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Health and Nutritional Status of Elderly Greek Migrants to Melbourne, Australia

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Summary

The health (self-reported health conditions) and nutritional status (food and nutrient intake, nutritional biochemistry, anthropometry) of 189 elderly Greeks living in Melbourne, Australia were described and compared with 104 elderly Greeks living in a rural town in Greece (Spata) using a validated health and food frequency questionnaire. Spata was chosen because the traditional diet is maintained by the community and may act as a 'surrogate' measure of diets prevalent in Greece prior to the Melbourne sample's migration to Australia in the 1960s. This enabled identification of dietary trends that may be contributing to the deteriorating health of elderly migrant Greeks. Compared with Spata Greeks, Melbourne Greeks had significantly greater intakes of animal foods (meat), legumes, protein, margarine, polyunsaturated fats, beer and lower intakes of cereals, carbohydrates, wine and olive oil. The contribution of these dietary differences, as well as the influence of high storage-iron levels, impaired immunity and greater prevalence of obesity and abdominal fatness, to the increasing prevalence of heart disease and cancer (especially amongst women) requires further study.

Introduction

According to 1982 mortality data [1], Greeks in Australia were deemed the 'second longest lived population in the world', after the Japanese in Hawaii [2] and followed closely by Greeks in Greece [3]. This mortality advantage was mainly due to low rates of coronary heart disease and colonic cancer [4–7]. In contrast, 1989 morbidity data [8] suggest that the health of Greek Australians may have deteriorated since 1982. The prevalence of heart disease, hypertension and hypercholesterolaemia was equal to or higher than Australian-born in all age groups. Interestingly, however, the prevalence of cancer remained lower in Greek Australians in all age groups. Studies on small samples of elderly migrants in Australia [9–11] also report that Southern Europeans have worse health and well-being than Australian-born and have a higher prevalence of obesity. It has been suggested that retention of some 'protective' elements of the traditional Greek diet, such as plant food and olive oil, may protect health [2] and reduce mortality rates in elderly age groups [12]. Even though there has been increasing interest in the traditional Greek diet as a health-promoting nutritional pattern, there have been few attempts to define food and nutrient composition of the Greek diet in Greece [12–17] and Australia [18–20] and identify changes upon migration and with increasing length of stay [6]. Such changes may shed light on possible causes for the deteriorating health of Greek Australians. Most of the studies on Greek Australians provide inadequate and incomplete data on their absolute intake of foods and nutrients and none has included elderly subjects. Elderly people are more likely to adhere to traditional cuisine and thus may provide more useful information on the protective components of such a diet. Greece provides an unusual opportunity because rural regions, such as Spata, still follow a more traditional Greek diet than city regions [17, 21] and can act as a 'surrogate' measure of diets prevalent in the 1950–60s, when mass migration to Australia took place. When a longitudinal study is not possible, comparisons of migrant diets with such 'surrogate' measures may provide insight into dietary trends and their potential impact on health status. This paper describes and compares the health status (self-reported health conditions) and nutritional status (food and nutrient intake, nutritional biochemistry, anthropometry) of elderly Greeks living in Melbourne and Spata. Data on Anglo-Celtic Australians were used for comparative purposes [22].

Methods

Sample selection: The study of elderly Greeks in Greece and Australia and of Anglo-Celtic Australians is part of a wider international study of elderly people [22–24]. This study was approved by the Monash University ethics committee. The telephone directory has been successfully used to obtain a representative sample of Greek Australians [18] and this method was employed in Australia to recruit elderly Greeks. In countries with low telephone usage, such as Greece, it is preferable to use electoral rolls, and these were therefore used in Spata. All study subjects were interviewed in their homes using an interviewer-administered questionnaire [22, 25–28]. All interviews and measurements were performed by a single observer, fluent in Greek. Residents in psychogeriatric homes were excluded. The total population in Spata in 1988 was about 10 000, of whom 6.4% were aged 70+. These subjects formed the sampling base. A total of 104 (M 51, F 53) subjects were included in the study (mean age 77 years; 60% 70–79; 40% 80+). The response rate was high at 89% and the sample did not differ in sex and age group distribution from the wider elderly community in Spata. In Melbourne, the study was conducted between 1990 and 1992. At the 1986 census in Victoria, 130 553 persons claimed to be of Greek ancestry, of whom 65 515 had been born in Greece [29]. Only 2% (2686 persons) were aged 70+. About 30 000 telephone connections were identified as belonging to Greek families, and these formed the sampling base of the study. A total of 189 (M 94, F95) subjects were included in the study (mean age 78 years; 65% 70–79; 35% 80+). The response rate was 84% and the sample did not differ significantly in sex or age group distribution from the wider elderly Greek community in Melbourne (1986 Victoria census) except for women aged 70–79 ($p = 0.05$). Geographic distribution (percentage living in various suburbs in Melbourne) was not significantly different from the wider elderly Greek community in Melbourne. The mean length of residence in Australia was 30 years.

Health status: This study employed the Multi-level Assessment Instrument [30] which has been recommended as one of the most valid and reliable measures of the health status of elderly people [31]. It includes a 30-item check-list of common self-reported health conditions (see Table I). Health complaints reported were cross-checked by the interviewer with prescribed medications to ensure that complaints were not merely self-perceived but had been diagnosed by a doctor, a consideration particularly relevant for heart disease, cancer and hypertension. This check may not work for conditions that can be treated with diet alone (e.g. diabetes, constipation).

