



STUDIES IN ADELAIDE, SOUTH AUSTRALIA AND MOSGIEL, NEW ZEALAND

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20.1 PEOPLE, PLACE, THE LIVING ENVIRONMENT AND THE SOCIETY

In mid-1985, a study commenced in Adelaide, South Australia. Using self-completed mail-administered questionnaires, this study aimed to: (a) describe dietary patterns and nutrient intake in a large representative sample of Adelaide residents over 65 years of age, and (b) investigate the relationship between various social, psychological and physical factors and diet in old age. An 18 month follow-up of a randomly selected subsample of the Adelaide subjects and an investigation of dietary change over time was also conducted and has been described elsewhere [1].

In New Zealand, three years after the Adelaide study, planning for another study began, this time a more comprehensive multi-disciplinary study of over-70 year-olds, which in addition to the above aims also included medical examinations and detailed nurse interviews covering a variety of areas (e.g. exercise, social support networks, mental state, sleeping habits, bowel function). Data collection for the New Zealand study was undertaken between 1989 and 1990. Analysis of the New Zealand data is continuing, and the results presented here must be considered preliminary.

Both the Adelaide and New Zealand studies were planned prior to the IUNS studies, and so the

data obtained are not exactly comparable with the IUNS study centre data. Nevertheless, there are many similarities between the studies, and a number of comparisons can usefully be made.

20.1.1 Geography and climate

The Australian study was conducted in Adelaide, the capital city of South Australia. It is located on the coastal plain on the east shore of St. Vincent's Gulf, and has a population of approximately one million people. Adelaide has a mild, dry, sunny climate throughout the year. The average temperature in January (summer) is 26.7°C and in July (winter) is 13.9°C.

The New Zealand study was undertaken in Mosgiel, a rural township of 13,500 people situated just south of Dunedin which lies on the east coast of the South Island. Mosgiel's climate is similar to Dunedin's, with an average temperature of 11°C, ranging from an average minimum of 2.5°C in winter to an average maximum of 19°C in summer.

20.1.2 Culture, religion and history

Adelaide was first settled in the 1830s, and South Australia was the only Australian colony to be established by free settlers. Adelaide is a city of great cultural and ethnic diversity, with only some 72% of the elderly population being born in Australia. There are sizeable Italian, Greek, German, and Polish communities.

The first ships of Scottish migrants set sail for Dunedin in 1847, and Mosgiel was first settled in the early 1860's. In contrast to New Zealand's North Island with its larger Maori population, less than 2% of Mosgiel's population is Maori, with the vast majority of the population being of European descent.

20.1.3 General demography and health statistics of the community

At the time of the Adelaide study, the population aged 65 years and over was about 102,000. In 1978-79, 55.6% of Australia's aged population derived 90% or more of their income from government pensions. The prevalence of selected conditions in Australia's aged population in 1986 was as follows: hypertension 20%M, 35%F; heart condition 19%M, 17%F; arthritis 13%M, 21%F; bronchitis/ asthma/ emphysema 7%M, 4%F.

In New Zealand, approximately 11% of the population is over 65 years, and the elderly population is projected to grow rapidly after 2005, when the survivors of the baby boom generation turn 60. It is projected that by the year 2031, one in every four New Zealanders will be aged 60 or over, and one in every 20 New Zealanders will be aged 80 or over. Ethnic minorities in New Zealand have more youthful age structures than the majority European population. In 1986, 16.4% of the Europeans were aged 60 and over, compared with less than 4% of New Zealand Maoris, who, until recently, were characterised by relatively high fertility.

Pacific Island Polynesians and Indians, who have a history of recent migration, also had only a small percentage of their populations (4% or less) aged 60 or over. In New Zealand, the majority of people retire from the labour force when they reach 60 years of age, and for many, retirement is a period of life financially dependent on the state.

20.1.4 Housing

In Australia, 94% of the aged population lived in private dwellings at the time of the 1981 Census, and only 6% lived in institutions. Australia has one of the highest rates of home ownership in the world. Over 97% of New Zealand senior citizens live in private dwellings - in their own homes, rented houses or leased accommodation. Like Australia, New Zealand also has a high rate of home ownership. At the 1986 Census, of those aged 60 years and over who were living in private dwellings, 85% owned their own homes (72% without a mortgage and 14% with a mortgage). Couples living on their own, without any children or other family members is the most common form of living arrangement among the elderly. At the 1986 Census, three-fifths of elderly males and two-fifths of elderly females were living in "couples only" households. Roughly half of those aged 85 years and over live alone.

20.1.5 State of development

Adelaide is South Australia's major commercial and financial centre. It has a wide variety of industrial enterprises including motor body assembly works, and many factories processing rural produce from the surrounding areas (e.g. fruit canning). Mosgiel lies on the Taieri Plain, an agricultural district of which Mosgiel is the centre. The town of Mosgiel services this surrounding district which is noted for its market gardening, small-fruit industry, sheep and dairy farms. Principal industries within Mosgiel are woollen mills, tanning and leather goods, timber treatment and sawmilling.

20.2 METHODOLOGY

20.2.1 Population selection and representativeness

In order for the study aims to be achieved, large representative populations of older adults were required. In the Adelaide study, this was facilitated by careful design and pre-testing of the dietary questionnaire, and by following the recommendations of Dillman [2] regarding optimum mail survey design for maximising response rate. In the New Zealand study, initial contact with subjects was made and interviews were conducted by a local nurse familiar to the subjects. Her excellent rapport with the elderly people of Mosgiel greatly contributed to the high response rate.

20.2.1.1 Adelaide

In early 1985, 3000 Adelaide residents aged 65 years and over were selected at random from the

State electoral rolls. More than 98% of the Australian and UK born population over 30 years are enrolled to vote, and 95% of the population as a whole are enrolled.

