

CHAPTER 12

FOOD AND NUTRIENT PREDICTORS OF LATER LIFE STATUS

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CHAPTER 12

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12.0 INTRODUCTION

The World Health Organisation's definition of 'health and quality of life' is not simply the absence of disease but includes something positive as well, that moves beyond the body to include personal and social well-being (WHO, 1984). There is general agreement in the literature on the five areas that should be included in a *total health assessment* of the elderly. This has been defined as *multidimensional assessment of health status*, which has become synonymous with quality of life (Fillenbaum, 1984).

These include not only physical health, but also functional health (e.g ability to carry out activities of daily living, disability), mental health (e.g well-being, depression), social health (e.g social activity, social networks and living arrangements) and economic functioning (Fillenbaum, 1984). Surprisingly, however, the literature is devoid of a single index or score that measures all these aspects of 'health status'. Information on physical health alone is inadequate when considering well-being and quality of life in elderly folk. For example, many of the disabling problems of older persons cannot be 'solved' or cured. However, when interviewed, older patients state frequently that their health is good in spite of the presence of these chronic conditions (Fillenbaum, 1984; Granney and Zimmerman, 1981).

If quality of life is of major importance in the aged, to what extent is it influenced by nutrition or vice versa? Rosenberg and Miller (1992) point to the growing evidence supporting the view that good nutritional status is an important determinant of quality of life due to its effect on the nervous system. A healthy nervous system facilitates independence by maintaining physical mobility, cognitive and visual function which allows an elderly person to be socially and physically active.

A later life status score (LLSS) was developed (Kouris-Blazos & Hsu-Hage, in press) which incorporated the multiple dimensions or 'life factors' of an elderly persons life, including well-being, memory, general health, medication-use, activities of daily living, exercise, social activity and social networks. Scores were generated for all these dimensions and summed to form the LLSS (see Chapter 3, section 3.8.2.1).

To identify 'food factors' which affect quality of life requires an analysis of food intakes in terms of overall mathematical descriptors of food patterns (e.g food variety, traditional food scores), category of food ingested (e.g fish, plant food), or the unifying value of a particular component of food, either nutrient or non-nutrient. Food intake has been described in broad food groups as grams intake per day, as calories consumed per day from each food group, as food group variety scores and total food variety, traditional food score and as nutrients (see Chapter 3, section 3.8.2.3).

In developing the LLSS, the following steps were performed:

- 1) Univariate analyses to examine the interrelationships of the life factors with each other and with food.
- 2) Step wise regression to determine the importance of each life factor in explaining the variance of the LLSS.
- 3) Multiple regression analysis to determine the importance of food/nutrients in predicting the LLSS.

The objective of this chapter is to explore:

- 1) The relationships between the life factors and food (univariate analysis).
- 2) The relationship between food/nutrient variables and *a multidimensional index of health status - later life status score (LLSS)* (multiple regression analysis).

12.1 UNIVARIATE ANALYSES

The purpose of the univariate analyses was to examine the interrelationships of the life factors with each other and with food. This is an important step in understanding the construction of the LLSS and interpretation of the multivariate analyses using the score with foods and nutrients.

12.1.1 LIFE FACTORS, HEALTH & WELL-BEING

The life factors included the following (see also Chapter 3, section 3.8.2.3):

1. Well-being score (0-7)
2. Memory score (0-5)
3. Activities of daily living score (15-62)
4. Exercise score (1-7)
5. Social activity (time-use) score (22-176)
6. Social network score (social relations) (12-46)
7. Self reported medication score (21-42)
8. Total Health Score (33-74)

For all life factors, a high score is a more favourable score, which indicates better function, health, mobility, well-being or less medications.

a) Total Health Score

Results: Significant positive correlations with the health score were found with all the life factors (except memory), in both Spata and Melbourne. Better health was associated with a greater sense of well-being (particularly in Melbourne), less medications, less disability, more exercise, greater social activity & social networks (mainly women).

Table 12.1.1a

Correlation (Spearman's) of life factors with Total Health Score

Life factors	SPATA		MELBOURNE	
	70 - 79 R ²	80+ R ²	70 - 79 R ²	80+ R ²
MEN				
N	32	19	66	28
Medication score	0.67****	0.8****	0.59****	0.56***
Well-being score	0.5**	-	0.54****	0.49**
Memory score	-	-	0.31**	-
ADL score	0.36*	-	0.53****	0.69****
Exercise score	0.67****	0.56**	0.37**	0.43**
Social activity score	-	-	-	0.42**
Social network score	-	-	-	-
WOMEN				
N	31	22	59	36
Medication score	0.56***	0.52**	0.52****	0.5***
Well-being score	0.39**	0.7***	0.58****	0.57***
Memory score	-	-	-	-
ADL score	0.58***	0.39	0.6****	-
Exercise score	0.52***	0.46**	0.53****	0.3**
Social activity score	0.48**	0.44*	0.37**	0.3*
Social network score	-	0.61**	0.39****	-

Significance: NS = not significant; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; **** $p < 0.0001$
A high score is a more favourable score.

b) Well-being

Results: Significant positive correlations with the well-being score were found with most of the life factors. In Melbourne, correlations were seen mainly in the 70-79 age group. In Spata, correlations were seen mainly in the men in both age groups. A better sense of well-being was associated with less medications, less disability, more exercise, greater social activity & social networks (see table 12.1.1b). The Melbourne women in particular had a better sense of well-being than the Spata women, even though they reported more

health problems. However, they also reported greater social activity and networking than Spata women which was significantly correlated to their well-being scores.

Table 12.1.1b
Correlation (Spearman's) of life factors
with Well-being score

Life factors	SPATA		MELBOURNE	
	70 - 79 R ²	80+ R ²	70 - 79 R ²	80+ R ²
MEN				
N	32	19	66	28
Medication score		-	-	-
Memory score		0.57 ^{***}	0.51 ^{**}	0.47 ^{****}
ADL score	0.63 ^{****}	0.48 [*]	0.58 ^{****}	0.43 ^{**}
Exercise score		0.69 ^{****}	0.45 [*]	0.35 ^{**}
Social activity score		0.63 ^{****}	-	0.27 ^{**}
Social network score		0.39 ^{**}	-	0.27 ^{**}
	-	-	-	-
WOMEN				
N	31	22	59	36
Medication score	0.4 ^{**}	-	0.38 ^{***}	-
Memory score	-	-	-	-
ADL score	-	-	0.43 ^{***}	0.34 [*]
Exercise score	-	0.47 ^{**}	0.39 ^{***}	0.47 ^{**}
Social activity score	-	-	0.32 ^{**}	-
Social network score	-	0.49 ^{**}	0.45 ^{***}	-

Significance: NS = not significant; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; **** $p < 0.0001$
A high score is a more favourable score.

12.1.2 FOOD, HEALTH & WELL-BEING

Food intake has been described for specific food items (g/day), as broad food groups (g/day), as calories consumed per day from each food group, as food group variety scores, traditional food score and as nutrients. All these descriptors of food have been used in univariate analyses.