Food and nutrient intake: The food frequency questionnaire (FFQ) was aimed at discovering the variety and quantity of 250 foods consumed over the past 12 months. The FFQ from the Australian Polyp Prevention Project [32] was adapted to include Greek foods and dishes (50 foods). The portion sizes of foods consumed were elicited in household measures, natural units (e.g. slices of bread) or with reference to food photographs depicting Greek dishes [33]. The FFQ was validated by comparing reported energy intake from the FFQ with minimal energy requirements (MER) calculated from basal metabolic rates (BMR) and the physical activity level (PAL) (MER = BMR × PAL). The MER was calculated for each subject by calculating BMR using the Schofield equations for the 60+ age group [34] and multiplying by an activity factor of 1.55 (assuming a sedentary lifestyle for elderly people) [35, 36]. The mean MERs did not differ significantly from those estimated from the FFQ for men, but did so for the women ($p = 0.05$). For about 40% of the women in both sites energy intake estimated from their FFQ was below this MER. More than two-thirds of these subjects were obese, suggesting either under-reporting or self-reported negative energy balance to lose weight. Therefore, when interpreting the food and nutrient intake data, the possibility of under-reporting by obese elderly Greek women should be kept in mind. This also raises questions about the applicability of the Schofield equation to elderly or obese subjects. A combination of the Australian (NUTTAB 1991) and Greek Food Composition Tables [32] was used for food and nutrient analyses (Tables II–IV). Macronutrient intake data were also expressed as a percentage of total energy intake (Table III) and the adequacy of micronutrient intakes expressed as a percentage achieving two-thirds of the American Recommended Dietary Intakes (RDI) [37] (Table V).

Nutritional biochemistry: Fasting venous blood was collected for the following tests: albumin; total lymphocyte count (TLC); haemoglobin, haematocrit; serum iron, ferritin, iron-binding capacity, iron saturation; vitamin B_{12} and folate; total cholesterol, LDL-cholesterol, HDL-cholesterol, triglycerides, LDL : HDL; and glucose. Subjects refusing to give blood were not excluded from the whole study. Blood sampling was preceded by an overnight fast. Both Spata and Melbourne blood samples were analysed at Monash Medical Centre laboratory in Australia, which complies with WHO Quality Assurance standards.

Anthropometry: Anthropometry included height (ht), weight (wt), arm muscle area, and circumferences at the level of the umbilicus (waist) and gluteus maximus (hip). These measurements were used to obtain body mass index (wt/ht^2), percentage body fat, lean mass, and waist-to-hip ratio or body fat distribution. To avoid inter-observer variation, these measurements were made by one trained researcher. The measurement procedures adopted match those used in the Euronut-Seneca study [15]. Body fat and lean mass were estimated using the Duerenberg equation [38]; fat free mass (FFM kg) = 0.282* ht + 0.395* wt + 8.4* sex − 0.144* age − 23.6 (height in cm, weight in kg, sex = 1 for men and 0 for women, age in years). Arm muscle area (cm^2) was calculated from arm circumference and triceps skin-folds [39].

Data analysis: Subjects were recruited from the age groups 70–79 and 80+. Even though the number of observations was small for some variables, these age groups were analysed separately as they appeared to show different trends. The Statistical Analysis System (SAS, 1993) was used for analyses. Non-parametric statistics (Wilcoxon rank sum test; continuous variables) and χ^2 (discrete variables) were used to test the significance of differences between sex, age group and centre (location).

Results

Results are specific to the community studied and may not be extrapolated to the wider elderly Greek population in Greece and Australia.

Health status: The ten most common self-reported health conditions are presented in Table I. For conditions that require prescribed medications for treatment, e.g. hypertension, heart disease, there was agreement between the proportions reporting the complaint and the proportions taking the prescribed medication. More than 90% of subjects reported at least one health condition. Significantly more women (70%) than men (55%) reported three health complaints. The most common health problem was hypertension (45%), followed by arthritis (30%). The proportions of Melbourne women (mainly aged 80+) reporting heart problems and cancer (40%, 14% respectively) were significantly greater than in the men (23%, 4%) and

Table I. The ten most common self-reported health conditions (%) and prescribed medications in elderly Greeks living in Spata, Greece and Melbourne, Australia

