Table VI. Comparison of nutritional biochemistry (fasting) of Spata and Melbourne samples (mean ± SD)

	Spata		Melbourne	
	70–79 years	80+ years	70–79 years	80+ years
Men (n)	24	14	47	14
Serum albumin (g/l)	44.5 ± 2	45.0 ± 3	43.8 ± 3[c]	43.9 ± 2[d]
Total lymphocyte count (mm^3)	2180 ± 610[i]	2227 ± 429	1813 ± 548[ci]	1914 ± 395
% lymphocytes (tlc/wbc × 100)	33 ± 12[a]	35 ± 5[l]	29 ± 9[c]	27 ± 5[j]
Haemoglobin (g/dl)	14.2 ± 1[ai]	14.3 ± 2[b]	14.9 ± 1[ci]	14.5 ± 1
Haematocrit (%)	44.4 ± 4[a]	44.5 ± 4[b]	45.1 ± 6[c]	41.1 ± 9
Plasma iron (μmol/l)	23.0 ± 7	24.9 ± 6	21.7 ± 7	20.6 ± 7[d]
Total iron binding (μmol/l)	59.9 ± 10	57.9 ± 7	62.4 ± 11	62.5 ± 11
Transferrin saturation (%)	39.8 ± 16	43.9 ± 12[b]	35.5 ± 14[c]	35.3 ± 12[d]
Plasma ferritin (μg/l)	96.9 ± 88[i]	76.7 ± 39[j]	184.4 ± 126[i]	167 ± 139[j]
Plasma folate (nmol/l)	19.8 ± 11	17.3 ± 5	17.3 ± 7	18.4 ± 7
Plasma B_{12} (pmol/l)	284.9 ± 153	244.4 ± 141[b]	286.6 ± 221[f]	239 ± 102[f]
Serum cholesterol (mmol/l)	6.1 ± 1[a]	6.6 ± 2	6.1 ± 1	6.1 ± 1
Serum triglycerides (mmol/l)	1.6 ± 0.7	1.7 ± 1	1.3 ± 0.7	1.3 ± 0.5
Serum HDL-cholesterol (mmol/l)	1.4 ± 0.3[ai]	1.3 ± 0.2[b]	1.2 ± 0.3[ci]	1.4 ± 0.3
Serum LDL-cholesterol (mmol/l)	3.9 ± 1	4.5 ± 1	4.2 ± 1	4.1 ± 1
LDL/HDL	2.9 ± 1[i]	3.5 ± 1	3.6 ± 1[ci]	3.1 ± 1
Fasting plasma glucose (mmol/l)	5.5 ± 1	5.5 ± 0.7	6.3 ± 2	6.0 ± 2
Women (n)	17	8	32	15
Serum albumin (g/l)	44.3 ± 2[k]	46.7 ± 3[gl]	42.3 ± 2.5[ck]	41.3 ± 2[dl]
Total lymphocyte count (mm^3)	2198 ± 447	2036 ± 507	2162[c] ± 550	1928 ± 526
% lymphocytes (tlc/wbc × 100)	36 ± 4[ak]	35 ± 12	33 ± 6[chk]	27 ± 7[h]
Haemoglobin (g/dl)	12.7 ± 0.6[ak]	13.0 ± 0.6[b]	13.5 ± 1[ck]	13.7 ± 2
Haematocrit (%)	39.9 ± 2[a]	41.0 ± 2[b]	40.3 ± 3[c]	40.9 ± 4
Plasma iron (μmol/l)	20.8 ± 6	20.9 ± 6[l]	18.8 ± 6	15.9 ± 5[dl]
Total iron binding (μmol/l)	62.2 ± 10	62.4 ± 8	64.8 ± 9.5	62.2 ± 8
Transferrin saturation (%)	34.8 ± 13	34.1 ± 10[bl]	29.8 ± 10[c]	25.8 ± 8[dl]
Plasma ferritin (μg/l)	72.3 ± 75	66.5 ± 35	129.5 ± 122	102.0 ± 71
Plasma folate (nmol/l)	21.8 ± 11	21.9 ± 7[l]	19.2 ± 8.1	15.9 ± 4.7[l]
Plasma B_{12} (pmol/l)	439.5 ± 390	580.4 ± 541[bl]	310.6 ± 176	252.7 ± 93[l]
Serum cholesterol (mmol/l)	7.1 ± 2.5[a]	7.2 ± 1.3[l]	6.3 ± 1.2	6.0 ± 1.3
Serum triglycerides (mmol/l)	1.3 ± 0.7	1.6 ± 0.5	1.3 ± 0.5	1.4 ± 0.6
Serum HDL-cholesterol (mmol/l)	1.7 ± 0.4[a]	1.5 ± 0.3[b]	1.5 ± 0.4[c]	1.3 ± 0.2
Serum LDL-cholesterol (mmol/l)	4.8 ± 2.4	5.0 ± 1.3	4.2 ± 1.0	4.1 ± 1.3
LDl/HDL	2.9 ± 1.5	3.5 ± 1.5	2.9 ± 1.0[c]	3.2 ± 1.2
Fasting plasma glucose (mmol/l)	5.8 ± 1.7	5.8 ± 1.3	5.9 ± 2.4	6.7 ± 2.7