Ten food groups were constructed from the 238 food items in the FFQ as follows (the main ingredient in a mixed dish was used for grouping) (see also chapters 3, 9):

- 1) *Meat group* - included beef, lamb, chicken, turkey, game, bird, rabbit, pork, offal, processed meat.
- 2) *Fish group* - fish, shellfish, fish roe dip.
- 3) *Dairy group* - milk, cheese, cheese pie, yoghurt, custard, milk puddings, custard pastry
- 4) *Vegetable group* - all vegetables, garlic, olives, including mixed dishes where vegetables are main ingredient (e.g mousaka, spinach rice casserole, eggplant and garlic/potato dip) and nuts.
- 5) *Legume group* - all legume soups, salads and casseroles, chickpea felafel, green peas and split peas.

- 6) *Cereal group* - bread, rice, noodles, pasta (including mixed pasta dishes like pastichio, lasagna), breakfast cereals, polenta, trahana (flour and sour milk pasta), cakes, sweet and dry biscuits.
- 7) *Fruit* - all fresh and dried fruit
- 8) *Alcohol* - beer, wine, spirits, liqueurs
- 9) *Sweets* - all foods where sugar is major ingredient e.g softdrinks, juices, sugar, jam, honey, confectionery, jelly, halva (tahini paste and sugar), chocolate, Turkish delight.
- 10) *Fats* - butter, margarine, oils, peanut butter, tahini paste

Of the 10 food groups, 7 groups were further collapsed into 2 very broad groups:

1. Animal foods group (food groups 1-3)
2. Plant food groups (food groups 4-7)

Sugar products, fats and alcohol were not included in this grouping.

Nine food group variety scores were constructed in order to describe variety of foods consumed within a food group, from a total of 238 foods in the food frequency questionnaire.

A *medium serving* of a food or mixed dish within a food group had to be consumed at least once a month a more to score. Alcohol and fats were collapsed into one group 'other foods variety score'.

- 1) *Meat variety score* (0-24) - consists of 24 foods from the meat group.
- 2) *Fish variety score* (0-19) - consists of 19 foods from the fish group.
- 3) *Dairy variety score* (0-30) - consists of 30 foods from the dairy group.
- 4) *Cereal variety score* (0-34) - consists of 34 foods from the cereal group.
- 5) *Vegetable variety score* (0-48) - consists of 48 foods from the vegetable group.
- 6) *Legume variety score* (0-13) - consists of 13 foods from the legume group.
- 7) *Fruit variety score* (0-33) - consists of 33 foods from the fruit group.
- 8) *Sweets variety score* (0-17) - consists of 17 foods from the sweets group.
- 9) *Other foods variety score* (0-20) - consists of 20 foods from the alcohol and fats group, including tea, coffee and water.

A total food variety score was constructed by adding together all the food group variety scores - the score ranged from 0-238.

In order to determine the degree of acculturation upon migration or 'westernization' of the Greek diet, 70 foods were identified as being 'traditional' or culture specific foods. These 70 foods (see chapter 3 & Appendix 10) were used to construct a **traditional food score** (0-70). If the food was consumed at least once in a year in any quantity then it received a score of 1.

A. HEALTH

i. Food intake & Health

Results: In Spata, a greater intake of plant food was associated with a higher health score in men and women. In men, this was mainly seen with vegetables (especially the 'other' vegetable group which included tomatoes and onions) and melon fruit (e.g watermelon, cantaloup in the 80+ age group only) (see table 12.1.2a). In women, the positive correlation with the health score was mainly seen with cereals and bread, root vegetables (potatoes, carrots) and fruit (watermelon, cantaloup, grapes, mainly 80+). Interestingly, a lower health score was associated with consumption of red meat and chicken (men only), tea (women only) and eggs (women only) and a greater consumption of yoghurt (women only).

Similarly in Melbourne, a high health score was associated with a greater intake of vegetables and fruit. In men, this was mainly seen with the 'other' vegetable group (which included tomatoes and onions), melon fruit (e.g watermelon, cantaloup in the 80+ age group only) and pasta. In women, this association was mainly seen with green leafy vegetables and fruit (watermelon, cantaloup and grapes). A negative correlation was seen with eggs and tea in women only and chicken in men only.

Table 12.1.2a

Correlation (Spearman's) of Food intakes with Total health score

	SPATA		MELBOURNE	
	70 - 79 R ²	80+ R ²	70 - 79 R ²	80+ R ²
MEN				
N	32	19	66	28
Specific food intake (g/day)				
Eggs	0.39**	-	-	-
Chicken	-0.34*	-	-0.45**	-
Other vegetables	0.48**	-	0.36*	-
Pasta	-	-	0.5*	-
Cakes, biscuits	-	-	-0.4*	-
Melon fruit	-	0.45*	-	0.49*
Food group intake (g/day)				
Total plant food intake	0.4**	-	-	-
Total meat intake	-	-0.44*	-	-
Total vegetable intake	0.36*	-	-	-
WOMEN				
N	31	22	59	36
Specific food intake (g/day)				
Eggs	-	-0.48**	-	-0.47**
Yoghurt	0.4**	-	-	-
Root vegetables	0.5**	-	-	-
Green leafy vegetables	-	-	0.4**	-
Bread	0.49**	-	-	-
Melon fruit	-	0.4*	0.44*	-
Other fruit	-	0.4*	0.44*	-
Tea	-	-0.45*	-	-0.47*
Food group intake (g/day)				
Total plant food intake	0.5***	-	-	0.5**
Total cereal intake	0.6***	-	-	-
Total fruit intake	-	0.45*	-	0.47*

Significance: NS = not significant; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; **** $p < 0.0001$.

Foods which were not significantly correlated with the health score were not included in the table.

ii. Food scores & Health

Results: In Spata, health was significantly correlated with a greater total food variety, animal food variety and plant food variety in both men and women aged 70-79. A greater variety of fruit was also significant in women only. In Melbourne, health was also associated with a greater total food variety (men only), traditional foods (men only) and cereal variety (women only) (see table 12.1.2b).

Table 12.1.2b

**Correlation (Spearman's) of Food scores
with Total health score**

	SPATA		MELBOURNE	
	70 - 79 R ²	80+ R ²	70 - 79 R ²	80+ R ²
MEN				
N	32	19	66	28
Total food variety score	0.34*	-	0.25*	-
Animal variety score	0.4**	-	-	-
Meat variety score	-	-	-	-
Traditional food score	-	-	0.25*	-
WOMEN				
N	31	22	59	36
Total food variety score	0.38*	-	-	-
Plant variety score	0.35*	-	-	-
Animal variety score	0.4*	-	-	-
Meat variety score	-	-	-	-0.3*
Fruit variety score	0.4*	-	-	-
Cereal variety score	-	-	0.3*	-

Significance: NS = not significant; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; **** $p < 0.0001$.

Food scores which were not significantly correlated with the health score were not included in the table. A high score indicates greater variety.

iii. Nutrient intake and Health

Results: For Spata men, better health was significantly correlated with a lower intake of protein, cholesterol, fat, zinc and iron and a greater intake of carotene and carbohydrate. For Spata women, better health was associated with a greater intake of protein, carbohydrate, thiamin and vitamin C and a lower intake of cholesterol, fat, sodium and niacin. In Melbourne, a higher health score was correlated with a lower intake of cholesterol, fat, zinc and iron in men and a lower intake of saturated fat in women (see table 12.1.2c).