	Spata				Melbourne			
	70–79 years (%)	(%)	80+ (%)	(%)	70–79 (%)	(%)	80+ (%)	(%)
Men (n)	32		19		66		28	
		Mx*		Mx		Mx		Mx
1. Hypertension	37.5	(40.6)	36.8	(41.0)	37.9	(42.4)	42.9	(46.3)
2. Arthritis	34.4	(0)	26.3	(0)	28.8[c]	(15.1)	32.1[d]	(17.8)
3. Impaired hearing	34.4[a]		52.6		25.8		57.1	
4. Impaired vision	18.8[e]		47.4[je]		12.1[f]		25.0[fj]	
5. Heart trouble	21.9	(25)	21.0	(20.9)	19.7	(24.2)	28.6	(35.7)
6. Diabetes	6.2	(6.2)	10.5	(0)	16.7	(12)	10.7	(7.1)
7. Constipation	3.1[i]	(0)	10.5	(10.5)	18.2[i]	(3.0)	25.0	(3.5)
8. Ulcer	15.6	(0)	21.0[b]	(5.2)	12.1	(7.5)	7.1	(3.5)
9. Stroke	0.0		15.8		3.0[f]		21.4[f]	
10. Cancer (excludes skin)	3.1		5.3		3.4[f]		0.0[df]	
Women (n)	31		22		59		36	
1. Hypertension	41.9	(38.7)	54.5	(45.4)	54.4	(47.4)	55.6	(52.7)
2. Arthritis	35.5[k]	(12.9)	31.8[l]	(9.0)	66.1[ck]	(42.3)	61.1[dl]	(47.2)
3. Impaired hearing	12.9[ag]		50.0[g]		15.3[h]		44.4[h]	
4. Impaired vision	12.9[g]		50.0[gl]		13.6		13.6[l]	
5. Heart trouble	19.3	(9.6)	13.6[l]	(13.6)	30.5[h]	(37.2)	50.0[hl]	(44.3)
6. Diabetes	16.1	(12.9)	22.7	(18.1)	20.3	(10.1)	22.2	(13.8)
7. Constipation	0.0[k]	(0)	4.5[l]	(4.5)	23.7[k]	(5.0)	27.8[l]	(13.8)
8. Ulcer	12.9	(3.2)	0.0[b]	(0)	16.9	(10.1)	11.1	(5.5)
9. Stroke	16.1[k]		4.5		6.8[k]		11.1	
10. Cancer (excludes skin)	3.2		4.5		3.0		14.3[d]	

Pairs of letters indicate significant differences, χ^2 $p < 0.05$):
a,b,c or d within centres—between sex for a given age group;
e,f,g or h within centres—between age groups for a given sex;
i,j,k or l between centres—for a given age group and sex.
* Mx = Medication (prescribed).

Spata women (16%, 4%). The prevalence of diabetes was high in both centres (M 10%, F 20%). Less common health complaints included stroke, ulcers and cancer.

Food intake: Compared with Spata Greeks, Melbourne Greeks had a significantly greater mean daily intake of total foods (1450 g vs. 1200 g); animal foods (500 g vs. 400 g), and plant foods (950 g vs. 800 g). Differences in

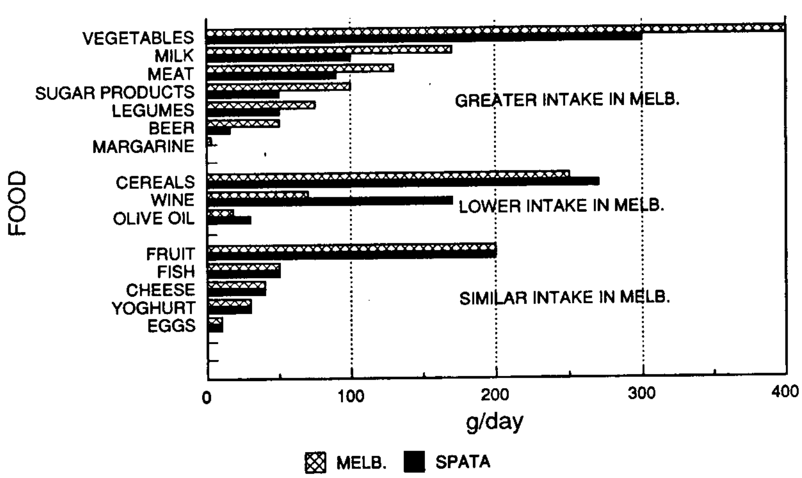

Figure 1. Differences in food group intake between elderly Greeks in Melbourne and Spata ($p < 0.05$).

Table II. Comparison of daily food consumption of Spata and Melbourne Greek elderly men and women by quantitative food frequency questionnaire: percentiles with (mean ± SD)