20.2.1.2 Mosgiel

Mosgiel is served by five family practitioners based at the Mosgiel Health Centre. The computerised age-sex register of the Centre was used as the sample frame for the study. Comparison with the electoral roll showed that 94% of all people living in the area were registered with the Centre. The percentage of elderly people in the area registered with the Centre may be higher than this because older people are likely to be less willing to travel for medical services. The sample frame included all people in residential homes in Mosgiel. The proportion of people living in residential home accommodation is similar to that in the country as a whole [3]. The sample did not include any person in continuing hospital care, but included all subjects irrespective of any chronic illness. The sample for study consisted of all people 70 years and over on 1 August 1988 registered with the Health Centre. Names, dates of birth and addresses were drawn from the computerised Health Centre records. All subjects in the study were Caucasian. There were no Maori or Pacific Island subjects of this age group living in the area. Only 2.3% of the elderly population in New Zealand is Maori and they tend to live in the warmer North Island. The sample consisted of people from a mixed background. Included were people who had retired from the surrounding rural area, people who had retired from Dunedin, the nearby city, and people who had worked in Mosgiel itself. Occupational class and property values indicated a predominantly middle-class retired community without extremes of poverty or wealth. The age and sex distribution of the sample was very similar to the country as a whole [3].

20.2.2 Response rate and refusals

20.2.2.1 Adelaide

Participating in the study were 2195 subjects over 65 years of age. After allowing for confirmed non-deliveries (n=154, i.e. subjects deceased or having changed address), the response rate was 77%. The sample was similar to the elderly population of the Adelaide Statistical Division in terms of age, sex, marital status and ethnic composition [4,5], and resembled Australia's aged population in terms of health characteristics such as the use of medical facilities and the prevalence of illness conditions [5], and pension receipt [4]. The occupational status distribution was very similar to that of the total Australian workforce [6]. Therefore, the results are likely to be representative of the Adelaide and Australian elderly populations.

20.2.2.2 Mosgiel

From the initial sample of 856 subjects, 782 (91.9%) agreed to participate in the study and completed both the nursing and medical assessments. Comparison with Health Centre records showed that those refusing were not a more frail group. The number reliably filling in the dietary

questionnaire was 727 (85%), and after excluding the 2% with more than 10 blank food items, energy and nutrient intakes were determined for 712 subjects.

20.2.3 Data collection

20.2.3.1 Adelaide

During June and July 1985, the survey instrument, a cover letter and a pre-paid, pre-addressed envelope, were mailed to each of the 3000 selected Adelaide residents. Up to three reminders were sent to non-responders at approximately two-weekly intervals after initial mailing.

20.2.3.2 Mosgiel

Initially subjects were visited in their homes by a local nurse with whom they were familiar. Over 90% of the elderly population registered with the Mosgiel Health Centre agreed to participate in the health survey, and 85% (n=727) filled in the nutrition questionnaire.

20.2.4 The questionnaires

The questionnaires were developed for use in large scale population studies aimed at achieving high response rates, and as such are relatively short and simple to complete. The format of the Adelaide and New Zealand food frequency questionnaires is essentially the same. There are minor differences in the details of the food list, in some food names, and also the New Zealand questionnaire is about 30 items longer. The Adelaide questionnaire was the first of the two to be designed, used and validated as a means of measuring food use in elderly people. The New Zealand questionnaire was simply an adaptation of the Adelaide questionnaire with the addition of several foods which, on the basis of the previous NZ dietary surveys and pre-testing with elderly New Zealanders, appeared to be an important part of the NZ diet. The NZ questionnaire was subsequently validated as a measure of nutrient intake.

20.2.4.1 Adelaide

Usual food consumption patterns were investigated using a self-completed semi-quantitative food frequency questionnaire which also included qualitative questions concerning food preparation and cooking practices, and took into account the seasonality of many food items (e.g. fruits, vegetables, soups). The questionnaire included a list of some 90 food and drink items. Selection of these items was based on previous extensively used food frequency questionnaires and the foods or food groups identified as being the most important macronutrient and micronutrient sources in the diets of Australian adults [33].

In determining the food list, a balance was necessary between adequate coverage of foods eaten by participants and minimal respondent burden. Much attention was devoted to the clarity of

instructions and the nature of response scales, and the print used was larger than that in similar questionnaires for the general population. In order to minimise fatigue and boredom, blocks of questions on the frequency of consumption of foods were interspersed with more qualitative questions on the types of foods eaten, on cooking methods or supplement use. The final design was the result of intensive pilot testing of various formats with more than 150 elderly people.

In response to the question, "How often do you usually eat these foods?", subjects were asked to choose from five options: 'never or rarely', 'about monthly', 'once or twice a week', 'three or four times a week' and 'about daily'. Slightly different categories were found during piloting to be more appropriate for most of the meat/ fish/ poultry items: 'never or rarely', 'about fortnightly', 'once a week', 'twice a week' and 'three or four times a week'. This is because people were generally able to be more specific about the frequency of consumption of these foods.

For those foods for which quantification is both straightforward and very important, amounts were requested (e.g. bread; eggs; biscuits; sugar in tea and coffee; glasses of milk, fruit juice, softdrinks, alcohol). For most foods, the questionnaire sought only information on the usual frequency of intake. It has been shown that the accuracy with which people can, without the aid of measuring devices, describe amounts of food eaten in quantifiable terms is poor [8,9]. Furthermore, some evidence suggests that a dietary questionnaire limited to the determination of frequency of consumption can provide information on subjects' relative intake of specific nutrients [10,11]. Estimation of nutrient intake from this questionnaire thus involved use of standard serving sizes for many foods. These were compiled from data on older adults from previous Australian 24-hour diet recall surveys [7]. The standard portion sizes were the average amounts consumed by subjects in these surveys.

20.2.4.2 *Mosgiel questionnaires and interviews*

As subjects were required to give 3-4 hours of their time to other interviews and investigations, it was essential that the dietary assessment method be short, simple and self-administered. The basic design of the food frequency questionnaire used in the Adelaide study was also ideally suited to these circumstances. The New Zealand food frequency questionnaire included a list of some 120 food and drink items plus qualitative questions concerning food preparation and cooking practices (particularly those affecting the fat and salt content of foods), and took into account the seasonality of many food items (e.g. fruits, vegetables, soups). Selection of the food items was based on an earlier diet survey identifying those foods or food groups making important contributions to the diets of older New Zealand adults [12]. Standard serving sizes were compiled from data on older adults from previous New Zealand 24-hour diet recall surveys [13,14].

