The modified FFQ administered to elderly Greek Australian islanders in this study is suggestive of a moderate adherence (61% and 63%) to the Med Diet using the MedDiet Score consistent with the Greek islanders in Greece. Adherence to the Med Diet increases survival, even among elderly people (Trichopoulou et al, 1995). Table 2 reports the mean intake of foods used to calculate the MedDietScore (0-55) and is suggestive of adherence to a Med Diet pattern in terms of the foods chosen by elderly Greek Australians, despite a moderate level of adherence. Older people over 65 years appear to prefer more traditional foods. The elderly Greek Australian islanders have a high intake of fruits and vegetables compared with the Australian population. Panagiotakos et al (2009) also reported that a

characteristic of the Greek Med Diet is the increased consumption of fruits and vegetables compared with other regions of the Mediterranean basin. The average intake of fruit and vegetables for men and women shown in Table 2 is approximately equivalent to 4-5 pieces of fruit and vegetables per day respectively. There are likely to be other diet and lifestyle factors such as legume intake and consumption of leafy green vegetables and fasting practices and the keeping of the home garden which may be markers of adherence and require further investigation.

Smoking is a significant risk factor for chronic disease and the preliminary results in this study suggest that compared with elderly Greek islanders (Tyrovolas et al, 2009) a higher proportion of Greek Australians have quit smoking which is consistent with data from the Australian Health Survey whereby rates of smoking in Australia have decreased steadily across all age groups since 2001 (ABS, 2011). Past smokers in this study consistent with the MEDIS study of Greek islanders in Greece were defined as those who had not smoked in over 12 months. The elderly Greek Australian islanders were also classified as overweight or obese based on BMI consistent with the adult Australian population aged 65-74 years (ABS, 2011). Further analysis will enable a comparison with elderly Greek islanders in Greece. The prevalence of diabetes in the Australian population is 4.0% and the rates increase with age. The highest rate of diabetes (16%) is in elderly Australians aged 65-74 years which is the trend suggested by the early findings in this study.

## **Conclusions**

These early findings from the Australian MEDIS study provide an insight into the demographics of the sample recruited to date and the moderate level of adherence to the traditional Med Diet pattern consistent with the Greek MEDIS study. The potential relationships that may exist between depressive symptoms and adherence to the Mediterranean diet in an elderly Greek Australian population from Crete and Cyprus are highlighted and the results suggest that there are many factors such as CVD risk factors to be considered from the data collected. Older adults are more susceptible to depression due to the changes which occur in ageing such as increased physical limitations and the potential for social isolation and this study has the potential for examining the impact of diet and lifestyle on isolated depression independent of other serious mental health diagnoses, and the impact of cardiovascular risk factors on depression. The results presented support the idea that the retention of traditional dietary practices and behaviours such as engaging in social networks, fasting and gardening support the continuation of a traditional eating pattern with widely documented health benefits and a positive impact on depressive symptoms for the elderly and should be encouraged by their healthcare providers.

## Limitations

This paper presents the early findings of this study with recruitment and data analysis still in progress. A larger sample size towards the target will assist with uncovering these associations in this population group and enable comparisons with elderly Greek islanders in Greece. Further analyses are required to investigate the effect of confounders. The cross-sectional study design implies that direct cause and effect relationships can't be established. The questions asked rely upon a participant's recall of food intake which may be a source of bias due to differences in accuracy of the memory of past events or experiences. Participants who were taking medications for Alzheimer's disease or whose family members reported they had difficulty with their memory were excluded.

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## Appendices

### *Appendix 1: Questions (1-15) in the Geriatric Depression Scale.*

1. Are you basically satisfied with your life?
2. Have you dropped many of your activities and interests?
3. Do you feel that your life is empty?
4. Do you often get bored?
5. Are you in good spirits most of the time?
6. Are you afraid that something bad is going to happen to you?
7. Do you feel happy most of the time?
8. Do you often feel helpless?
9. Do you prefer to stay home rather than going out and doing new things?
10. Do you feel you have more problems with your memory than most others?
11. Do you think it is wonderful to be alive now?
12. Do you feel worthless the way you are now?
13. Do you feel full of energy?
14. Do you feel that your situation is hopeless?
15. Do you think that most people are better off than you are?