	Spata (g/day)*						Melbourne (g/day)*					
	70–79 years			80+ years			70–79 years			80+ years		
Men (n)	32			19			66			28		
Percentiles %	25	50	75	25	50	75	25	50	75	25	50	75
Total food	1103	1287	1560	1066	1243	1349	1300	1543	1903	1325	1541	1767
	(1343 ± 342^{ai})			(1210 ± 275^{bj})			(1603 ± 421^{ci})			(1589 ± 376^{dj})		
Animal food	295	359	428	265	381	554	371	486	604	420	532	728
	(389 ± 200^{i})			(428 ± 193^{j})			(521 ± 219^{ci})			(629 ± 364^{dj})		
% total food	27	28	27	25	31	41	28	31	32	32	34	41
	(28 ± 10^{j})			(35 ± 13)			(32 ± 8^{i})			(38 ± 13)		
Meat/poultry	58	·86	125	63	90	128	118	151	189	100	133	197
	(98 ± 51^{ai})			(114 ± 86^{bj})			(158 ± 62^{ci})			(149 ± 65^{dj})		
Fish	27	57	88	28	52	64	34	58	84	25	43	62
	(60 ± 40)			(49 ± 30)			(63 ± 41)			(48 ± 35)		
Milk	0	69	131	0	120	137	0	147	200	100	200	325
	(101 ± 156)			(97 ± 78^{j})			(145 ± 158^{f})			(270 ± 312^{dfj})		
Yoghurt	0	12	49	0	19	75	0	11	29	0	11	29
	(31 ± 41)			(35 ± 40)			(26 ± 40)			(27 ± 38)		
Cheese	30	43	55	22	41	71	21	46	67	15	40	54
	(44 ± 20)			(47 ± 29)			(47 ± 31)			(36 ± 22)		
Eggs	0	4	16	0	8	24	0	4	16	3	6	16
	(11 ± 15)			(14 ± 17)			(11 ± 18)			(14 ± 30)		
Plant food	869	956	1050	637	800	996	858	1042	1237	858	994	1140
	(954 ± 243^{aei})			(781 ± 225^{ej})			(1083 ± 287^{cji})			(965 ± 220^{dfj})		
% total food	79	74	67	60	64	74	66	67	65	65	64	64
	(72 ± 10^{i})			(65 ± 13)			(68 ± 8^{i})			(62 ± 13)		
Vegetables	254	334	499	178	230	361	390	470	555	296	387	442
	(378 ± 163^{aei})			(274 ± 143^{ej})			(486 ± 186^{cfi})			(387 ± 152^{fj})		
Legumes	30	48	86	26	42	56	53	84	113	53	71	97
	(60 ± 42^{ai})			(44 ± 26^{j})			(93 ± 59^{i})			(78 ± 48^{dj})		
Cereals	222	326	406	152	253	428	186	248	343	189	248	332
	(324 ± 141^{ai})			(274 ± 133)			(264 ± 98^{ci})			(268 ± 114)		
Fruit	85	154	294	133	180	232	139	206	342	164	222	300
	(192 ± 138)			(189 ± 92)			(240 ± 142)			(232 ± 106)		
Plant/animal	1.9	2.8	3.6	1.3	2.2	3.5	1.9	2.6	3.1	1.2	2.1	3.1
	(3.2 ± 1.7^{i})			(2.5 ± 1.9)			(2.6 ± 1.0^{i})			(2.2 ± 1.1)		
Fats	25	32	50	25	35	50	17	25	38	20	25	33
	(34 ± 12)			(35 ± 13^{bj})			(30 ± 13^{c})			(27 ± 11^{j})		
Olive oil	25	32	50	25	35	50	15	20	30	8	15	25
	(34 ± 12^{i})			(34 ± 12^{bj})			(21 ± 15^{ci})			(18 ± 13^{j})		
Sugars	12	21	54	10	16	76	15	41	201	14	41	175
	(37 ± 39^{i})			(68 ± 109)			(119 ± 142^{i})			(110 ± 152)		
Alcohol	0	200	300	0	100	500	0	50	210	0	25	200
	(168 ± 149^{a})			(207 ± 243^{b})			(128 ± 161^{c})			(124 ± 168^{d})		
Beer	0	0	30	0	0	500	0	0	50	0	0	50
	(6 ± 27^{i})			(28 ± 114)			(46 ± 92^{i})			(52 ± 108^{d})		
Wine	0	200	275	0	100	200	0	0	100	0	0	150
	(162 ± 145^{l})			(179 ± 212^{j})			(76 ± 123^{i})			(68 ± 112^{j})		
Women (n)	31			22			59			36		
Percentiles %	25	50	75	25	50	75	25	50	75	25	50	75
Total food	819	1196	1305	853	946	1211	1046	1280	1524	1010	1240	1470
	(1069 ± 315^{ak})			(1080 ± 349^{bl})			(1295 ± 320^{ck})			(1277 ± 372^{dl})		
Animal food	234	332	457	279	372	449	293	394	520	223	338	570
	(336 ± 140)			(385 ± 150)			(412 ± 157^{c})			(445 ± 174^{d})		
% total food	29	28	35	33	39	37	28	31	34	22	27	39
	(32 ± 11)			(36 ± 9)			(32 ± 11)			(34 ± 9)		
Meat/poultry	41	62	90	63	75	111	73	104	141	64	88	132
	(71 ± 40^{ak})			(86 ± 34^{b})			(109 ± 52^{ck})			(99 ± 53^{d})		
Fish	17	50	60	14	25	53	23	44	64	16	30	54
	(48 ± 42)			(40 ± 37)			(49 ± 37)			(41 ± 34)		

Table II. (continued)