Table 12.1.2c

Correlation (Spearman's) of nutrient intakes with Total health score
(controlled for energy intake)

	SPATA		MELBOURNE	
	70 - 79 R ²	80+ R ²	70 - 79 R ²	80+ R ²
MEN				
N	32	19	66	28
Protein (g)	-	-0.4	-	-
Carbohydrate (g)	-	0.45*	-	-
Cholesterol (mg)	-	-0.46*	-	-0.46*
Fat (g)	-	-0.48*	-	-
Monounsaturated fat (g)	-	-0.47*	-	-0.47*
Zinc (mg)	-0.35*	-	-0.30**	-
Iron (mg)	-0.34*	-	-0.39***	-
Niacin (NE mg)	-	-	-	-
Carotene (µg)	0.4**	-	-	-
WOMEN				
N	31	22	59	36
Protein (g)	-	0.45*	-	-
Sugar	-	0.45*	-	-
Starch (g)	0.39*	-	-	-
Cholesterol (mg)	-	-0.52**	-	-
Fat (g)	-0.4**	-	-	-
Saturated fat	-	-	-	-0.36*
Monounsaturated fat (g)	-0.39*	-	-	-
Sodium (mg)	-	-0.48*	-	-
Niacin (NE mg)	-	-0.42*	-	-
Thiamin (mg)	0.48**	-	-	-
Vitamin C (mg)	-	0.43*	-	-

Significance: NS = not significant; * p<0.05; ** p<0.01; *** p<0.001; **** p<0.0001.

Nutrients which were not significantly correlated with the health score were not included in the table. A high health score indicates better health.

B. WELL-BEING

i. Food intake & Well-being

Results: As with the health score, a better sense of well-being was associated with a greater intake of plant food in both Spata and Melbourne (see table 12.1.2d). In Spata, this was mainly seen with vegetables (especially the 'other' vegetable group which included tomatoes). A better sense of well-being was also associated with a greater intake of rice (women only), yoghurt (women only), olive oil (men only), water (men only) and egg (women only). A greater intake of beef was associated with a poorer sense of well-being in both men and women. In Melbourne, well-being was significantly correlated with marrow vegetables (zucchini, pumpkin, cucumber, eggplant), mixed vegetable

dishes (e.g ratatouille, women only), other vegetable group (e.g tomatoes, women only) and beer (women only). Negative correlations were seen with tea (men only) and beef (women only).

Table 12.1.2d

Correlation (Spearman's) of Food intakes with Well-being score

	SPATA		MELBOURNE	
	70 - 79 R ²	80+ R ²	70 - 79 R ²	80+ R ²
MEN				
N	32	19	66	28
Specific food intake (g/day)				
Beef	-	-0.5**	-	-
Marrow vegetables	-	-	0.25*	-
Other vegetables	0.5**	-	-	-
Oil	0.4**	-	-	-
Water	0.35*	-	-	-
Tea	-	-	-0.33**	-
Food group intake (g/day)				
Total plant food intake	0.49**	-	0.3**	-
WOMEN				
N	31	22	59	36
Specific food intake (g/day)				
Beef	-	-0.5**	-	-0.33*
Eggs	-	0.4*	-	-
Yoghurt	0.35**	-	-	-
Rice	0.4*	-	-	-
Mixed vegetable dish	-	-	0.29*	-
Marrow vegetables	-	0.4*	-	0.38*
Other vegetables	0.5**	-	-	0.37*
Beer	-	-	0.25*	-
Food group intake (g/day)				
Total plant food intake	0.4*	-	0.26*	0.35*

Significance: NS = not significant; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; **** $p < 0.0001$

Foods which were not significantly correlated with the well-being score were not included in the table. A high well-being score indicates better sense of well-being.

ii. Food scores & Well-being

Results: In Spata, a better sense of well-being was significantly correlated with a greater variety of vegetables in the men only whereas in the women a greater total food variety assumed importance, reflected in the significant correlations with most of the food group variety scores, including the traditional food score. In Melbourne, significant positive correlations were seen only in the women for plant food variety and vegetable variety (see table 12.1.2e).

Table 12.1.2e
Correlation (Spearman's) of Food scores with Well-being score

	SPATA		MELBOURNE	
	70 - 79 R ²	80+ R ²	70 - 79 R ²	80+ R ²
MEN				
N	32	19	66	28
Traditional food score	-	-	-	-
Total food variety	-	-	-	-
Plant variety score	-	-	-	-
Animal variety score	-	-	-	-
Dairy variety score	-	-	-	-
Vegetable variety score	0.37*	-	-	-
Cereal variety score	-	-	-	-
			-0.33**	-
WOMEN				
N	31	22	59	36
Traditional food score	0.53***	-	-	-
Total food variety	0.49**	-	-	-
Plant variety score	0.37*	-	-	0.35*
Animal variety score	0.57***	-	-	-
Dairy variety score	0.6****	-	-	-
Vegetable variety score	-	-	-	0.4**
Cereal variety score	0.58***	-	-	-

Significance: NS = not significant; * p<0.05; ** p<0.01; *** p <0.001; **** p<0.0001

Food scores which were not significantly correlated with the well-being score were not included in the table. A high score indicates greater variety.

iii. Nutrient intake and Well-being

Results: In Spata, a better sense of well-being was associated with a greater intake of water, carotene and vitamin C and a lower intake of cholesterol (women only). In Melbourne, a greater intake of alcohol and a lower intake of cholesterol was associated with a higher well-being score in the women only (see table 12.1.2f).

Table 12.1.2f
Correlation (Spearman's) of nutrient intakes with Well-being score
(controlled for energy intake)

	SPATA		MELBOURNE	
	70 - 79 R ²	80+ R ²	70 - 79 R ²	80+ R ²
MEN				
N	32	19	66	28
Water (g)	0.36*	-	-	-
Carbohydrate (g)	-0.4*	-	-	-
Carotene (µg)	0.39*	-	-	-
Vitamin C (mg)	0.36*	-	-	-
WOMEN				
N	31	22	59	36
Water (g)	-	0.45*	-	-
Cholesterol (mg)	-	-0.46*	-	-0.36*
Alcohol (g)	-	-	0.3**	-

Significance: NS = not significant; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; **** $p < 0.0001$.

Nutrients which were not significantly correlated with the well-being score were not included in the table. A high score indicates better sense of well-being.

12.1.3 LIFE FACTORS & FOOD VARIETY

See section 12.1.2 and chapter 3 for details on the construction of the food variety score.

Results: In Spata, a greater total food variety was significantly correlated with better self rated health and total health score, greater sense of well-being (women only), more exercise, greater social activity and networking and less medications (women only). Similarly in Melbourne, a greater total food variety was associated with a greater total health score (men only), exercise score and social activity/network score (see table 12.1.3).

Table 12.1.3

**Correlation (Spearman's) of Life factors with
Total food variety score**

	SPATA		MELBOURNE	
	70 - 79 R ²	80+ R ²	70 - 79 R ²	80+ R ²
MEN				
N	32	19	66	28
Total health score	0.34 [*]	-	0.34 ^{**}	-
Self rated health	0.46 ^{**}	0.59 ^{**}	-	-
Exercise score	0.5 ^{**}	-	-	0.5 ^{**}
Social activity score	0.53 ^{**}	-	0.29 ^{**}	0.5 ^{**}
Social network score	0.4 ^{**}	0.5 ^{**}	-	0.6 ^{***}
WOMEN				
N	31	22	59	36
Total health score	0.38 [*]	0.7 ^{****}	-	-
Self rated health	0.56 ^{***}	-	-	-
Medication score	0.54 ^{***}	-	-	-
Well-being score	0.49 ^{**}	-	-	-
Exercise score	0.36 [*]	-	0.25 [*]	-
Social activity score	0.5 ^{**}	-	-	0.4 ^{**}
Social network score	-	-	0.3 ^{**}	0.5 ^{***}

Significance: NS = not significant; * p<0.05; ** p<0.01; *** p <0.001; **** p<0.0001

A high score is a more favourable score. Scores that were not significantly correlated with food variety were not included in the table.