20.2.5 Dietary analysis

The analysis of both these semi-quantitative questionnaires involves the use of standard serving

sizes for many food items. As the amounts of foods consumed vary from subject to subject, the use of standard portion sizes for many food items means that for individuals the figures resulting from the nutrient analysis program are likely to involve a considerable degree of error. Nevertheless, the validation study of the New Zealand questionnaire demonstrates that it provides very similar information to 10 days of careful diet recording (see next section). Data from both studies has been expressed in relation to the latest US recommended dietary intakes.

20.2.5.1 Adelaide

The results were analysed using a specially adapted version of the FREQUAN program [7,28] which uses as a database a revised version of the McCance and Widdowson food tables [16], which have been adjusted and supplemented to suit Australian conditions, and standard serving or portion sizes [7,17]. The program uses answers to questions concerning cooking and food preparation practices which affect salt, fat or vitamin content to adjust the values obtained from the main frequency questions.

20.2.5.2 Mosgiel

Nutrient values were computed using as the data base the New Zealand food composition tables which consist mainly of British and New Zealand data [18]. The data base is continually being updated and expanded but at the time of this analysis included about 1200 food items. The food frequency questionnaire results were analysed using a program developed in the Department of Human Nutrition, which uses standard serving sizes compiled from 24-hour recall data from the latest New Zealand national diet survey. Many of the standard food amounts used were higher for men than women. The program uses answers to questions concerning cooking and food preparation practices which affect fat content to adjust the values obtained from the main frequency questions. In computing nutrient intakes from the food frequency questionnaire, unanswered items were assumed to be never or rarely consumed; however, 15 subjects with more than 10 blank food items were excluded from the nutrient analysis. This represents exclusion of only 2% of those who returned dietary questionnaires.

20.2.6 Validity of dietary questionnaires

The validity of the semi-quantitative questionnaires used has been investigated using two different approaches. The first approach examined the ability of the questionnaire to measure food intake, and the second focused on the ability to estimate mean group nutrient intakes and to classify individuals according to levels of nutrient intake.

20.2.6.1 Adelaide questionnaire

The Adelaide questionnaire used here was shown to have a high degree of reproducibility or test-retest reliability when comparisons were made between data from questionnaires

administered to a random sample of 153 elderly people at an interval of approximately 18 months [19]. In a group of 40 elderly subjects, a comparison of self-reports of food intake from the food frequency questionnaire with an unexpected direct observation of the foods which subjects had in their home, showed that the questionnaire had a high degree of validity as a tool for assessing food intake in elderly people [20]. The kappa statistic indicated good agreement (in all cases greater than that expected due to chance) between the reported use of individual foods in the questionnaire and the observed presence of absence of those foods in the subject's home.

20.2.6.2 *Mosgiel questionnaire*

Nutrient intakes estimated using the questionnaire were compared with results obtained from five two-day diet records using household measures in a group of 53 older adults (mean age 70 years) in Dunedin [15]. Mean intakes for most nutrients were less than 5% different between the two methods. Correlations between the nutrient intake values (excluding supplements) from the diet records and those from the food frequency questionnaire ranged from a low of 0.34 for zinc in women to more than 0.75 for protein, zinc and calcium in men. For most nutrients, at least 70% of the subjects when classified by the food records fell into the same quintile or into the within-one-quintile category when classified by the food frequency questionnaire. These data indicate that in elderly subjects a simple self-administered semi-quantitative dietary questionnaire can provide very similar information (for both group and individual intakes for many nutrients) to that obtained from 10 days of careful diet recording.

20.3 DEMOGRAPHY

Although the Adelaide study involved subjects over 65 years of age, the results have been reanalysed for comparability with other studies using only those in the 70 and over age group. Characteristics of the study community are tabulated in the appendices, but are briefly outlined here.

20.3.1 Age

In Adelaide, 16% of the men and 20% of the women were 80 years or older, while in Mosgiel 26% of men and 33% of women in the study were in this 'old-old' age group. The higher proportion of subjects in the NZ study population in this age group may be partly explained by the higher response rate in the NZ study combined with the slightly lower response in the 80 years and over group in the Australian study.

20.3.2 Rural/ urban background

Both the Adelaide and Mosgiel communities could be considered to be urban; however, the Mosgiel subjects lived in a small town which serves the surrounding agricultural district.

20.3.3 Marital status

In this respect, the two study populations were generally similar, with higher proportions of elderly men being married and higher proportions of women being widowed. It should be noted that as the NZ population was essentially the entire elderly population of Mosgiel, a number of married couples were included in the population.

20.3.4 Education, occupational status and income

This information was collected only in the Adelaide study. A large proportion of subjects had had little or no formal schooling, and in terms of source of income and occupational status were similar to the general Adelaide population. Although no specific data were collected on these variables for the Mosgiel population, occupational class and property values in the area generally indicated a predominantly middle class retired community without extremes of poverty and wealth.

20.4 SELF-REPORTED HEALTH AND MEDICAL HISTORY

20.4.1 Self-rated health

As can be seen in Appendix A3 Table 10.1, the majority of Adelaide subjects rated their health as being good or very good. Although this question was not asked in the Mosgiel study, a question was asked about how healthy subjects perceived themselves to be compared with others of their own age group and gender. The majority felt they were about the same or a little more healthy than their peers.

20.4.2 Use of medical care

This area was covered only in the Adelaide study. During the year prior to the study, some two-thirds of elderly subjects had consulted a GP once every few months or less often. Some 14-15% of those over 70 years and 17% of those 80 years and over had been hospitalised for at least a week during the year prior to the study.

20.4.3 Health conditions and medications

It is impossible to compare the prevalence of health conditions and use of medications between the two studies because they were self-reported in the Adelaide study (see appendix for results) and were determined from medical records and interviews with a geriatrician in the Mosgiel study. Hypertension, heart conditions and bronchitis/ asthma/ emphysema were the most commonly reported conditions in the Adelaide study. Analysis is currently underway for the Mosgiel study, and results will be published as each area is investigated in detail [34] Dietary habits in elderly diabetics have been investigated in the Adelaide sample [21].