	Spata (g/day)*						Melbourne (g/day)*					
	70–79 years			80+ years			70–79 years			80+ years		
Percentiles %	25	50	75	25	50	75	25	50	75	25	50	75
Milk	0	86	168	86	120	120	0	100	200	100	200	200
	(96 ± 90)			(110 ± 59^{l})			(106 ± 99^{h})			(156 ± 104^{dhl})		
Yoghurt	5	19	47	7	38	57	0	14	29	0	8	38
	(28 ± 31)			(42 ± 44)			(24 ± 33)			(29 ± 44)		
Cheese	26	36	53	17	29	53	28	48	69	14	31	39
	(43 ± 45)			(38 ± 37)			(49 ± 31^{h})			(29 ± 17^{h})		
Eggs	0	2	8	0	3	16	2	6	8	4	8	16
	(6 ± 11)			(10 ± 14)			(9 ± 13)			(11 ± 13)		
Plant food	535	749	930	459	679	820	693	864	1053	317	455	553
	(732 ± 253^{ak})			(695 ± 255^{l})			(885 ± 281^{ck})			(833 ± 268^{dl})		
% total food	65	63	71	54	72	68	66	67	69	61	67	68
	(68 ± 11)			(64 ± 9)			(68 ± 11)			(65 ± 9)		
Vegetables	190	299	377	136	217	275	285	390	500	270	309	376
	(291 ± 144^{ak})			(239 ± 122^{l})			(400 ± 155^{chk})			(326 ± 136^{hl})		
Legumes	17	29	55	27	47	61	46	66	100	15	41	88
	(38 ± 33^{ak})			(48 ± 29^{l})			(77 ± 59^{hk})			(55 ± 48^{dhl})		
Cereals	146	200	316	158	211	341	148	203	245	175	228	285
	(227 ± 99^{a})			(245 ± 122)			(208 ± 76^{hc})			(247 ± 99^{h})		
Fruit	97	163	223	69	141	205	126	164	252	113	177	268
	(176 ± 95)			(163 ± 129)			(200 ± 122)			(205 ± 118)		
Plant/animal	1.7	2.4	3.6	1.3	1.9	2.7	1.9	2.6	3.6	1.3	1.9	1.9
	(2.8 ± 1.8)			(2.0 ± 0.8)			(2.9 ± 1.6)			(2.7 ± 1.7)		
Fats	25	25	35	15	25	25	15	25	30	16	25	33
	(30 ± 12^{k})			(25 ± 11^{b})			(25 ± 9^{ck})			(25 ± 11)		
Olive oil	25	25	35	15	25	25	3	15	25	8	15	25
	(29 ± 11^{k})			(25 ± 11^{bl})			(15 ± 11^{ck})			(18 ± 13^{l})		
Sugars	10	17	48	10	15	44	3	15	152	7	31	80
	(45 ± 61)			(56 ± 130)			(87 ± 127)			(83 ± 131)		
Alcohol	0	0	0	0	0	0	0	0	50	0	0	65
	(16 ± 45^{a})			(45 ± 101^{b})			(48 ± 102^{c})			(33 ± 55^{d})		

Pairs of letters indicate significant differences in mean intakes, Wilcoxon $p < 0.05$;
a,b,c or d within centres—between sex for a given age group;
e,f,g or h within centres—between age groups for a give sex;
i,j,k or l between centres—for a given age group and sex.
* Includes non-consumers.

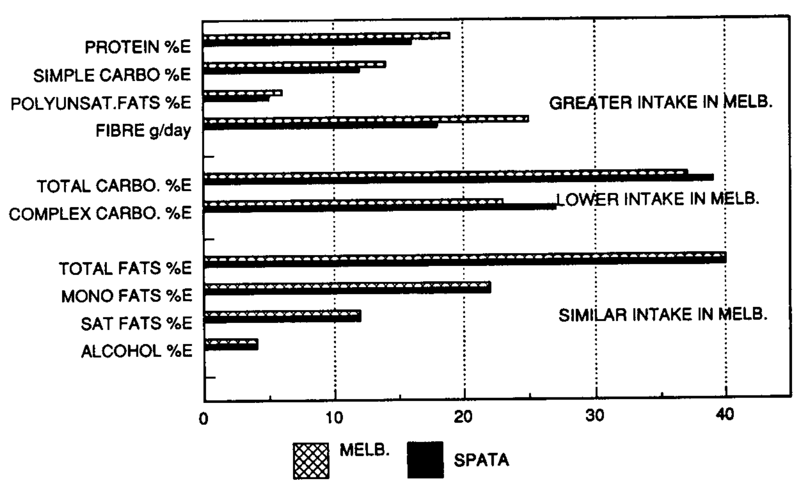

Figure 2. Differences in macronutrient intake of elderly Greeks in Melbourne and Spata ($p < 0.05$).

food group intake are summarized in Figure 1 and Table II. Melbourne men aged 70–79 obtained a greater proportion of their total food intake from animal foods (35%) and a smaller proportion from plant foods (65%) compared with Spata men (31%, 69% respectively). This was also reflected in the significantly lower plant to animal food ratio in Melbourne (2.6) compared with Spata (3.2). In contrast, women in Spata and Melbourne had similar ratios (33%, 67% respectively). For cereal consumption, centre differences were only seen for men aged 70–79 (Spata 300 g/day; Melbourne 266 g/day).

Nutrient intake: The Melbourne and Spata samples had a similar intake of total calories (M 2300 kcal, F 1800 kcal), the higher total food intake of Melbourne Greeks being offset by their lower intake of olive oil, fats and alcohol. The differences in macronutrient intake are summarized in Figure 2 and Table III. More than 90% of subjects were not achieving the recommended energy intake from complex (40–50%) and total carbohydrates (50–60%). In contrast, 30–50% of the Melbourne subjects were consuming more than 15% of their energy intake from refined carbohydrates compared with less than 10% of the Spata sample. Only 8% of Spata men and none of the Spata women had fibre intakes above the recommended 30 g/day compared with 21% of Melbourne women and 35% of men. More than 95% of subjects had fat intakes above the

Table III. Comparison of daily macronutrient consumption of Spata and Melbourne Greek elderly men and women (including non-consumers) by quantitative food frequency questionnaire