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.

reported a similarly high prevalence of heart trouble (23%) comparable with the prevalence reported in the elderly Anglo-Celtic Australian study [22] and elderly Greek subjects in the Euronut-Seneca study [15]. In contrast with the men, Greek women in Melbourne (mainly aged 80+) had a significantly greater prevalence of heart disease (40%) than the men, the Spata women (16%) and the women in the elderly Anglo-Celtic Australian study [22]. Melbourne and Spata men also reported a similarly low prevalence of cancer (4%, excluding skin cancer) which was significantly lower than the prevalence reported in the elderly Anglo-Celtic Australian study (>7%, excluding skin cancer) but comparable with the prevalence reported in elderly Greeks in the Euronut study [15]. Melbourne women (mainly aged 80+) had a greater prevalence of cancer than the men and the Spata women and the women in the Anglo-Celtic Australian study. This suggests that Melbourne women are losing their protection against heart disease, and also cancer, at a faster rate than the men and the Spata women.

The traditional Greek diet can be defined as vegetarian, foods from plant sources forming the core of the diet, while foods from animal sources provide the fringe of the diet (plant to animal food ratio 75 : 25) [17, 48, 49]. This dietary pattern, prevalent prior to the 1960s, has been associated with a lower prevalence of heart disease, colonic cancer [5, 6, 42] and reduced risk

Table VII. Comparison of anthropometric measurements of Spata and Melbourne samples (mean ± SD)

	Spata		Melbourne	
	70–79 years	80+ years	70–79 years	80+ years
Men (n)	26	15	64	28
Height (cm)	165.9 ± 6^{a}	163.9 ± 6^{b}	165.2 ± 6^{c}	163.2 ± 6^{d}
Weight (kg)	75.7 ± 14^{a}	67.9 ± 10	76.3 ± 11^{c}	72.3 ± 11^{d}
BMI (kg/height m^2)	27.4 ± 4	25.2 ± 3	27.9 ± 4^{c}	27.0 ± 4
% <20	3.8	6.6	1.6	3.5
% 20–24.9	26.9	26.7	20.3	28.6
% 25–29.9	34.7	66.7	48.4	39.3
% ⩾30	34.6^{ae}	0.0^{bej}	29.7^{c}	28.6^{dj}
Estimated body fat (%)*	32 ± 5^{a}	32 ± 4^{b}	33 ± 4^{c}	34 ± 4^{d}
Estimated lean mass (kg)*	51 ± 6^{ae}	46 ± 5^{be}	51 ± 5^{cf}	47 ± 6^{df}
Arm muscle area (cm^2)	51.8 ± 9^{ae}	45.2 ± 6.6^{e}	56.2 ± 12^{cf}	52.0 ± 9^{df}
Umbilical circumference	100.8 ± 11	96.9 ± 8.9^{b}	100.1 ± 9^{c}	100.5 ± 10
Maximal gluteal circumference	105.5 ± 9	102.7 ± 8.1	103.0 ± 7	101.1 ± 7
Umbilical/maximal gluteal	0.95 ± 0.04^{a}	0.94 ± 0.04^{bj}	0.98 ± 0.06^{c}	0.99 ± 0.06^{j}
% ⩾0.9	96.2	86.7	93.7	100.0
Women (n)	20	9	59	35
Height (cm)	151.3 ± 6^{a}	149.8 ± 4^{b}	149.8 ± 5^{c}	148.5 ± 6^{d}
Weight (kg)	64.7 ± 10^{a}	61.2 ± 8	68.8 ± 11^{ch}	61.4 ± 14^{dh}
BMI	28.2 ± 4	27.2 ± 4	30.7 ± 5^{ch}	27.8 ± 6^{h}
% <20	0.0	0.0	1.7	8.5
% 20–24.9	15.0	44.5	3.4	28.6
% 25–29.9	60.0	22.2	45.8	22.9
% ⩾30	25.0^{agk}	33.3^{bgl}	49.1^{chk}	40.0^{dhl}
Estimated body fat (%)*	47 ± 3^{a}	49 ± 2^{b}	48 ± 3^{c}	50 ± 3^{d}
Estimated lean mass (kg)*	34 ± 5^{a}	31 ± 4^{b}	35 ± 5^{ch}	30 ± 6^{dh}
Arm muscle area (cm^2)	2.8 ± 10^{agk}	40.3 ± 6^{g}	49.7 ± 11^{chk}	42.0 ± 12^{dh}
Umbilical circumference	107.0 ± 11	105.7 ± 12^{b}	108.0 ± 10^{c}	103.6 ± 13
Maximal gluteal circumference	107.3 ± 10	104.9 ± 9	105.6 ± 9	102.1 ± 9
Umbilical/maximal gluteal	0.99 ± 0.03^{a}	1.01 ± 0.08^{b}	1.02 ± 0.06^{c}	0.98 ± 0.17
% ⩾0.8	100.0	100.0	100.0	100.0