20.4.4 Self-reported use of micronutrient supplements

In the Adelaide study, some one third of men and 45% of women regularly (i.e. at least once a week) used some form of supplement [22]. Note that in this study the broad definition of dietary supplements was used, with a general question covering vitamins, minerals or any other form of supplement such as bran or wheatgerm. In Mosgiel, 8% of men and about 15% of women regularly used some form of micronutrient supplement, and a considerably larger proportion regularly used some other form of supplement such as bran or wheatgerm. Combining the responses from the two separate questions in the Mosgiel study for comparison with the Adelaide results, showed that the prevalence of use of supplements (micronutrient or other) was roughly 10% lower in the Mosgiel population. Common to both studies was the greater popularity of supplements amongst women. Use of supplements on an occasional basis (i.e. vitamin C during a cold) was less prevalent than regular use, and also more common in Australia than New Zealand.

20.4.5 Menstruation and menopause

No information was gathered on these areas.

20.5 FOOD BELIEFS

Although analysis on this topic has only just begun, considerable data exists for the Mosgiel population on food and nutrition attitudes. (see dietary questionnaire in appendix). Self perception of control over future health and its relation to health practices has been investigated using The Mosgiel data base [23]. Subjects who felt they had a great deal of control over future health had lower alcohol, fat, protein and meat intakes, but had the highest carbohydrate, fibre and vegetable intakes. They were also more likely to trim the fat from their meat and to use polyunsaturated margarine.

20.6 FOOD PRACTICES

20.6.1 Past food intake

This was not investigated in either study.

20.6.2 Meal pattern.

The food frequency questionnaire does not collect information on the specific meals at which foods are eaten. However, both studies similarly showed that the majority of elderly people rarely or never missed meals.

20.6.3 Cooking methods

The popularity of the various cooking methods are detailed in Appendix A3 (Adelaide: Tables 10.17-10.27; New Zealand: Tables 11.6 -11.12). Generally the patterns are quite similar in the two countries; however, boiling vegetables, adding salt during cooking and the use of dripping or lard to cook meat were more common in New Zealand; whereas soaking vegetables in water prior to cooking, eating the fat on meat, and the use of polyunsaturated margarine and vegetable oil to cook meat were more common in Australia. The time difference between the studies (1985 - Adelaide vs 1989-90 - New Zealand) must be remembered when comparing food and cooking patterns. Some of the differences (e.g. eating the fat on meat) may reflect a change with time towards habits more in line with the dietary guidelines.

20.7 FOOD PREPARATION, APPETITE AND EATING

20.7.1 Appetite

Although no data on appetite was collected in the Mosgiel study, the questions on appetite used in the IUNS studies are identical to those in the Adelaide study. More than three quarters of the Adelaide subjects reported enjoying their food as much as they used to when younger, and some two-thirds rated their appetite as good or very good. However, the most important reasons for no longer enjoying food as much were a loss of appetite, food no longer smelling or tasting as good (especially in men), a lack of company at mealtimes (particularly in the over-80s), and amongst women, a loss of interest in cooking.

20.7.2 Eating environment and cooking facilities

Virtually all subjects in the Mosgiel study reported having a refrigerator, stove and oven, and adequate storage space. About one quarter reported having a microwave oven. These questions were not covered by the Adelaide study.

20.7.3 Dental status

The prevalence of perceived chewing difficulties in the Adelaide sample is shown in the Tables 10.171 & 10.173 in Appendix A3. The relationship between dental status and dietary intake in this group is described elsewhere [24]. Two thirds of men and over 80% of women in the Mosgiel study had no natural teeth, and over 90% of the study population wore false teeth. Chewing difficulties were investigated by a number of questions: whether subjects perceived problems with chewing food, whether food stuck under false teeth, whether there was pain from false teeth when chewing, whether false teeth were perceived to limit the type of food eaten, or whether false teeth were perceived to cause major problems. Responses to individual items are detailed in the appendix, and 20% of men and 23% of women responded 'yes' to at least one of these questions concerning chewing difficulties.

20.8 FOOD INTAKE

20.8.1 Food indices

Several food scores have been constructed from the food frequency questionnaires in both the Adelaide and Mosgiel studies. The method of computing these has been described in detail elsewhere [25], and they have been usefully applied in investigating the relationships between food choice and other variables such as marital status [26], social class [25], and lifestyle [27]. The Adelaide and Mosgiel questionnaires differ considerably from the IUNS food frequency questionnaire (as summarised in 20.15.1), and thus the food indices are also very different. The IUNS scores represent grams consumed per day from specific food groups, whereas the Adelaide and Mosgiel scores represent the numbers of times per month any items were consumed from a particular food group. The actual scores are not presented here because of the lack of comparability with IUNS results; however, the important point is that it is possible to produce useful food group scores from qualitative food frequency data. Computation of the variety scores used in the Adelaide and Mosgiel studies involved a similar approach to that used in the IUNS studies (i.e. a count of the total number of different foods eaten during a specified period); however, because of the considerably greater length of the IUNS dietary questionnaires, once again the actual scores are not comparable. The interesting question is whether analysis of IUNS study centre data yields similar relationships between dietary variety and socio-economic and lifestyle variables as found in the Adelaide study [25-27].

20.8.2 Individual foods

As a result of the different nature of the food frequency questionnaires, results on the intake of individual foods are presented in terms of frequency of use (Appendix A3: Adelaide: Tables 10.103-10.113; New Zealand: Tables 11.23-11.113), rather than grams consumed per day as is the case in the IUNS studies.

Food habits in Australia and New Zealand are essentially very similar. In New Zealand a number of traditional foods are consumed by Maori and Pacific Island people (e.g. certain fish, leafy vegetables, coconut cream); however, all subjects in the Mosgiel study were Caucasian so this wasn't a source of difference in dietary habits between the two study populations. For several foods, there were differences in the frequency of consumption. Some of the foods eaten more often by elderly New Zealanders included: cheese, puddings, roast meat, mince meat, turnip, cabbage, and silverbeet; however, elderly Australians more frequently ate: breakfast cereals, grapes, rockmelon, steak, chops, and bacon.