	Men				Women			
	Spata		Melbourne		Spata		Melbourne	
	70–79 years	80+ years	70–79 years	80+ years	70–79 years	80+ years	70–79 years	80+ years
No. of subjects	32	19	66	28	31	22	59	36
Energy (kcal)	2268 ± 460^{a}	2114 ± 380^{b}	2405 ± 547^{c}	2302 ± 501^{d}	1714 ± 427^{a}	1697 ± 518^{b}	1883 ± 408^{c}	1830 ± 401^{d}
Carbohydrate								
(% kcal)	38.8 ± 8^{l}	37.3 ± 8	35.8 ± 6^{i}	37.0 ± 5	39.2 ± 6^{k}	39.6 ± 8	35.5 ± 6^{hk}	38.4 ± 6^{h}
(g)	221.7 ± 66	199.7 ± 64	215 ± 60	213 ± 54	167.9 ± 49	170.5 ± 65	168.6 ± 50	175.2 ± 45
Complex								
(% kcal)	28.2 ± 8.2^{i}	24.6 ± 9	21.8 ± 5^{i}	21.5 ± 5	26.8 ± 7^{k}	26.1 ± 7	22.4 ± 5^{k}	23.6 ± 5
(g)	161.8 ± 60	134.3 ± 59	130.8 ± 40	124.9 ± 42	115.9 ± 45	114.7 ± 58	105.5 ± 32	107.0 ± 28
Refined								
(% kcal)	10.5 ± 3^{i}	12.6 ± 5^{j}	13.8 ± 5^{i}	15.3 ± 5^{j}	12.3 ± 4	13.5 ± 7	12.9 ± 5	14.5 ± 5
(g)	59.4 ± 23	64.6 ± 26	83.0 ± 34	87.0 ± 29	51.5 ± 18	55.2 ± 27	62.0 ± 30	67.0 ± 31
Fibre (g)	22.7 ± 6^{ei}	18.4 ± 5^{ej}	29.8 ± 10^{i}	25.7 ± 9^{j}	16.6 ± 6^{k}	16.2 ± 6^{l}	24.2 ± 8^{k}	21.4 ± 7^{l}
Protein								
(% kcal)	15.6 ± 2^{i}	15.4 ± 4^{j}	19.0 ± 3^{i}	18.8 ± 3^{j}	15.5 ± 3^{k}	15.9 ± 3^{l}	18.8 ± 4^{k}	17.8 ± 3^{l}
(g)	88.6 ± 22	81.4 ± 24	114.1 ± 28	108.0 ± 29	67.3 ± 22	67.7 ± 25	88.0 ± 24	81.5 ± 23
Fat								
(% kcal)	40.4 ± 7	41.1 ± 8	41.8 ± 5^{c}	41.2 ± 4	44.1 ± 6	42.3 ± 7	44.1 ± 5^{c}	42.1 ± 6
(g)	101.1 ± 23	95.4 ± 20	112.2 ± 31	105.5 ± 27	83.7 ± 22	78.7 ± 24	92.3 ± 22	86.4 ± 24
Saturated								
(% kcal)	11.0 ± 2^{a}	12.0 ± 3	12.0 ± 2^{c}	13.0 ± 2	13.0 ± 3^{a}	12.0 ± 2	13.0 ± 2^{c}	12.0 ± 2
(g)	28.2 ± 8	28.1 ± 6	32.1 ± 11	32.7 ± 9	24.1 ± 8	23.5 ± 9	26.7 ± 7	24.7 ± 6
Mono-unsat.								
(% kcal)	21.0 ± 5	21.0 ± 5	21.0 ± 4	20.0 ± 3	23.0 ± 4^{k}	22.0 ± 5	21.0 ± 4^{k}	21.0 ± 4
(g)	52.8 ± 13	49.2 ± 12	55.4 ± 16	50.0 ± 13	43.6 ± 13	40.5 ± 12	44.5 ± 12	42.6 ± 14
Polunsat.								
(% kcal)	5.0 ± 1.0^{i}	5.0 ± 1^{j}	6.0 ± 2^{ci}	6.0 ± 2^{j}	5.0 ± 1^{k}	5.0 ± 1^{l}	7.0 ± 2^{ck}	6.0 ± 2^{l}
(g)	12.0 ± 3	10.7 ± 2	16.3 ± 6	14.7 ± 7	9.7 ± 3	8.7 ± 3	14.2 ± 5	12.4 ± 4
Cholesterol (mg)	272 ± 106^{i}	286 ± 136	361 ± 133^{i}	357 ± 162	199 ± 109^{j}	221 ± 107	284 ± 111^{j}	282 ± 86
Alcohol								
(% kcal)	4.5 ± 4^{a}	5.5 ± 6^{b}	3.1 ± 4^{c}	2.8 ± 4^{d}	0.5 ± 1^{a}	1.6 ± 4^{b}	1.2 ± 3^{c}	1.4 ± 2^{d}
(g)	15.0 ± 13	17.3 ± 20	10.7 ± 14	9.5 ± 12	1.5 ± 4	3.9 ± 9	3.3 ± 8	3.2 ± 5

Values are means ± standard deviations.
Pairs of letters indicate significant differences, Wilcoxon $p < 0.05$:
a,b,c or d within centres—between sexes for a given age group;
e,f,g or h within centres—between age groups for a given sex;
i,j,k or l between centres—for a given age group and sex.

