A dietary survey of older people in Edinburgh

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1. Dietary histories covering 1 week were obtained from 212 men and 263 women, aged 62–90 years, who formed a random sample of the older people living in a defined area of Edinburgh. The histories were validated by 2 d weighed-diet records for 219 of the subjects.

2. Nutrient intakes are given as mean values and standard deviations, and as percentage distributions of intake relative to the recommended intakes of nutrients. Intakes are also related to factors which might affect diet adversely.

3. Mean values obtained suggested that intakes were less than recommended intakes for more nutrients for women than for men, particularly values for energy and vitamin D. Values for percentage distributions indicated that a substantial proportion of all subjects had low intakes of ascorbic acid and vitamin D, that the energy intake of many women was low and that for most nutrients a greater proportion of men than of women had the recommended intake. Factors associated with significant proportions of subjects with less than the recommended intakes were mental illness in women and deafness and severe dyspnoea in men.

4. Possible action to improve the diet of the elderly is discussed.

The results of a nutrition survey of the elderly (Department of Health and Social Security, 1972) suggested that the diet of older people is qualitatively similar to, but less in quantity than that of the rest of the population. A longitudinal study of ageing persons has been in progress in Edinburgh since 1968. So far the subjects have been examined on three separate occasions. Food intake was studied during the first of these three examinations. The results, which are described in this paper, although broadly similar to those of the survey, are capable in some respects of different interpretation.

METHODS

Subjects

The subjects studied were 215 men and 272 women, aged 62–90 years, who were a simple random sample of 27000 older people living in a defined area of Edinburgh. The method of sampling with a comparison of respondents and non-respondents has been described in detail elsewhere (Milne, Maule & Williamson, 1971).

Dietary survey

Dietary histories covering 1 week were obtained by one of us (M.E.L.) from 212 men and 263 women. Weighed-diet records for 2 d were also obtained from 219 of the subjects. The latter were not selected from all subjects by random sampling but because they were able to see and co-operate. They may therefore have been less impaired intellectually than some of the others. Dietary histories were compared with weighed-diet records by subtracting, for each individual, nutrient intakes obtained by

Table 1. *Validation of dietary histories for older people, assessed by comparing diet histories covering 1 week and weighed-diet records for 2 d*

(Mean values with their standard errors for differences between daily intake assessed by diet history and by weighed-diet record, and correlation coefficients (r) between dietary histories and weighed-diet records for 219 subjects)

	Mean difference	SE of mean difference	Statistical significance of mean difference from zero: t	P	r*
Energy: kcal	61·32	14·66	4·18	<0·01	0·94
MJ	0·26	0·06			
Total protein (g)	−0·17	0·62	0·28	NS	0·87
Fat (g)	2·61	0·86	3·02	<0·01	0·89
Carbohydrate (g)	9·54	1·83	5·22	<0·01	0·94
Calcium (mg)	42·44	9·81	4·32	<0·01	0·87
Iron (mg)	−0·24	0·15	1·65	NS	0·76
Vitamin A (μg retinol equivalent)	−90·38	212·13	0·43	NS	0·62
Thiamin (mg)	0·004	0·009	0·44	NS	0·85
Riboflavin (mg)	0·003	0·022	0·14	NS	0·86
Nicotinic acid (mg)	−0·65	0·17	3·82	<0·01	0·92
Ascorbic acid (mg)	2·31	1·01	2·28	<0·05	0·70
Vitamin D (μg cholecalciferol equivalent)	−0·33	0·22	1·50	NS	0·79
Pyridoxine (mg)	−0·011	0·013	0·85	NS	0·89

NS, not significant.
* For all results: $P < 0·01$.

weighing from those obtained by history. From the differences the mean difference with its standard error was calculated for energy intake and for each nutrient (Table 1). The t test was used to determine whether the mean differences differed significantly from zero. Of the thirteen nutrients in Table 1, for seven the mean difference did not differ from zero and for the remainder the differences, although statistically significant, were not large. Also given in Table 1 are correlation coefficients between dietary intakes determined by history and by weighing.

Food tables prepared by the Ministry of Health (Disselduff, Marr & Robertson, 1968) were used to calculate the intakes given in Tables 2 and 3. The dietary histories were obtained in the subjects' homes a few days after examination of the subjects by a physician (J.S.M.) and a psychiatrist (M.M.M.). Both these workers used a semi-structured questionnaire to obtain information about past and present health. Full clinical examination was done and a number of variables associated with ageing were measured. Particular attention was paid to factors which might affect the intakes adversely. Angina and intermittent claudication were diagnosed using Rose's questionnaire (Rose & Blackburn, 1968). Dyspnoea and persistent cough and phlegm were estimated using the Medical Research Council Committee on the Aetiology of Chronic Bronchitis (1965) questionnaire on respiratory symptoms. Information about other physical disabilities was collected during clinical examination. Mental illness was assessed at a full psychiatric examination.