Pairs of letters indicate significant differences, χ^2 (%) or Wilcoxon (score), $p < 0.05$:
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.
* Duerenberg equation (see Methods).

of death in later life [12], and is now regarded as a prudent diet [17, 49, 50]. The traditional Greek diet translates into the following macronutrient proportions; low–moderate protein intake (<15% of energy intake); high total fat intake (40–45%); high monounsaturated fat intake (20–22%); low saturated fat intake (10–12%); low polyunsaturated fat intake (<5%); moderate carbohydrate intake (38–44%; complex 28%; refined 12%) and low–moderate alcohol intake (<5%) [16, 17]. In recent years, Greeks in Greece [21] and abroad [2, 4, 5] have been moving away from the traditional dietary pattern, towards a more 'affluent' diet, characterized by a proportionately higher animal food intake (especially marked in migrants) and lower plant food intake. Since Spata was chosen for its 'traditionality' it was not surprising that the plant to animal food ratio was significantly greater in Spata (69 : 31) than in Melbourne (65 : 35), with the latter approaching the lower ratio found amongst elderly Anglo-Celtic Australians (59 : 41) [22]. Energy intakes from the macronutrients were in the realm of the traditional Greek diet for both locations, except that Melbourne subjects had lower intakes of complex carbohydrates (37%) and greater intakes of refined carbohydrates (14%; mainly from fruit juice), protein (19%; mainly from meat) and polyunsaturated fat (6%; mainly from margarine), similar to levels found in Anglo-Celtic Australians [22, 49]. The greater intakes of meat (130 g) and protein (19% energy) by Melbourne Greeks are approaching the intakes of elderly Anglo-Celtic Australians (160 g/day; 19% energy) [22]. Similar findings have been reported in other studies [4, 6]. Even though meat intake was significantly lower in Spata (90 g/day), this was still greater than intakes reported in Greece in the 1960s (35 g/day) [44]. In contrast, fish consumption has remained high in both Melbourne and Spata (50 g/day) since the 1960s (40 g/day) and has not dropped to the