Table IV. Comparison of daily mineral and vitamin consumption of Spata and Melbourne Greek elderly men and women by quantitative food frequency questionnaire

	Spata		Melbourne	
	70–79 years	80+ years	70–79 years	80+ years
Men				
No. of subjects	32	19	66	28
Sodium* (mg)	2276 ± 746	1989 ± 246	2389 ± 1018	2089 ± 655
Potassium (mg)	2713 ± 791^{i}	2349 ± 667^{i}	3605 ± 964	3414 ± 909^{j}
Calcium (mg)	697 ± 265	676 ± 176	801 ± 311	881 ± 429
Phosphorus (mg)	1172 ± 286^{i}	1113 ± 287^{j}	1517 ± 428^{i}	1508 ± 428^{j}
Magnesium (mg)	250 ± 63^{i}	220 ± 53^{j}	340 ± 98^{i}	318 ± 96^{j}
Iron (mg)	21.8 ± 11	18.5 ± 7	25.6 ± 5	20.1 ± 10
Zinc (mg)	14.7 ± 4^{i}	15.1 ± 6	20.0 ± 7^{i}	17.0 ± 5
Vitamin A				
RE (μg)	723 ± 444^{i}	732 ± 506	1028 ± 510^{ci}	1032 ± 413
Retinol (μg)	391 ± 395	427 ± 495	375 ± 344	369 ± 270
Carotene (μg)	1988 ± 886^{i}	1827 ± 984^{j}	3919 ± 1885^{di}	3975 ± 1638^{j}
Thiamin (mg)	0.9 ± 0.3^{ei}	0.7 ± 0.2^{bej}	1.3 ± 0.5^{i}	1.2 ± 0.3^{j}
Riboflavin (mg)	1.3 ± 0.4^{i}	1.3 ± 0.4^{j}	1.8 ± 0.6^{i}	1.8 ± 0.7^{j}
Niacin (mg)	31.7 ± 8^{i}	28.5 ± 9^{j}	44.3 ± 11^{i}	40.6 ± 10^{j}
Vitamin C (mg)	86.9 ± 35^{i}	73.8 ± 21^{j}	171.9 ± 73^{i}	150.5 ± 81^{j}
Women				
No. of subjects	31	22	59	36
Sodium* (mg)	1610 ± 541	1588 ± 884	1911 ± 616^{h}	1631 ± 518^{h}
Potassium (mg)	2103 ± 732^{k}	2025 ± 692^{l}	2837 ± 732^{k}	2653 ± 781^{l}
Calcium (mg)	580 ± 222	579 ± 260	668 ± 212	637 ± 219
Phosphorus (mg)	933 ± 303^{k}	941 ± 343^{l}	1192 ± 296^{k}	1178 ± 410^{l}
Magnesium (mg)	181 ± 57^{k}	181 ± 62^{l}	267 ± 69^{k}	246 ± 70^{l}
Iron (mg)	19.3 ± 12	16.3 ± 11	20.1 ± 10.0	20.7 ± 17
Zinc (mg)	12.2 ± 4^{k}	12.8 ± 5	15.4 ± 5^{k}	13.9 ± 5
Vitamin A				
RE (μg)	495 ± 293^{k}	515 ± 241^{l}	941 ± 378^{ck}	827 ± 419^{l}
Retinol (μg)	242 ± 215	258 ± 179	344 ± 273	353 ± 313
Carotene (μg)	1515 ± 813^{k}	1543 ± 871^{l}	3577 ± 1676^{dhk}	2840 ± 1778^{hl}
Thiamin (mg)	0.7 ± 0.2^{k}	0.7 ± 0.2^{bl}	1.0 ± 0.3^{k}	0.9 ± 0.3^{l}
Riboflavin (mg)	1.0 ± 0.3^{k}	1.1 ± 0.4^{l}	1.4 ± 0.4^{k}	1.4 ± 0.4^{l}
Niacin (mg)	23.7 ± 8^{k}	23.4 ± 8^{l}	33.9 ± 9^{k}	31.2 ± 9^{l}
Vitamin C (mg)	73.6 ± 32^{k}	68.5 ± 36^{l}	147.3 ± 68^{k}	123.9 ± 65^{l}

* Values relate only to non-discretionary salt (i.e. does not include salt added to cooking/at table).
Values are means ± standard deviation.
Pairs of letters indicate significant differences, Wilcoxon $p < 0.05$:
a,b,c or d within centres—between sexes for a given age group;
e,f,g or h within centres—between age groups for a given sex;
i,j,k or l between centres—for a given age group and sex.

recommended maximum of 30% calories from fat. Comparing the absolute intake of micronutrients in the two samples, Melbourne subjects had a significantly greater intake of potassium (3000 mg vs. 2200 mg); phosphorus (1300 mg vs. 1000 mg); magnesium (300 mg vs. 200 mg); zinc (16 mg vs. 13 mg); vitamin A (900RE vs. 600RE); thiamin (1.2 mg vs 0.75 mg); riboflavin (1.6 mg vs. 1.2 mg); niacin (37 mg vs. 26 mg) and vitamin C (150 mg vs. 75 mg) and a similar intake of calcium (M 700 mg, F 600 mg); iron (20 mg) and non-discretionary sodium (M 2200 mg F 1700 mg) (Table IV). A greater proportion of Spata subjects had potassium intakes below 1875 mg (M 15%, F 45%) compared with the Melbourne sample (M 2%, F 11%) (Table V).