20.9 NUTRIENT INTAKE

Different food composition data bases were used for nutrient analysis in the two studies, and this

may account for some of the differences in nutrient intakes between Adelaide and Mosgiel. It is well established that the use of different data bases can lead to differences in nutrient intake even when analysing the same data set. Data bases may differ in the methods of analysis, sampling of foods or degree of completeness.

20.9.1 Nutrients

Nutrient intake results are presented and discussed in detail in two recent papers [28,29]. Energy intakes were very similar for the Adelaide and Mosgiel study populations. In both studies, the estimated mean protein intakes were in excess of the recommendations, (by 17% and 13% in Adelaide and Mosgiel, respectively). The percentage of energy derived from fat was excessive in the Adelaide study (37%), but in Mosgiel was consistent with the recommended goals (33%). P/S ratios, however, appeared to be higher in the Adelaide study. The 4-5 year time difference between data collection in the two studies may partly account for the difference in total fat intake. Carbohydrate contributed a higher proportion of energy intake in Mosgiel. In both studies, fibre intakes were below recommended levels, and alcohol intakes were substantially higher in men than women. Most mean micronutrient intakes were above the recommended levels in the Adelaide and Mosgiel studies, and a large range of intakes was found in both. Calcium, iron, zinc and vitamin A intakes were some 10-20% higher in Adelaide than in Mosgiel. Intakes of ascorbic acid and vitamin E were at least 20% lower in Adelaide than in Mosgiel.

20.9.2 Nutrient density

The differences in nutrient density found reflect the differences in nutrient intake (described above) because the energy intakes were less than 5% different between the two populations.

20.9.3 Proportion below 2/3 of the US RDA

The proportion consuming less than two thirds of the US RDA was higher in Mosgiel for zinc, particularly in women; and was higher in Adelaide for ascorbic acid and vitamin E.

20.10 ANTHROPOMETRIC MEASURES

The only anthropometric measures determined in the Adelaide study were height and weight; however, the Mosgiel study involved a wider range of measurements. Mid-arm circumference and triceps skinfold were measured using a flexible steel tape and Harpenden's skinfold callipers. Neither study determined body fatness by electrical impedance or loss of height.

20.10.1 Body weight, body height and BMI

In the Mosgiel study, weight was measured in light clothing without shoes to the nearest half

kilogram. Height was measured to the nearest centimetre. Heights and weights from the Adelaide study are self-reported. Thus only the Mosgiel data are strictly comparable with data from other centres. A tendency towards under-reporting in overweight subjects may explain the lower proportion of subjects in the BMI =25.1-29.9 category and the lower proportion of women in the BMI \geq 30 category in the Adelaide study.

20.10.2 Body fat distribution (Waist Hip ratio)

This was determined only in the Mosgiel study, and results are shown in Appendix A3, Tables 10.164-10.165. Waist circumference was measured 1 cm below the umbilicus and the hip measurement was the largest measurement over the buttocks.

20.10.3 Skinfold thicknesses

The triceps skinfold was the only measurement made but the results have not been included in this publication.

20.10.4 Mid-arm muscle area

Mean and median values were higher for men than women and in those 70-79 years than in the over-80s.

20.11 BIOCHEMICAL MEASURES

Blood pressure and blood measurements were made only in the New Zealand study. Two hours after the start of a standardised midday meal, venous blood was taken for glucose, insulin and lipid studies. The results shown for each are the mean of two duplicate measurements. The standardised meal was made as close as possible to a usual meal and consisted of meat, three vegetables (including potato) and an apple crumble dessert. The meal contained 100 grams of carbohydrate, 30 grams of fat and 30 grams of protein. None of the following were measured in the Mosgiel study: serum iron, B12, folate, electrolytes, creatinine, urea, fructosamine, albumin, total protein.

20.11.1 Blood pressure

Diastolic blood pressure was similar across the different age and sex groups (Appendix A3, Tables 10.166-10.167), and systolic blood pressure was higher in women than in men.

20.11.2 Serum lipids

Both total and HDL cholesterol levels were higher in women than in men; whereas mean triglyceride levels were slightly lower in women. Compared to results for the 70-79 year age

group, total cholesterol values were lower in the over-80s, HDL levels were similar, and triglyceride levels were lower.

20.11.3 Serum glucose

Glucose was estimated by the glucose oxidase method on an Hitachi 737 autoanalyser. Age was positively correlated with blood glucose levels using a Pearson test (or a Spearman correlation coefficient) in the total sample and in women, but not in men. Mean values were significantly lower for men than for women. Of interest is the finding that in this community-based sample where variations in diet and exercise were not extreme, glucose levels were significantly lower in those women who exercised [30]. Insulin levels were also found to be significantly lower in women who took regular exercise.

20.12 SOCIAL FACTORS & ACTIVITIES

20.12.1 Time spent for social activity

The Adelaide questionnaire includes a similar list of activities to those used in the IUNS studies; however, subjects were simply asked to indicate whether or not they had taken part in each of the activities during the month prior to the study. The list includes both social and physical activities and the results are presented in Appendix A3, Tables 10.166-10.167. However, the different nature of the questions means that the results are not directly comparable with data from IUNS study centres. A lifestyle variable was computed which counted the total number of different activities in which each subject had taken part. Using multiple regression models, this lifestyle variable was found to be the best predictor of dietary variables amongst all those socio-economic and physical factors investigated in the Adelaide study [27]. The lifestyle variable alone accounted for 15% of variance in dietary variety score, and 11% of the variance in the variety of vegetable intake; however, it was not associated with energy intake. Participation in a greater variety of physical and social activities is associated with use of a greater variety of foods, which in turn is linked with higher micronutrient intakes. To borrow a phrase from Baird and Schutz [31] who reported similar relationships between lifestyle and nutritional status (both dietary and biochemical measures), perhaps "positive attitudes and behaviour suggestive of physical, social, emotional, intellectual and economic wholeness - in other words, an entire lifestyle - ... have a positive relationship to both dietary intake and serum nutrient levels".