12.2 MULTIVARIATE ANALYSES

The purpose of the multivariate analyses and stepwise regression was to determine the importance of each life factor in explaining the variance of the LLSS and subsequently to determine the importance of food/nutrients in predicting the LLSS.

12.2.1 LATER LIFE STATUS SCORE

The eight life factor scores were standardised (i.e each score was divided by its highest score and X 10) so that they all had a common denominator (10). These scores were then summed to form the *Later life status score* which ranged from 0-80. A higher score indicated better 'quality of life'.

Later life status score (standardised) = memory score + well-being score + general health score + medication score + activities of daily living score + exercise score + social activity score + social networks score = **0 - 80**

Results: Men (ranging from 59.5 to 66.5) had a significantly greater LLSS than the women (ranging from 54.5 to 62.2). This was true for all age groups in both Spata and Melbourne. Those aged 80+ scored less than those aged 70-79, particularly men and

Melbourne women. This indicated that age group adjustment would be necessary when using the later life status score in multivariate analyses with foods and nutrients. Centre differences were significant for the women only aged 70-79 - Melbourne women had a greater score than the Spata women (see table 12.2.1).

Table 12.2.1

Descriptive statistics for Later Life Status Score
(LLSS, standardised)

Score 0-80	SPATA		MELBOURNE	
	70 - 79 R ²	80+ R ²	70 - 79 R ²	80+ R ²
MEN				
N	32	19	66	28
Mean	66.1 ^{ae}	59.5 ^{be}	66.5 ^{cf}	59.9 ^{df}
SD	8.2	7.9	6.0	7.9
Minimum	41.6	42.7	39.2	38.9
5%	50.0	42.7	55.4	47.7
25%	63.0	51.8	63.8	55.6
50%	68.2	60.2	66.9	60.9
75%	72.7	63.6	70.8	65.8
95%	75.0	76.7	74.0	70.7
Maximum	75.2	76.7	74.8	74.4
WOMEN				
N	31	22	59	36
Mean	58.2 ^{ak}	54.5 ^b	62.2 ^{cgk}	54.9 ^{dg}
SD	6.8	7.9	6.7	7.1
Minimum	46.8	37.8	43.3	35.7
5%	47.7	40.7	49.5	42.5
25%	53.1	51.8	58.4	50.3
50%	56.8	54.8	63.0	54.8
75%	62.8	58.3	66.7	59.9
95%	68.8	65.9	72.4	67.3
Maximum	75.1	72.7	74.0	68.1

Same pair of letters show significant differences, Wilcoxon $p < 0.05$:

a,b,c or d within centres - between gender for a given age group

e,f,g or h within centres - between age groups for a given gender

i,j,k or l between centres - for a given age group and gender

Gender differences: Spata 70-79 and 80+; Melbourne 70-79 and 80+.

Age group differences: Spata men; Melbourne men and women.

*Centre differences: women 70-79. * A high score indicates better 'later life status'.*

12.2.2 LIFE FACTORS AND LATER LIFE STATUS SCORE

In order to determine the degree to which each life factor influenced the standardised LLSS, correlation and stepwise regression analyses were performed.

12.2.2.1 Life factors and correlations

Correlation analyses were performed in order to explore the relationship of each of the standardised life factors to each other (see tables 12.2.2.1a,b).

Results: The majority of the life factors were 'positively' correlated with each other. The LLSS was significantly correlated with all the life factors ($p < 0.0001$) for both men and women in Spata and Melbourne. The total health score and well-being scores were also significantly correlated with all the life factors (except with memory). The medication and memory scores were weakly correlated (if at all) with the life factors (except in Melbourne men). Activities of daily living score was significantly correlated with all life factors, especially in Melbourne. The exercise score was also significantly correlated with all life factors, especially in Spata and Melbourne men. The social activity and networks score were also strongly associated with all the life factors, except with medication and memory scores. It appears that the life factors are not truly independent variables.

12.2.2.2 Life factors & Stepwise regression

To determine the relative importance of each standardised life factor in explaining the variation of the standardised LLSS, stepwise regression was performed (see figure 12.2.2.2).

Results: In Spata, exercise alone explained more than 60% of the variation of the LLSS for both men and women; this was followed by the well-being score (M 15.3%, F 17.8%) and memory (M 1.1%, F 10.9%). The relative importance of age, as a determinant of later life status (M 14.5%, F 6%), was also greatly attenuated.

Table 12.2.2.1a

**Pearson's correlation coefficients (correlation matrices)
Standardised Life factor Scores & Later Life Status Score**

Spata men

	A	B	C	D	E	F	G	H	I	
A.....		0.67****	0.38**	0.6****	0.85****	0.74****	0.88****	0.75****	0.59****	<i>LIFE FACTORS</i>
B.....			0.77****	0.26	0.5***	0.43***	0.65****	0.37**	0.33**	<i>A = Later life status score</i>
C.....				0.01	0.25	0.27*	0.37**	0.09	0.30*	<i>B = General health score</i>
D.....					0.56****	0.27*	0.32**	0.41**	0.17	<i>C = Medication score</i>
E.....						0.57****	0.62****	0.54****	0.41**	<i>D = Memory score</i>
F.....							0.57****	0.55****	0.42***	<i>E = Well-being score</i>
G.....								0.63****	0.6****	<i>F = Activities of daily living</i>
H.....									0.39**	<i>G = Exercise score</i>
I.....										<i>H = Social activity score</i>
										<i>I = Social network score</i>

Spata women

	A	B	C	D	E	F	G	H	I	
A.....		0.67****	0.38**	0.4**	0.64****	0.74****	0.79****	0.69****	0.59****	<i>LIFE FACTORS</i>
B.....			0.54****	0.08	0.49***	0.49****	0.5***	0.47***	0.36**	<i>A = Later life status score</i>
C.....				0.03	0.35**	0.12	0.3*	0.28*	0.15	<i>B = General health score</i>
D.....					0.015	0.03	0.1	0.11	0.01	<i>C = Medication score</i>
E.....						0.3*	0.3*	0.22	0.34**	<i>D = Memory score</i>
F.....							0.69****	0.63****	0.61****	<i>E = Well-being score</i>
G.....								0.65***	0.47***	<i>F = Activities of daily living</i>
H.....									0.43***	<i>G = Exercise score</i>
I.....										<i>H = Social activity score</i>
										<i>I = Social network score</i>

Table 12.2.2.1b

Pearson's correlation coefficients (correlation matrices)
Standardised Life factor Scores & Later Life Status Score