Height was measured with a Harpenden stadiometer (Holtain Ltd, Brynberian, Crymych, Dyfed, Wales) and body-weight, wearing clothing weighing less than 500 g,

was measured with a lever balance accurate to 100 g. Relative weights were calculated by expressing measured body-weights as percentages of the appropriate desirable 'weight-for-height' taken from the tables of the Metropolitan Life Insurance Company (Halpern, Glenn & Goodhart, 1960), using the median weight for the medium-sized body frame. Handgrip was measured with a mercury manometer (Milne, Maule, Cormack & Williamson, 1972). Visual acuity was assessed with Snellen's types and hearing loss was assessed by pure-tone audiometry. Respiratory function was examined with a Vitalograph spirometer (Vitalograph Ltd, Maids Moreton House, Buckingham) and $FEV_{1.0}\%$ (Milne & Williamson, 1972*a*) calculated from the results.

The dietary histories were obtained and the examinations done during the period January 1968–January 1970. A sociological assessment was also made of the same subjects in their own homes a few months after the other examinations, and the findings have been used in the present study. Classification of social class was based on that of the General Register Office (1966).

RESULTS

The dietary findings (nutrient intakes) are given first as mean values and standard deviations for groups of men and of women aged 62–74 years and 75–90 years. Secondly the findings for the same four groups are expressed as the percentage of each group who consumed less than 50, 50–99 and 100 or more % of the recommended intakes of various nutrients (Department of Health and Social Security, 1969). Finally the groups of subjects taking the recommended intakes or less for six of the nutrients are considered in relation to the presence of certain 'risk' factors which might be associated with the consumption of poorer diets.

Tables 2 and 3. Mean values and standard deviations for the intakes of energy and of the various nutrients are given for the two age groups of men in Table 2 and for the same age groups of women in Table 3. The results suggested that more intakes for women than for men were below those recommended, particulary those for energy and vitamin D. For most nutrients, intake decreased progressively with age.

Tables 4 and 5. The percentage distributions of the relative intakes (intake as a percentage of the recommended intake (Department of Health and Social Security, 1969)) of nutrients for the two age groups of men and of women are given in Tables 4 and 5 respectively. The only items for which 75% of the subjects ate the recommended amount or more were total protein, calcium and nicotinic acid. This was true for both groups of men and for the younger group of women. For the older group of women the only nutrient with this level of intake was Ca. At the opposite extreme a substantial proportion of all subjects (between 10 and 44%) eat less than 50% of the recommended intakes of ascorbic acid and vitamin D. The values for percentage distribution of intake suggested that many men and women eat diets deficient in ascorbic acid and vitamin D and confirmed that energy intake was low for many women and that for most nutrients a greater percentage of men than women had recommended intakes.

Table 2. *Daily intakes* of various nutrients for two age groups of older men, obtained from dietary histories covering 1 week*

(Mean values and standard deviations)

	Age groups			
	62–74 years (*n* 158†)		75–90 years (*n* 54)	
	Mean	SD	Mean	SD
Energy: kcal	2494	587	2176	546
MJ	10·5	2·5	9·1	2·3
Total protein (g)	74·5	16·5	69·5	17·3
Fat (g)	102·8	27·8	90·8	26·2
Carbohydrate (g)	293·8	78·4	266·2	73·7
Calcium (mg)	958	293	964	276
Iron (mg)	11·7	3·0	10·7	2·8
Vitamin A (μg retinol equivalent)	1158	631	1004	504
Thiamin (mg)	0·9	0·2	0·9	0·2
Riboflavin (mg)	1·7	0·6	1·5	0·5
Nicotinic acid (mg)	17·0	7·8	13·5	6·6
Ascorbic acid (mg)	32·5	14·7	32·3	19·4
Vitamin D (μg cholecalciferol equivalent)	3·1	2·6	2·4	2·2
Pyridoxine (mg)	1·3	0·4	1·2	0·4
Energy (%) from:				
Protein	12·1	1·9	13·0	2·2
Fat	37·5	7·2	37·8	6·5
Carbohydrate	44·1	5·2	46·0	6·3
Alcohol	6·3	—	3·2	—

* Calculated from dietary histories using food tables (Disselduff, Marr & Robertson, 1968).
† Three missing values.