20.12.2 Social network / support

It is possible that the greater social support associated with a rich and varied lifestyle may be a key to the importance of lifestyle to dietary habits. Social support networks were investigated in detail in the Mosgiel study using the comprehensive instrument of Berkman [32]. A number of items from the instrument have been selected for presentation of results in Appendix A3, Tables 11.173 -11.207, these are generally the ones most comparable with IUNS questions on this topic.

Preliminary analysis of the data show that 9% of men and 10% of women could be classified as having at least one of the following circumstances: no confidant, no-one to count on for emotional support, preference for more emotional support than was received, or a feeling of not being very close to any of his/ her children. Defining this as the 'poor social support' group, women in this group were found to have significantly lower intakes of fibre, vitamin B6, ascorbic acid, iron, copper, potassium and magnesium than the rest of the women in the sample (unpublished results). There were no significant differences for men; however, the men with 'poor social support' as defined in this way formed a very small group.

20.12.3 Living arrangements

In Adelaide, 96% of subjects lived in private dwellings, compared to 94% of Australia's population at the 1981 census. A similar proportion of subjects in Mosgiel were living in private dwellings, and again this was similar to that in New Zealand as a whole. In Mosgiel, 24% of men and 56% of women lived alone, as compared with 17% of men and 46% of women in Adelaide. The difference is probably explained by the higher proportion of subjects in the NZ study population in the over-80 age group. The proportion living alone increases with age.

20.13 LIFESTYLE

20.13.1 Alcohol use

As shown in Appendix A3, Table 11.205, self-reported consumption was greater in men than in women, and in those aged 70-79 years than in the over-80s. It was also found that the proportion of non-drinkers increased with increasing age in both sexes.

20.13.2 Sleep

The Mosgiel study included a detailed investigation of sleeping patterns; however, this topic was not included in the Adelaide study. Questions were similar to those included in the IUNS studies, but rather than asking about usual times of going to bed and getting up, subjects were asked for this information referring to the previous two nights and two mornings. The results were simply averaged in these preliminary analyses (24-hour clock shown). The number of hours sleep is the average computed from the mean times of actually going to sleep and actually waking up over the previous two days. (Table 20.1)

Table 20.1 Hours of sleep per night.

	Men		Women	
	70-79	80+	70-79	80+
Mean time going to bed	22.06	21.78	22.19	21.44
Mean time getting up	7.83	7.86	7.84	7.99

Mean hours sleep	7.58	7.90	7.06	7.78
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20.13.3 Exercise

The only information in the Adelaide study is the very qualitative data on physical activities in the 'Lifestyle' section (see Section 20.12.1). In the Mosgiel study, subjects were asked about how often they had taken part in each of an extensive list of physical activities during the previous four weeks. Subjects could then be classified according to the most vigorous activities he or she had performed at least 12 times in the previous four weeks. Heavy exercise included such activities as digging with a spade, cutting the lawn, chopping wood, playing table tennis or tennis, fitness exercises, jogging or swimming; moderate exercise included activities such as vacuuming, hanging clothes on the line, weeding, bowls, golf, walking to the shops, walking for exercise and fun, walking a mile or more continuously; light activities included dusting, washing dishes, ironing, playing snooker or darts, relaxation classes; and the inactive group included those who performed none of these activities. Subjects were divided into the four groups as follows: heavy exercise - 17%, moderate exercise - 60%, light exercise - 20%, and inactive - 3%.

20.14 DISABILITY

Neither the use of therapeutic aids nor incontinence were investigated in the Adelaide and Mosgiel studies.

20.14.1 Activities of daily living

Although this was investigated in the Mosgiel study, analysis has not yet been completed. The results will not be comparable to the IUNS data due to the different format of the questions (see questionnaire in appendix).

20.14.2 Shopping

In Adelaide, one simple question was asked regarding whether the subject had any difficulties in doing the grocery shopping (they were able to indicate if they were not involved in grocery shopping). Only some 5% of men reported difficulties (with about a third having no involvement in food shopping); however, about one in five women aged 70-79 years and more than a third of the women in the over-80 age group reported difficulties.

In the Mosgiel study, the main person involved in doing the food shopping was recorded. Men usually shared this task with a spouse or other household member, and women usually reported that they did the shopping themselves. However, compared with women aged 70-79 years, only about half as many women in the 80 years and over group did the shopping, with there being a large increase in shopping being done by a person from outside the household or the subject living in a residential home or hospital.

20.15 DIFFERENCES BETWEEN THE ADELAIDE, MOSGIEL AND IUNS STUDIES

20.15.1 Questionnaires

One of the main differences between the Adelaide and New Zealand studies and the IUNS studies is that the whole Adelaide questionnaire and the dietary part of the Mosgiel questionnaire were self-administered, rather than interviewer administered as in the case of the IUNS studies. The Adelaide study was a mail survey, and in the New Zealand study the dietary questionnaire was self-completed and then reviewed with the subject by one of the research team.

The New Zealand study is more comprehensive than the Adelaide study, and is the more comparable of the two with the IUNS studies in terms of the depth and variety of information gathered. There are, however, in several instances differences in the way topics are investigated or questions are worded. For example, in the sections on exercise, activities of daily living, social activity, social networks.

Below is a list of some of the areas of investigation covered by the IUNS questionnaire, but not by the Adelaide and New Zealand studies:

- Health of subject's family members.
- Health aids.
- Eating out.
- Food and religion.
- Eating utensils, "table" practices, cooking/ serving/ eating vessels.
- Electrical impedance
- Skin test
- Interviewer assessment

Areas covered by the IUNS and New Zealand studies, but not by the Adelaide study:

Exercise, activities of daily living, social networks, biological variables, minimal state examination, depression, sleep, bowel habits smoking, anthropometry. Food-related: storage and cooking facilities, food beliefs.

Areas covered by the IUNS and Adelaide studies, but not the Mosgiel study:

- Detailed self-assessment of health status.
- The Mosgiel study included very little demographic data, in particular no information was collected on socio-economic status.