Melbourne men

	A	B	C	D	E	F	G	H	I	
A.....		0.6****	0.37***	0.7****	0.7****	0.74****	0.68****	0.68****	0.64****	<i>LIFE FACTORS</i>
B.....			0.59****	0.26**	0.55****	0.59****	0.42****	0.26**	0.27**	<i>A = Later life status score</i>
C.....				0.12	0.29**	0.32***	0.26**	0.13	0.14	<i>B = General health score</i>
D.....					0.38****	0.34***	0.26**	0.42****	0.45****	<i>C = Medication score</i>
E.....						0.54****	0.37***	0.31**	0.33***	<i>D = Memory score</i>
F.....							0.56****	0.47****	0.41****	<i>E = Well-being score</i>
G.....								0.45****	0.36***	<i>F = Activities of daily living</i>
H.....									0.43****	<i>G = Exercise score</i>
I.....										<i>H = Social activity score</i>
										<i>I = Social network score</i>

Melbourne Women

	A	B	C	D	E	F	G	H	I	
A.....		0.63****	0.28**	0.6****	0.72****	0.75****	0.73****	0.64****	0.63****	<i>LIFE FACTORS</i>
B.....			0.52****	0.05	0.58****	0.52****	0.5****	0.4****	0.36***	<i>A = Later life status score</i>
C.....				0.04	0.30**	0.16	0.15	0.07	0.05	<i>B = General health score</i>
D.....					0.17	0.38****	0.1	0.11	0.01	<i>C = Medication score</i>
E.....						0.41****	0.44****	0.32***	0.41****	<i>D = Memory score</i>
F.....							0.7****	0.41****	0.35***	<i>E = Well-being score</i>
G.....								0.65***	0.47***	<i>F = Activities of daily living</i>
H.....									0.49****	<i>G = Exercise score</i>
I.....										<i>H = Social activity score</i>
										<i>I = Social network score</i>

In Melbourne, more than 85% of the variation of the LLSS was accounted for by activities of daily living (M 42%, F 15.7%), well-being (M 5.8%, F 43.8%), memory (M 21.3%, F 11.3%) and age (M 16.7%, F 21.1%). Social activity also assumed greater importance in the Melbourne Greeks explaining up to 5% of the variation of the LLSS as opposed to less than 2% in Spata. The total (general) health score and medication score explained <1% of the variation of the LLSS in both Spata and Melbourne.

12.2.3 LATER LIFE STATUS SCORE & FOOD

12.2.3.1 Absolute intake of food groups

Table 12.2.3.1 shows the percentage variation of the standardised LLSS explained by the various food groups (grams/day), after controlling for age.

Results: For the Spata men, a higher LLSS was positively associated with fish intake which explained 9% of the variation ($p=0.02$) and negatively associated with meat intake (6% variation, $p=0.04$). The positive associations with intakes of fat (4.7%), vegetable (4.7%) and alcohol (3.4%) were not statistically significant, although they collectively accounted for more than 12% of the variation of the LLSS.

The LLSS of Spata women was positively related to the intakes of fruit and legumes which explained 12.3% and 13.7% respectively, of the variation of the LLSS. A greater intake of cereals (4%) and a lower intake of meat (4%), dairy (3%) and fat (2.7%) were also important discriminants of the LLSS accounting for more than 12% of the variation; they were not statistically significant. The LLSS of Melbourne men was positively associated with fruit and alcohol intake, collectively accounting for 5% of the variation; they were not significant. For the Melbourne women, the LLSS was positively related to vegetable intake ($p<0.0001$) which explained about 10% of the variation of the LLSS.

12.2.3.2 Calories provided by food groups

Table 12.2.3.2 shows the percentage variation of the LLSS explained by calories derived from the various food groups, after controlling for energy intake and age.

Results: For the Spata men, the LLSS was positively associated with calories derived from the intake of fat ($p=0.03$) and legumes (not significant) which contributed 8% and 4.2% respectively, to the variation of the LLSS. The LLSS of Spata women was positively

related to calories from the intake of fruit and legumes which contributed 10.2% ($p=0.01$) and 11.1% ($p=0.007$) respectively, to the variation of the LLSS. The associations with calories from the intake of fat (negative), meat (negative) or dairy (positive) were not statistically significant, but each contributed 3.6%, 4% and 4.3% of the variation of the LLSS.

For the Melbourne men, the LLSS was positively associated with calories derived from the intake of fat, alcohol or fruit, but did not reach statistical significance. For the Melbourne women, the LLSS was positively associated with the intake of calories from vegetables which explained 6% of the variation ($p=0.005$).

12.2.3.3 Food group variety scores

The food group variety scores described in section 12.1.2 were standardised. The scores were divided by the maximum achievable score (and x 10) to create a common denominator (10). These scores were then summed to create the standardised Total Food Variety Score which ranged from 0-90. Table 12.2.3.3 shows the percentage variation of the standardised LLSS explained by the standardised food group variety scores.

Total food variety score (standardised) = meat variety + fish variety + dairy variety + cereal variety + vegetable variety + legume variety + fruit variety + sweets variety + other foods variety = **0-90**

Results: The LLSS was positively associated with a greater variety derived from vegetable intake for women only in Spata and Melbourne. The variation of the LLSS explained by vegetable variety was 7% for Melbourne women ($p=0.004$) and 9% in Spata women ($p=0.02$). For the men, fruit variety assumed importance in Melbourne explaining up to 4% of the variation ($p=0.04$). In Spata men, fish intake variety explained 19.6% ($p=0.0005$) of the variation of the LLSS and the relationship was positive. When these results are viewed in conjunction with tables 12.2.3.1 and 12.2.3.2, it suggests that a high vegetable, fruit and fish intake should include a variety of such plant foods in order to be of benefit in later life. Interestingly, eating a variety of 'traditional' foods alone was not associated with better later life status.

Table 12.2.3.1

**Percentage variation of standardised Later Life Status score
explained by Food groups (grams/day)
(controlled for age group)
Stepwise Regression**

	Parameter estimate	Pearson's R ² *100	P value
SPATA			
Men (n=51)			
age group	-6.6	14.0	**
fish	0.02	9.0	*
fat	0.2	4.7	NS
vegetables	0.02	4.7	NS
meat	-0.03	6.0	*
alcohol	0.08	3.4	NS
Women (n=53)			
age group	-3.6	5.8	NS
fruit	0.03	12.3	**
legumes	0.09	13.7	**
cereal	0.01	4.0	NS
meat	-0.03	4.0	NS
dairy	-0.01	3.0	NS
fat	-0.01	2.7	NS
MELBOURNE			
Men (n=94)			
age group	-6.6	17.6	***
fruit	0.08	2.7	NS
Alcohol	0.07	2.8	NS
Women (n=95)			
age group	-7.3	21.1	****
Vegetable	0.016	9.5	***

Significance: NS = not significant; * p<0.05; ** p<0.01; *** p <0.001; **** p<0.0001.
A high later life status score indicates 'better quality of life'.