lower levels reported in Anglo-Celtic Australians (15 g/day) [22, 51]. National authorities are now inclined to recommend decreased consumption of animal protein in preference for plant proteins, which have been associated with reduced rates of heart disease and colonic cancer [52, 53]. Continued high intake of animal proteins in Melbourne Greeks may be contributing to the changing prevalence of these diseases. Melbourne Greek elderly subjects (especially men) have also maintained the high vegetable (400 g/day) and legume (70 g/day) intake of the 1960s [51] but have markedly decreased their consumption of cereals (250 g/day), complex carbohydrates (22% energy intake), and fruit (200 g/day). Elderly Anglo-Celtic Australians have high plant food intakes similar to Melbourne Greeks, but the types of plant foods consumed are significantly different—namely a lower intake of legumes (20 g/day, comprised mainly of peas) and cereals (comprised mainly of bread and breakfast cereals). Certain legumes and cereals have been shown to lower cholesterol and to be potentially protective against colonic cancer [53, 54]. Melbourne Greeks may have continued protection against colon cancer relative to Anglo-Celtic Australians owing to their higher intakes of specific legumes (e.g. dried beans, chick-peas) and cereals (rice, pasta).

The high intake of total fat by elderly Greeks (40–42% energy intake) is also in agreement with other studies in Greece [15–17]. Case–control studies from Greece have not shown adverse effects of the currently high fat intake (40–45%) on risk of cancer, coronary heart disease or obesity. Researchers in Greece argue that the current evidence does not justify reduction of fat intake in the Greek diet if derived mainly from mono-unsaturated fats [16, 41, 43], particularly since olive oil facilitates increased consumption of plant foods [12] and has been associated with reduced rates of heart disease [54]. Olive oil consumption has been reported to have decreased markedly in Greece since the 1960s (from about 60 g/day [51, 55] and to have decreased even further in migrant Greeks [5, 6]. Much of this olive oil has been replaced by margarines and other polyunsaturated oils, which have recently been linked to heart disease and cancer [53]. Spata elderly subjects consumed only olive oil (30 g/day) which was an important marker of adherence to the traditional Greek diet. In the Euronut study, Greek elderly subjects in a rural village reported eating about 30 g/day [12]. In contrast, Melbourne elderly consumed significantly less olive oil (18 g/day) and had introduced margarine into their diets (3 g/day), but not to the levels found in elderly Anglo-Celtic Australians (15 g/day) [22]. Red wine has also been associated with reduced incidence and mortality from coronary heart disease [56], whereas beer has been epidemiologically linked with rectal cancer [57] and heart disease [50, 58]. About 90% of the alcohol consumed by Spata men was from locally produced wine (170 g/day; 60% red, 40% white). In Melbourne, only 58% of the alcohol consumed by men was from wine (70 g/day); 37% was as beer (50 g/day) and 5% as spirits. The reduced intake of red wine and olive oil and the increased intake of margarine and beer may be playing a significant role in the changing health profile of migrant Greeks. With respect to micronutrient intake, the diets of Melbourne Greeks were more nutritionally adequate than Spata Greeks, owing to a significantly greater intake of meat, vegetables, legumes and milk. The nutrients at greatest risk of deficiency included thiamin, magnesium, and vitamin A, with more than 50% of Spata elderly subjects failing to achieve two-thirds of the RDI compared with less than 20% of Melbourne subjects. The risk of deficiency was lower for calcium, followed by zinc and lastly riboflavin, in both study sites. Vitamin C, niacin, iron, potassium (except for Spata women) and phosphorus were least likely to be inadequately consumed, especially in Melbourne. Published studies of elderly people have also reported similarly low intakes of these nutrients [15, 59, 60]. Measurements of body fatness and nutritional biochemistry revealed some important differences between the two locations. Melbourne Greeks (particularly the women) were at greater risk of disease than Spata Greeks because of the greater prevalence of morbid obesity, centrally distributed fat [61], unfavourable blood lipid profiles and impaired immunity [62]. The immune function of Melbourne Greeks appears to be dropping to the lower levels found in Anglo-Celtic Australians [22]. High levels of storage iron have been associated with impaired immunity, as well as heart disease and colon cancer [63]. High storage iron levels were more prevalent in Melbourne (20%) than Spata (3%), approaching the high levels found in Anglo-Celtic Australians (>20%). The extent to which iron status contributes to the deteriorating health and immune function of elderly Greeks needs further investigation.

In conclusion, there is evidence that elderly Spata Greeks (mainly men aged 70–79) are 'healthier' than elderly Melbourne Greeks, especially with respect to blood lipid profiles and immune function. Compared with Spata Greeks, Melbourne Greeks had significantly greater intakes of animal foods (meat), legumes, protein, margarine, polyunsaturated fats, and 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, merits further study.

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