Clinical information is available for two men and five women whose energy intake was less than 50% of the recommended amount. One man had a painful healing operation wound in his mouth and the other was socially deprived. Of the five women, one later died of a carcinoma of the colon, one had diabetic retinopathy with severe osteoarthritis of the hip, one had poor vision with fixed flexion in both knees and the remaining two had no discoverable reason for low intake.

The following 'risk' factors were not found to have any association with intake for six nutrients (energy, protein, Ca, iron, ascorbic acid, vitamin D): intermittent claudication, visual acuity ($\geqslant 6:60$), haemoglobin (< 120 g/l), $FEV_{1\cdot0}$ ($< 60\%$), congestive heart failure, persistent cough and phlegm, reduced hip movement, reduced knee movement, stroke, living alone, recent bereavement. There were several factors apparently associated with intakes lower than the recommended levels for one particular nutrient. These were for men: angina, ascorbic acid; regular attention from doctor, energy; not married, Fe; social class III, IV or V, ascorbic acid; for women: peptic ulcer, vitamin D; handgrip (< 120 mm Hg), ascorbic acid; neurosis, ascorbic acid; not married, vitamin D. These seven isolated instances may have occurred by chance in 264 χ^2 tests used in assessing 'risk' factors. However, bilateral handgrip below 120 mm Hg is known to be associated with dementia (Milne *et al.* 1972) and

Table 3. *Daily intakes* of various nutrients for two age groups of older women, obtained from dietary histories covering 1 week*

(Mean values and standard deviations)

	Age group			
	62–74 years (*n* 190†)		75–90 years (*n* 73‡)	
	Mean	SD	Mean	SD
Energy: kcal	1771	394	1648	331
MJ	7·4	1·7	6·9	1·4
Total protein (g)	57·8	11·2	54·4	12·3
Fat (g)	85·2	22·8	74·5	17·1
Carbohydrate (g)	203·0	54·3	201·0	49·5
Calcium (mg)	799	216	786	216
Iron (mg)	9·0	2·0	8·1	2·1
Vitamin A (μg retinol equivalent)	1014	542	825	353
Thiamin (mg)	0·8	0·2	0·7	0·2
Riboflavin (mg)	1·2	0·3	1·1	0·4
Nicotinic acid (mg)	9·6	2·3	8·7	2·5
Ascorbic acid (mg)	32·3	18·1	29·4	22·9
Vitamin D (μg cholecalciferol equivalent)	2·0	1·6	1·8	1·6
Pyridoxine (mg)	0·9	0·2	0·9	0·2
Energy (%) from:				
Protein	13·3	2·1	13·3	1·7
Fat	43·1	5·0	40·7	4·9
Carbohydrate	43·2	5·7	45·7	5·5
Alcohol	0·4	—	0·3	—

* Calculated from dietary histories using food tables (Disselduff, Marr & Robertson, 1968).
† Three missing values.
‡ Six missing values.

reduced intake of ascorbic acid in men of social classes III, IV and V may reflect the greater likelihood of buying fruit by men in social classes I and II.

There were however three groups of 'risk' factor in which values for intake which were significantly inadequate, were predominant. For men these were dyspnoea of grade 3 (Medical Research Council Committee on the Aetiology of Chronic Bronchitis, 1965) or more, and hearing loss of 30 dB or more in the lower frequencies. For women, five significantly inadequate values were associated with the presence of mental illness, particularly dementia.

Table 6. Mean heights and body-weights and standard deviations are given in Table 6 for the four groups of subjects. Relative body-weights (body-weight as a percentage of desirable 'weight-for-height') of 120% or more were found in 37% of men and 56% of women. There was no difference between those with relative weights above and below 120% in respect of intakes above and below those recommended except for protein and Fe for men, for whom the intake in a greater percentage of the heavier group was greater than that recommended.