Table 12.2.3.2

**Percentage variation of Standardised Later Life Status score
explained by Calories from food groups
(controlled for age group & energy intake)**

Stepwise Regression

	Parameter estimate	Pearson's R ² *100	P value
SPATA			
Men (n=51)			
age group	-5.8	20.2	**
Kcal	0.004		
fat	0.02	8.2	*
legumes	0.04	4.2	NS
Women (n=53)			
age group	-3.6	12.0	*
Kcal	0.005		
fruit	0.06	10.2	**
legumes	0.06	11.1	**
fat	-0.01	3.6	NS
meat	-0.02	4.0	NS
dairy	-0.01	4.3	NS
MELBOURNE			
Men (n=94)			
age group	-6.7	17.9	****
Kcal	-0.001		
Fat	0.012	2.7	NS
Alcohol	0.012	2.0	NS
Fruit	0.015	2.7	NS
Women (n=95)			
age group	-7.1	23.5	****
Kcal	0.0013		
Vegetables	0.017	0.06	**

Significance: NS = not significant; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; **** $p < 0.0001$

Table 12.2.3.3

**Percentage variation of Standardised Later Life Status score
explained by Food scores**
(controlled for age group)

Stepwise Regression

	Parameter estimate	Pearson's R ² *100	P value
SPATA			
Men (n=51)			
age group	-6.6	14.0	**
fish variety	-6.6	14.0	***
Women (n=53)			
age group	-3.6	5.8	NS
Vegetable variety	2.1	9.0	*
MELBOURNE			
Men (n=94)			
age group	-6.6	17.6	****
fruit variety	1.2	3.6	*
legume variety	1.0	2.0	NS
vegetable variety	1.2	2.4	NS
Women (n=95)			
age group	-7.3	21.1	****
vegetable variety	1.8	7.0	**

Significance: NS = not significant; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; **** $p < 0.0001$

Table 12.2.3.4

**Percentage variation of Later Life Status score
explained by Nutrient intake**
(controlled for age group and energy intake)

Stepwise Regression

	Parameter estimate	Pearson's R ² *100	P value
SPATA			
Men (n=51)			
age group	-5.8	20.2	***
Kcal	0.004		
Carbohydrate	-0.07	6.8	*
Zinc	-1.02	14.3	**
Vitamin C	0.08	6.1	*
Vitamin A	0.003	2.5	NS
Women (n=53)			
age group	-3.6	12.0	NS
Kcal	0.004		
fibre	1.5	21.3	***
zinc	-0.7	4.8	NS
polyunsaturated fat	-0.85	3.4	NS
MELBOURNE			
Men (n=94)			
age group	-6.7	17.9	****
kcal	-0.0007		
sodium	-0.003	3.3	NS
magnesium	0.04	2.0	NS
niacin	-0.4	4.0	*
carbohydrate	-0.03	2.5	NS
Women (n=95)			
age group	-7.1	23.5	****
Kcal	0.003		
Cholesterol	-0.02	3.7	*
Carbohydrate	-0.06	3.4	*

Significance: NS = not significant; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; **** $p < 0.0001$

12.2.3.4 Nutrient intakes

Table 12.2.3.4 shows the percentage variation of the LLSS explained by nutrient intake, after controlling for energy intake and age.

Results: In Spata men, the LLSS was negatively related to the intakes of carbohydrates and zinc, and positively related to the intake of vitamin C. Zinc intake explained 14.3% of the variation ($p=0.001$), followed by carbohydrate (6.8%, $p=0.04$) and vitamin C (6.1%, $p=0.02$). A negative relationship between the LLSS and zinc intake was also observed in Spata women, explaining up to 5% of the variation, but was statistically insignificant. In Spata women, 21.3% of the variation of the LLSS was attributable to the high intake of fibre ($p=0.0002$) and 3.4% to the low intake of polyunsaturated fat (not significant). The LLSS of Melbourne men was negatively associated with the intake of niacin, which accounted for 4% of the variation of the LLSS ($p=0.03$). In Melbourne women, the LLSS was negatively associated with the intakes of cholesterol ($p=0.03$) and carbohydrates ($p=0.04$), collectively explaining up to 7% of the variation of the LLSS.

12.3 DISCUSSION

Generally, the LLSS of male or younger elderly were superior to their female or older counterparts. The contribution of age to the variation of the LLSS was consistent and persistent in all dietary models where various expressions of food habits were examined. These findings suggest that the LLSS is a reasonable discriminator of an elderly person's life insofar as the age differences are concerned.

Given that the life expectancy of women generally exceeds that of men, there is no reason as to why men should have a better later life status than women. To this end, the LLSS may differentiate men and women in favour of physical performance, independence, disability and well-being.

The most important factors identified as determining later life status or quality of life in Greek elderly included mobility and independence (exercise and activities of daily living), well-being and memory. Social activity and networks were the next most important factors - mainly in Melbourne. Health and medication were of least importance in determining later life status.

Similarly in other studies (Heikkinen, 1987; Butler, 1992; Schlettwein-Gsell, 1992; Dwyer et al., 1991; Saltman et al., 1989), being free of illness did not necessarily ensure quality of life; mobility, independence, cognitive function, psychological state, social relations or networks assumed greater importance. The important findings from these studies is that the elderly did not associate absence or control of illness with 'health'. In fact, good health was defined consistently in non-medical terms. This suggests that quality of life in the elderly is associated with mobility (ADL, exercise), cognitive status (memory) and psychological status (well-being) rather than the presence or absence of disease or medication use. For example a possible scenario may be 'I feel great, I am mobile, I can remember most people and places even though I have high blood pressure'.

In Spata, exercise explained about 60% of the variation of the LLSS, where as in Melbourne, activities of daily living explained up to 43% of the score. These differences are probably related to the lifestyle changes that have occurred on migration. Melbourne Greeks no longer have the opportunity to exercise as much, since farming is no longer part of their lifestyle. Therefore, other forms of 'mobility' such as activities of daily living, may assume greater importance.

It is not surprising that exercise and mobility were the strongest determinants of the LLSS in Greek elderly. Impairments exert negative influences not only on morbidity and mortality, but also on social and psychological function. They limit an individual's quality of life and ability to live independently, to maintain or begin relationships, and to pursue recreational activities and other goals (Dwyer et al., 1991).

Buskirk's (1985) review of data on health maintenance and exercise supports the assumption that regular exercise blunts many of the physiological declines associated with ageing, improves sense of well-being and quality of life. At increased ages there is a gradual reduction in the basal metabolic rate, but no proportional reduction of the demand for essential nutrients. Physical activity has been associated with greater energy intakes and subsequently nutrient intakes and quality of life in the aged (Astrand, 1992; Smiciklas-Wright, 1990).

A high absolute intake (grams/day and kcal) of vegetables, fruit and legumes appeared to be the most important 'food' determinants of later life status in Greek elderly, followed by a low intake of meat (except Melbourne elderly). Fish intake was positively associated with the LLSS in Spata men only. Fat and alcohol consumption in the men were also positively associated (barely significant) with a high LLSS, whereas in women the association was negative (fat only, not significant). Similar results were obtained when

correlating the total health score and well-being score with food intake. In particular, the 'other' vegetable group (predominantly tomatoes and onions) and the melon fruits (watermelon and cantaloup) were significantly correlated ($p < 0.01$, $R^2 = 0.4$) to the health and well-being scores in men and women in both Spata and Melbourne. Cereal foods were important in the Spata women only ($p < 0.001$, $R^2 = 0.6$) and 'other' fruits (40% grapes) were significant in the women only. Beef and chicken were negatively correlated with these scores ($p < 0.01$, $R^2 = 0.5$).