20.15.2 Dietary intake assessment

The Adelaide and New Zealand food frequency questionnaires are essentially the same in design, the only differences being in the total number of items (the New Zealand questionnaire being about 30 items longer). The Adelaide questionnaire was the first to be designed, used and validated as a means of measuring food use in elderly people. The New Zealand questionnaire was simply an adaptation of the Adelaide questionnaire with the addition of several foods which, on the basis of the previous NZ dietary surveys and pre-testing with elderly New Zealanders, appeared to be an important part of the NZ diet. The NZ questionnaire was subsequently more thoroughly validated as a measure of nutrient intake.

These questionnaires were developed for use in large scale population studies aiming at achieving high response rates, and as such are relatively short and simple to complete. The last three differences listed below add substantially to the time taken to complete the IUNS questionnaire. The main differences between the above questionnaires and the IUNS questionnaire are:

- the use of a five option multi-choice frequency of consumption scale in the Adelaide and New Zealand studies, and use of a code scheme to describe frequency of intake in the IUNS studies.
- the Adelaide and New Zealand questionnaires were self-administered
- the longer food list in the IUNS questionnaire
- the investigation of past food intake (i.e. before the second World War) in the IUNS questionnaire
- questioning on serving size (in conjunction with food photographs) in the IUNS questionnaire, whereas the other two questionnaires are semi-quantitative (i.e. information on amounts was requested only for a limited number of foods).

Furthermore, the IUNS study involves a far more detailed investigation of alcohol intake than the Adelaide and NZ studies, and also collects data on time of eating (which is not considered at all in the latter studies), and details of how food intake has changed over the years (more, same, less of particular food types). Several aspects of the Adelaide and New Zealand food frequency questionnaires and food-related questions are extremely similar or identical to the IUNS dietary questionnaire: appetite, food avoidance, eating environment, fat and salt, cooking methods.

20.16 SUMMARY

ADELAIDE (SOUTH AUSTRALIA) STUDY

- The Adelaide study was conducted between 1985-1986 on 2195 Caucasian subjects of Anglo-Celtic ancestry aged 65+; 16% of the men and 20% of the women were aged 80+; 17% of men and 46% of women lived alone.
- A self-completed mail-administered questionnaire and semi-quantitative food frequency questionnaire (90 food and drink items) were used.
- The sample was randomly selected from electoral rolls (only subjects living in residential homes in urban areas were included in the study). Response rate 77%. The sample was representative of elderly living in Adelaide and Australia.
- This study has a cross-sectional design and aimed to (a) describe dietary patterns and nutrient intake (b) investigate the relationship between various social, psychological and physical factors and diet in old age. Blood tests were not performed and only self-reported height and weight were obtained.

NEW ZEALAND (MOSGIEL) STUDY

- The New Zealand study was conducted between 1989-1990 on 782 Caucasian subjects of Anglo-Celtic ancestry aged 70+; 26% of the men and 33% of the women were aged 80+; 24% of men and 56% of women lived alone.
- An interviewer administered questionnaire for the health & lifestyle questions and a self-administered food frequency questionnaire (120 food and drink items, similar to the Adelaide questionnaire) were used.
- The sample was randomly selected from the Mosgiel Health Centre (all subjects sampled were living in residential homes in urban areas). Response rate 92% for Health & Lifestyle questionnaire and 85% for Food Frequency questionnaire. The sample was representative of elderly living in Mosgiel.
- The study has a cross-sectional design and the aims were similar to the Adelaide study. However, more detailed information was gathered on lifestyle habits, social support, mental state and bowel function. Also a physical examination was performed (included blood pressure, blood glucose, insulin and lipids) as well as anthropometric measurements (tricep skinfold, mid arm circumference, weight, height, umbilical circumference and maximum circumference over the buttocks).
- The New Zealand study is more comparable to the IUNS study than the Adelaide study. However, differences in the way topics are investigated or questions are worded make comparisons difficult, for example, in the sections on exercise, activities of daily living, social activity, social networks. Furthermore, the semi-quantitative nature of the food

frequency questionnaire limits comparisons with the quantitative food frequency questionnaire used in the IUNS study.

20.17 REFERENCES

1. Horwath CC. Dietary changes reported by a random sample of elderly people. *Journal of Nutrition for the Elderly*, 1992(a);1 2(2): 13-27.
2. Dillman DA. *Mail and telephone surveys: The total design method*. Wiley, New York, 1978.
3. Department of Statistics, *Elderly Population of New Zealand*. Catalogue No. 03.110, March, 1990.
4. Australian Bureau of Statistics: *Australia's age population 1982*, Catalogue No. 4109.0, 1982.
5. Australian Bureau of Statistics : Catalogue 3201.0, *Estimated resident population by sex and age : States and territories of Australia, June 1985 and preliminary June 1986*. Issued November, 1986.
6. Nixon J, Pearn J. Norms for the social class distribution: Reference data for epidemiological and health studies. *Med J Aust*, 1980; 2(5): 271-73.
7. Baghurst KI, Record SJ. Intake & sources, in selected Australian subpopulations, of dietary constituents implicated in the etiology of chronic diseases. *J Food & Nutr*, 1983; 40(1): 1-15.
8. Baghurst KI, Record SJ. A computerised dietary analysis system for use with diet diaries or food frequency questionnaires. *community Health Studies*, 1984; 8(1): 11-18.
9. Guthrie HA. Selection and quantification of typical food portions by young adults. *J Am Diet Assoc*, 1984; 84(12): 1440-4.
10. Rapp SR, Dubbert PM, Burkett PA, Buttross Y. Food portion size estimation by men with type II diabetes. *J Am Diet Assoc*, 1986; 86(2): 248-51.
11. Samet JM, Humble CG, Skipper BE. Alternatives in the collection and analysis of food frequency interview data. *Am J Epidemiol*, 1984; 120(4): 572-81.
12. Pietinen P, Hartman A, Haapa E, et al.. Reproducibility and validity of dietary assessment instruments I and II. *J Am Diet Assoc*, 1986; 86(2): 249-51.
13. Birkbeck JA. *New Zealanders and their diet. A report to the National Heart Foundation of New Zealand on the National Diet Survey 1977*. Second revised edition, 1983.