Nutritional biochemistry: When interpreting the blood results of this study, one should keep in mind that the average participation rate for blood testing was 52% giving a total of 67 (M 40, F 27) subjects in Spata and 107 (M 60, F 47) subjects in Melbourne. The results reported, therefore, are not truly representative of all elderly Greeks living in Spata and Melbourne (Table VI). All subjects had serum albumin values above 35 g/l, except among Melbourne women aged 80+, 7% of whom had values of 34 g/l. Spata men aged 70–79 had a significantly greater TLC than Melbourne

Table V. Percentages consuming less than two-thirds of the United States Recommended Daily Intake for minerals and vitamins in Spata and Melbourne

	Men				Women			
	Spata		Melbourne		Spata		Melbourne	
	70–79 years	80+ years	70–79 years	80+ years	70–79 years	80+ years	70–79 years	80+ years
No. of subjects	32	19	66	28	31	22	59	36
Sodium* (mg)	3	10	11	0	9	21	0	4
Potassium (mg)	9	21	0	0	35	54	8	14
Calcium (mg)	25	21	20	14	39	50	25	31
Phosphorus (mg)	3	5	0	0	16	0	0	38
Magnesium (mg)	44	58	12	18	55	73	17	28
Iron (mg)	0	5	0	4	3	14	0	6
Zinc (mg)	0	5	0	4	29	36	14	28
Vitamin A (RE μg)	53	58	26	18	68	54	15	25
Thiamin (mg)	31	79	6	14	48	68	10	17
Riboflavin (mg)	12	5	3	0	23	9	3	11
Niacin (mg)	0	0	0	0	0	0	0	0
Vitamin C (mg)	6	5	0	0	16	18	2	0

* Non-discretionary only.

men aged 70–79. Spata women aged 70–79 and men aged 80+ also had a greater TLC than Melbourne subjects. The prevalence of low TLC (<1500 mm^3) was significantly greater in Melbourne (M 25%, F 15%) than Spata (7%). Iron deficiency anaemia (TIBC >55 μmol/l, transferrin saturation <15%) was found in six subjects. The prevalence of iron deficiency anaemia was greater in Spata (M 20%, F 33%) than Melbourne (M 13%, F 17%). Storage-iron levels of >300 μg/l plasma ferritin for men and >165 μg/l for women are considered high in elderly people. Significantly more Melbourne subjects had values in this range (M 19%, F 22%) than did the Spata subjects (M 3%, F 4%). Plasma folate concentrations were satisfactory in all subjects. The mean levels for plasma B_{12} were above the criterion of 111 pmol, used to define a high risk of deficiency, but 10% of the men had levels <111 pmol. The majority of Spata subjects (M 70%, F 78%) and Melbourne subjects (M 66%, F 67%) had serum total cholesterol levels above 5.5 mmol/l. A greater proportion of Spata men (25%) than women (7%) had serum triglycerides above 2.0 mmol/l; the proportions in Melbourne were 10% of men and 13% of women. A greater proportion of Spata subjects (M 95%, F 96%) had HDL cholesterol levels above 1 mmol/l (men) or 1.2 mmol/l (women) than did the Melbourne subjects (M 56%, F 70%). A smaller proportion of Spata men (mainly aged 70–79) had LDL cholesterol levels above 4 mmol/l (45%) compared with Spata women (67%) and Melbourne subjects (M 56%, F 57%). The prevalence of diabetes (fasting glucose >7.7 mmol/l) [39] was greater in women in Melbourne (20%) than in Spata (8%).

Anthropometry: In Spata, anthropometry was performed only on those subjects who had their blood sampled (M 40, F 27), therefore results may not be representative of all elderly Greeks living in Spata. In contrast, all subjects in the Melbourne sample underwent anthropometry (Table VII). A significantly greater proportion of Melbourne subjects were obese (F 45%, M 30%) compared with the Spata sample (<30%). The women tended to be more overweight than the men and to have higher waist–hip ratios (WHR). Almost all subjects had WHR above the recommended level. Less than 10% of Melbourne (mainly women aged 80+) and Spata subjects (mainly men aged 80+) were at risk of protein energy malnutrition reflected by their low BMIs and arm muscle area values. The mean percentages of body fat and lean body mass were similar in the centres (body fat M 33%, F 49%; lean body mass M 48 kg, F 33 kg).

Discussion

Southern Europeans (SEA) living in Europe and Australia have been reported to have low morbidity and mortality rates from heart disease and cancer, particularly colon and breast cancer [1–3, 40, 42–44]. Mortality and morbidity from these diseases especially coronary heart disease have recently been shown to be increasing in a steady and alarming way amongst Greeks in Greece and in Australia [3, 15, 43, 46, 47]. In Australia, the prevalence of heart disease amongst SEA has reached the high levels found amongst the Australian-born in all age groups [8], whereas they continue to enjoy lower rates of cancer. SEA had about half the prevalence of cancer seen in the Australian born, except in the older age groups where the prevalence was found to be similar amongst women although lower for SEA men [8]. The current study also reflects these trends. Melbourne and Spata men