The relationship between quality of life and food intake has not been reported in other studies. In a study by Walker and Beauchene (1991) on 61 elderly aged 60-94 years, physical health (measured using the Guttman Health Scale) was related to nutrients (vitamin A, ascorbic acid and fibre) predominantly found in plant foods. Nevertheless, epidemiological data indicate that a high intake of vegetables, fruit and fish are associated with reduced rates of heart disease and colonic cancer (Kushi et al., 1985; James et al., 1989; US National Research Council, 1989; Wahlqvist and Kouris-Blazos, 1991). Legumes have also been shown to be cholesterol lowering (Kestin et al., 1989; Shutler et al., 1987) and potentially protective against cancer (Ireland and Giles, 1993).

It is interesting, that of all the fruits and vegetables tested, the 'other' vegetable group (65% tomatoes and onions 25%), the melon fruit group (80% watermelon and 20% cantaloup) and the 'other' fruit group (40% grapes) were significantly correlated with the total health and well-being scores. These plant foods, namely tomatoes, watermelon, grapes and onions are known to contain antioxidants (lycopene and flavonoids) and thus to have potential benefits against heart disease and cancer (Ireland and Giles, 1993). Hsu-Hage (1987) has also reported significant associations between melon fruit intake and reduced cardiovascular risk factors.

Lean meat diets have also been shown to lower cholesterol (Kestin et al., 1989), but less effectively than legume based diets. It appears that lean meat (as opposed to fatty meat) does not pose a threat to cardiovascular health. However, its association with cancer, especially colonic cancer, is still a contentious issue and remains equivocal (Ireland and Giles, 1993).

The effect of limited food choice on the health and nutritional status of the elderly can be serious, because consumption of a varied diet is considered the most effective way to assure adequate nutrient intake (US Department of Agriculture, 1985). Additionally, a variety of foods are recommended in order to provide other nutrients and non-nutrients for which human requirements have been less well defined (Wahlqvist, 1990). The

relationship between quality of life and food variety has not been reported in other studies. Wahlqvist et al. (1989) showed that food variety is associated with less non-invasive evidence of macrovascular disease. Horwath (1987) has shown that, as dietary variety increases, so the self assessment of health also increases from poor to very good in elderly Australians. Horwath also showed that social/leisure activity alone accounted for 15% of the variance of the total food variety score, and 11% of the variance of the vegetable variety score. Participation in a greater variety of social activities was associated with use of a greater variety of foods, which in turn was linked with higher micronutrient intakes. Similarly to the study by Horwath, in the current study, a greater total food variety was significantly correlated with better self rated health ($p < 0.01$, R^2 0.5, Spata only), a higher total health score ($p < 0.05$, R^2 0.35), greater well-being (Spata women only, $p < 0.01$, R^2 0.5) and social activity & network scores in Greek elderly ($p < 0.01$, R^2 0.5).

In the current study, vegetable variety was the most significant contributor to the variation of the LLSS, particularly for the women in both Spata and Melbourne, where it explained up to 10% of the variation ($p < 0.01$) of the LLSS. In other words, the high vegetable intake should probably include a variety of vegetables in order to be of benefit in later life. Interestingly, eating a variety of 'traditional' foods alone was not associated with better later life status.

Rosenberg and Miller (1992) point to the growing evidence supporting the view that good nutritional status is an important determinant of quality of life because of its effect on the nervous system. For example, a healthy nervous system will maintain physical mobility, cognitive, psychological and visual function. Visual function has been shown to be advantageously affected by antioxidants such as vitamins C and E (Jacques et al. 1988), physical mobility and cognitive function by vitamins B6, B12, folate, vitamin C, riboflavin, thiamin and iron (Goodwin et al. 1983). Similarly in the current study, a greater intake of vitamin C was associated with a higher LLSS (6% variation, $p < 0.05$) and well-being score in Spata men ($p < 0.05$, R^2 0.36). The total health score was also positively correlated with thiamin intake in Spata women ($p < 0.01$, R^2 0.5).

Meat is an excellent source of zinc, niacin and iron. The negative association of zinc intake in Spata to the LLSS, is probably related to the negative association of meat intake to the LLSS as shown in table 12.2.3.2. Zinc and iron intake were also negatively correlated with the total health score in the men only ($p < 0.01$, R^2 0.3; $p < 0.001$, R^2 0.3). Meat intake per se was not found to be negatively associated with the LLSS in Melbourne. However, the negative association of niacin intake to the LLSS may be acting

as a surrogate measure for meat intake. Similarly, the importance of vitamin C and fibre in explaining the variation of the LLSS, is probably related to the significant positive association of vegetable intake with this score.

In summary, these results suggest that a higher plant food (in particular vegetables, legumes and fruit) and fish intake and a lower animal food intake (in particular red meat and chicken) are predictive of better later life status in elderly Greeks. The high vegetable intake should probably include a variety of vegetables (especially tomatoes and onions) in order to be of benefit in later life and the high fruit intake should probably include a variety of fruits (especially grapes, watermelon and cantaloup).

In this study, efforts were made to create the later life status score, an index that embraces eight meaningful aspects of life, in an attempt to identify dietary predictors of an elderly person's life. The eight aspects of life, whilst being inter-related statistically, are considered independent resources that determine quality of life in old age (Butler, 1992; Schlettwein-Gsell, 1992). The use of these aspects of life to describe later life status requires validation, especially for elderly of other cultural or ethnic background (Kouris-Blazos & Hsu-Hage, in press).

12.4 SUMMARY

The total health score was significantly correlated with a greater sense of well-being (particularly in Melbourne), less medications, less disability, more exercise, greater social activity & social networks (mainly women).

The well-being score was significantly correlated with less medications, less disability, more exercise, greater social activity & social networks (Spata men and Melbourne elderly aged 70-79 only). The Melbourne women had a better sense of well-being than the Spata women, even though they reported more health problems. However, they also reported greater social activity and networking than Spata women which was significantly correlated to their well-being scores.

In Spata men, a higher health score was significantly correlated with a greater intake of other vegetables (tomatoes & onions) and melon fruit (watermelon, cantaloupe in the 80+ age group only). In Spata women, the positive correlation was mainly seen with cereals and bread, root vegetables (potatoes, carrots) and fruit (mainly watermelon, cantaloupe, grapes, 80+ only). A lower health score was associated with a greater intake of red meat and chicken (men only), tea (women only) and eggs (women only) and a high score with a greater consumption of yoghurt (women only).

Similarly in Melbourne men, a greater intake of the 'other' vegetable group (which included tomatoes), melon fruit (e.g watermelon, cantaloupe, 80+ age group only) and pasta were associated with better health. In the women this association was seen with green leafy vegetables and also with watermelon, cantaloupe, and grapes. As with Spata, a negative correlation was seen with eggs and tea in women only and chicken in men only.

In Spata, a better sense of well-being was also associated with a greater intake of other vegetables (tomatoes & onions), rice (women only), yoghurt (women only), olive oil (men only), water (men only) and egg (women only). A greater intake of beef was associated with a poorer sense of well-being in both men and women. In Melbourne, well-being was significantly correlated with marrow vegetables (zucchini, pumpkin, cucumber, eggplant), mixed vegetable dishes (e.g ratatouille, women only), other vegetable group (e.g tomatoes, women only) and beer (women only). Negative correlations were seen with tea (men only) and beef (women only). In Spata, the total health score was significantly correlated with a greater total food variety, animal food variety and plant food variety in

both men and women aged 70-79. A greater variety of fruit was also significant in women only.