14. Wilson N, Russell DG, Paulin J, Hopkins W, Horwath CC, Mann J, Nye T, Parnell W, Spears G, Wilson B, Worsley T, Cushman G, Laidler A, Birkbeck J. Life in New Zealand Survey, Hillary Commission for Recreation and Sport. Summary Report, University of Otago, 1990.
15. Unpublished 24 hour recall results from The Life in New Zealand survey, 1991.
16. Horwath CC. Validity of a short food frequency questionnaire for estimating nutrient intake in elderly people. *British Journal of Nutrition* 1993; 70: 3-14.
17. Paul AA, Southgate DAT. McCance and Widdowson's The composition of foods. HMSO London, 1978.
18. Baghurst KI, Baghurst PA. The measurement of usual dietary intake in individuals and groups. *Transactions of the Menzies Foundation* 1981; 3: 139-60.
19. Milligan GC, Webster BW, Burlingame BA. The New Zealand Food Composition Tables, Department of Scientific and Industrial Research, Biotechnology Division, 1988.
20. Horwath CC. A random population study of the dietary habits of elderly people. PhD thesis. Dept. of Community Medicine, Adelaide University, South Australia, 1987.
21. Horwath CC, Worsley A. Assessment of the validity of a food frequency questionnaire as a measure of food use by comparison with direct observation of domestic food stores. *American Journal of Epidemiology*, 1990; 131(6): 1059-67.
22. Campbell AJ, Busby WJ, Horwath CC. Factors associated with constipation in a community based sample of people 70 years and over. *Journal of Epidemiology & Community Health*, 1993; 47: 23-6.
23. Horwath CC, Worsley A. Dietary habits of elderly persons with diabetes. *Journal of the American Dietetic Association*, 1991; 91(5): 553-57.
24. Horwath CC, Worsley A. Dietary supplement use in a randomly selected group of elderly Australians - results from a large nutrition and health survey. *Journal of the American Geriatrics Society*, 1989; 37(8): 689-696.
25. Campbell AF Busby WJ, Horwath CC, Robertson MC. Control over future health in old age: Characteristics of believers and sceptics, Submitted Oct, 1993.
26. Horwath CC. Chewing difficulty and dietary intake in the elderly. *Journal of Nutrition for*

- the Elderly, 1989; (92): 17-24.
27. Horwath CC. Socio-economic status and dietary habits in the elderly: Results from a large random survey. *Journal of Human Nutrition and Dietetics*, 1989(b); 2(3): 173-83.
 28. Horwath CC. Marriage and diet in elderly Australians: Results from a large random survey. *Journal of Human Nutrition and Dietetics*, 1989(c); 2(3): 185-93.
 29. Horwath CC. Socio-economic and behavioural effects on the dietary habits of elderly people. *International Journal of Biosocial and Medical Research*, 1989(d); 11(1): 15-30.
 30. Horwath CC. Dietary survey of a large random sample of elderly people: Energy and Nutrient intakes. *Nutrition Research*, 1989(a); 9: 479-92.
 31. Horwath CC, Campbell AJ and Busby W. Dietary survey of an elderly New Zealand population. *Nutrition Research*. 1992; 12: 441-453.
 32. Campbell AJ, Busby WJ, Horwath CC, Robertson MC. Relation of age, exercise, anthropometric measurements and diet with glucose and insulin levels in a population aged 70 years and over. *American Journal of Epidemiology*. 1993; 138(9): 688-96.
 33. Baird PC, Schutz HG. Life style correlates of dietary and biochemical measures of nutrition. *J Am Diet Assoc*, 1980; 76(3): 228-235.
 34. Berkman LF. The assessment of social networks and social support in the elderly. *J Am Geriatr Soc*, 1983; 31: 743-49.

CHAPTER 20

STUDIES IN ADELAIDE, SOUTH AUSTRALIA AND MOSGIEL, NEW ZEALAND STUDY

20.1 PEOPLE, PLACE, THE LIVING ENVIRONMENT AND THE SOCIETY

- 20.1.1 Geography and climate
- 20.1.2 Culture, religion and history
- 20.1.3 General demography and health statistics of the community
- 20.1.4 Housing
- 20.1.5 State of development

20.2 METHODOLOGY

- 20.2.1 Population selection and representativeness
- 20.2.2 Response rate and refusals
- 20.2.3 Data collection
- 20.2.4 The questionnaires
- 20.2.5 Dietary analysis
- 20.2.6 Validity of dietary questionnaires

20.3 DEMOGRAPHY

- 20.3.1 Age
- 20.3.2 Rural/ urban background
- 20.3.3 Marital status
- 20.3.4 Education, occupational status and income

20.4 SELF-REPORTED HEALTH AND MEDICAL HISTORY

- 20.4.1 Self-rated health
- 20.4.2 Use of medical care
- 20.4.3 Health conditions and medications
- 20.4.4 Self-reported use of micronutrient supplements
- 20.4.5 Menstruation and menopause

20.5 FOOD BELIEFS

20.6 FOOD PRACTICES

- 20.6.1 Past food intake
- 20.6.2 Meal pattern.
- 20.6.3 Cooking methods

20.7 FOOD PREPARATION, APPETITE AND EATING

- 20.7.1 Appetite

20.7.2 Eating environment and cooking facilities

20.7.3 Dental status

20.8 FOOD INTAKE

20.8.1 Food indices

20.8.2 Individual foods

20.9 NUTRIENT INTAKE

20.9.1 Nutrients

20.9.2 Nutrient density

20.9.3 Proportion below 2/3 of the US RDA

20.10 ANTHROPOMETRIC MEASURES

20.10.1 Body weight, body height and BMI

20.10.2 Body fat distribution (Waist Hip ratio)

20.10.3 Skinfold thicknesses

20.10.4 Mid-arm muscle area

20.11 BIOCHEMICAL MEASURES

20.11.1 Blood pressure

20.11.2 Serum lipids

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20.12 SOCIAL FACTORS

20.12.1 Time spent for social activity

20.12.2 Social network/ support

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20.15.1 Questionnaires

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