In Melbourne, the total health score was also positively correlated with a greater total food variety (men only), traditional food variety (men only) and cereal variety (women only). In Spata, a better sense of well-being was significantly correlated with a greater variety of vegetables in the men only. In the women, a greater total food variety assumed importance, reflected in the significant correlations with most of the food group variety scores, including the traditional food score. In Melbourne, significant positive correlations were seen only in the women for plant food variety and vegetable variety.

In Spata a greater total food variety was significantly correlated with better self rated health ($p < 0.01$, R^2 0.5) and total health score ($p < 0.05$, R^2 0.35), greater sense of well-being ($p < 0.01$, R^2 0.5, women only), more exercise ($p < 0.01$, R^2 0.45), greater social activity ($p < 0.01$, R^2 0.5) and networking (men only) and less medications (women only). Similarly in Melbourne, a greater total food variety was associated with a greater total health score ($p < 0.05$, R^2 0.34, men only), exercise score ($p < 0.05$, R^2 0.25, women only) and social activity/network score.

For Spata men, better health was significantly correlated with a lower intake of protein, cholesterol, fat, zinc and iron and a greater intake of carotene and carbohydrate. For Spata women, better health was associated with a greater intake of protein, carbohydrate, thiamin and vitamin C and a lower intake of cholesterol, fat, sodium and niacin. In Melbourne, a higher health score was correlated with a lower intake of cholesterol, fat, zinc and iron in men and a lower intake of saturated fat in women.

In Spata, a better sense of well-being was associated with a greater intake of water, carotene and vitamin C and a lower intake of cholesterol (women only). In Melbourne, a greater intake of alcohol and a lower intake of cholesterol was associated with a higher well-being score in the women only.

The 'life factors' that were used to compose the multidimensional index of health or Later Life Status Score (LLSS) included: well-being score, memory score, total health score, medication score, activities of daily living (ADL) score, exercise score, social activity score and social networks score. The LLSS was used to indicate the 'quality of life' in the elderly. The men in both Spata and Melbourne had significantly greater LLSS scores (63) than the women (57), which was mainly attributed to their significantly greater exercise levels and ability to cope with most activities of daily living. The score also decreased

with age. Centre differences were significant for the women only aged 70-79. Melbourne women had a greater LLSS (and well-being and self-rated health scores) than the Spata women, even though they reported more health problems.

This is probably related to their greater social networking and social activity scores (see also chapter 6). Furthermore, social activity/networks explained a greater proportion of the variance (5%) of the LLSS in Melbourne women compared with Spata women <2%.

The majority of the life factors were 'positively' correlated with each other. The LLSS was significantly correlated with all the life factors ($p < 0.0001$) for both men and women in Spata and Melbourne. The total health score and well-being scores were also significantly correlated with all the life factors (except with memory). The medication and memory scores were weakly correlated (if at all) with the life factors (except in Melbourne men). ADL score was significantly correlated with all life factors, especially in Melbourne.

The exercise score was also significantly correlated with all life factors, especially in Spata and Melbourne men. The social activity and networks score were also strongly associated with all the life factors, except with medication and memory scores. It appears that the life factors are not truly independent variables.

Social activity also assumed greater importance in the Melbourne Greeks explaining up to 5% of the variation of the LLSS as opposed to only 1% in Spata. The total (general) health score and medication score explained <1% of the variation of the LLSS in both Spata and Melbourne. This suggests that quality of life in the elderly is associated with mobility (ADL, exercise), cognitive status (memory) and psychological status (well-being) rather than the presence or absence of disease or medication use.

In Spata, exercise alone explained more than 60% of the variation of the LLSS for both men and women; this was followed by the well-being score (M 15.3%, F 17.8%) and memory (M 1.1%, F 10.9%). The relative importance of age, as a determinant of later life status (M 14.5%, F 6%), was also greatly attenuated. In Melbourne, more than 85% of the variation of the LLSS was accounted for by activities of daily living (M 42%, F 15.7%), well-being (M 5.8%, F 43.8%), memory (M 21.3%, F 11.3%) and age (M 16.7%, F 21.1%).

The total (general) health score and medication score explained <1% of the variation of the LLSS in both Spata and Melbourne.

When the absolute intakes of various foods were used in multivariate analyses, a higher LLSS was associated with a higher fish intake in Spata men, which explained 9% of the variation ($p=0.02$), followed by a lower meat intake (6% variation) ($p=0.04$) and a higher fat (4.7%), vegetable (4.7%) and alcohol (3.4%) intake (not significant). For the The LLSS of Spata women was positively related to the intakes of fruit (12.3%) and legumes (13.7%).

A greater intake of cereals (4%) and a lower intake of meat (4%), dairy (3%) and fat (2.7%) were also important discriminants of the LLSS accounting for more than 12% of the variation; they were not statistically significant.

The LLSS of Melbourne men was positively associated with fruit and alcohol intake, collectively accounting for 5% of the variation; they were not significant. For the Melbourne women, the LLSS was positively related to vegetable intake ($p<0.0001$) which explained about 10% of the variation of the LLSS.

When the food group sources of calories were used in multivariate analyses, a higher LLSS was associated with more calories from fat (8% of variation, $p=0.03$) and legumes (4.2% not significant) in Spata men. For the Spata women, more calories from fruit and legumes ($p<0.01$) and less from meat, fat and dairy products (not significant) were associated with a higher LLSS.

For the Melbourne men, fat, alcohol and fruit were positively associated with the LLSS, but did not reach statistical significance. For the Melbourne women, a greater intake of calories from vegetables were significantly associated with a higher LLSS, explaining 6% of the variation ($p=0.005$).

When the food group variety scores were used in multivariate analyses, vegetable variety was the most significant contributor to the variation of the LLSS, particularly for the women, where it explained up to 10% of the variation. For the men, fruit variety (Melbourne) and fish variety (Spata) assumed importance, explaining 4% and 19.6% of the variation of the LLSS respectively.

Interestingly, eating a variety of 'traditional' foods alone was not associated with better later life status. However, eating traditional foods was associated with a greater total health score in Melbourne men (R^2 0.25, $p<0.05$) and better well-being (R^2 0.53, $p<0.0001$) in Spata women.

When nutrient intakes were used in multivariate analyses, the LLSS was negatively related to the intakes of carbohydrates and zinc, and positively related to the intake of vitamin C in Spata men. Zinc intake explained 14.3% of the variation ($p=0.001$), followed by carbohydrate (6.8%, $p=0.04$) and vitamin C (6.1%, $p=0.02$). A negative relationship between the LLSS and zinc intake was also observed in Spata women, explaining up to 5% of the variation, but was statistically insignificant.

In Spata women, 21.3% of the variation of the LLSS was attributable to the high intake of fibre ($p=0.0002$) and 3.4% to the low intake of polyunsaturated fat (not significant). The LLSS of Melbourne men was negatively associated with the intake of niacin (4% of the variation of the LLSS, $p=0.03$). In Melbourne women, the LLSS was negatively associated with the intakes of cholesterol ($p=0.03$) and carbohydrates ($p=0.04$), collectively explaining up to 7% of the variation of the LLSS.

These results suggest that a higher plant food intake (in particular vegetables, legumes and fruit) and a lower animal food intake (in particular red meat and chicken) are predictive of better 'quality of life' in elderly Greeks. The high vegetable intake should probably include a variety of vegetables (especially tomatoes and onions) in order to be of benefit in later life and the high fruit intake should probably include grapes, watermelon and cantaloup.