Table 4. *Percentage of older men of two age groups whose daily intake of various nutrients was different from that recommended by the Department of Health and Social Security* (1969)

	Age group							
	62–74 years (*n* 158*)				75–90 years (*n* 54)			
Intake as a percentage of recommended intake ...	< 50	50–99	⩾ 100	Recommended intake	< 50	50–99	⩾ 100	Recommended intake
Energy	1·2	40·5	58·2	2350 kcal 9·9 MJ	—	53·7	46·3	2100 kcal 8·8 MJ
Total protein	0·6	15·8	83·5	59 g	—	14·8	85·2	53 g
Calcium	0·6	4·4	94·9	500 mg	—	—	100·0	500 mg
Iron	1·3	26·0	72·8	10 mg	1·9	38·9	59·3	10 mg
Vitamin A	1·3	19·6	79·1	750 μg retinol equivalent	—	31·5	68·5	750 μg retinol equivalent
Thiamin	1·9	50·0	48·1	0·9 mg	1·9	29·6	68·5	0·8 mg
Riboflavin	3·2	56·3	40·5	1·7 mg	3·7	72·2	34·1	1·7 mg
Ascorbic acid	10·2	35·5	54·4	30 mg	16·7	44·4	38·9	30 mg
Vitamin D	17·7	37·4	44·9	2·5 μg cholecalciferol equivalent	26·0	46·3	27·8	2·5 μg cholecalciferol equivalent
Nicotinic acid	—	20·9	79·1	11 mg†	—	16·7	83·3	9 mg†
Pyridoxine	20·3	74·7	5·1	2 mg	40·7	55·5	3·7	2 mg

* Three missing values.
† British Medical Association (1950) recommended intake.

Table 5. *Percentage of older women of two age groups whose daily intake various nutrients was different from that recommended by the Department of Health and Social Security* (1969)

	Age group							
	62–74 years (*n* 190*)				75–90 years (*n* 73†)			
Intake as a percentage of recommended intake ...	< 50	50–99	⩾ 100	Recommended intake	< 50	50–99	⩾ 100	Recommended intake
Energy	2·1	73·7	24·2	2050 kcal 8·6 MJ	1·4	72·6	26·0	1900 kcal 8·0 MJ
Total protein	—	25·8	74·2	51 g	1·4	31·5	67·1	48 g
Calcium	—	8·4	91·6	500 mg	—	8·2	91·8	500 mg
Iron	2·1	67·9	30·0	10 mg	6·8	76·7	16·4	10 mg
Vitamin A	0·5	32·6	66·8	750 μg retinol equivalent	1·4	53·5	45·2	750 μg retinol equivalent
Thiamin	1·1	67·4	31·6	0·8 mg	2·7	52·0	45·2	0·7 mg
Riboflavin	5·3	64·7	30·0	1·3 mg	2·7	78·1	19·2	1·3 mg
Ascorbic acid	12·6	43·6	43·7	30 mg	17·8	46·6	35·6	30 mg
Vitamin D	32·6	46·3	21·1	2·5 μg cholecalciferol equivalent	43·8	42·5	13·7	2·5 μg cholecalciferol equivalent
Nicotinic acid	0·5	20·0	79·5	8 mg‡	2·7	41·1	56·2	8 mg‡
Pyridoxine	71·6	28·4	—	2 mg	78·1	21·9	—	2 mg

* Three missing values.
† Six missing values.
‡ British Medical Association (1950) recommended intake.

Table 6. *Heights and body-weights of older men and women of two age groups, whose dietary history was studied*

(Mean values and standard deviations)

Age group	Height (m)		Body-weight (kg)	
	Mean	SD	Mean	SD
Men				
62–74 years (*n* 159)	1·676	0·0666	67·8	11·98
75–90 years (*n* 52)	1·661	0·0777	69·2	12·74
Women				
62–74 years (*n* 190)	1·551	0·0652	62·9	12·37
75–90 years (*n* 74)	1·521	0·0611	57·7	12·65

DISCUSSION

The recommended intakes of the Department of Health and Social Security (1969) are known to be based on scanty evidence (Hyams, 1973) and are therefore of doubtful value in assessing nutritional status. However, in the absence of satisfactory tests for slight malnutrition, the dietary intakes in this survey have been expressed as percentages of the recommended intakes.

There was no gross evidence of malnutrition on clinical examination in the present study. Anaemia of all kinds, based on the WHO (1959) definition, was present in only 8% of persons examined (Milne & Williamson, 1972*b*). Two men had zero levels of leucocyte ascorbic acid, suggesting that overt scurvy was imminent; in fact one of the men, who had lived alone in a poor area, had had scurvy some years previously. The largest group with abnormal nutrition was the 'overweight' group but there was no difference between those with relative weights of 120% or more and those with relative weights less than this in respect of intakes above and below those recommended, except for protein and Fe for men, for whom the intake in the 'overweight' group was greater than that recommended. Possible clinical reasons for low energy intake have been discussed (see p. 520).

The surveys most suitable for comparison with the present study are that reported by the Panel on Nutrition of the Elderly (Department of Health and Social Security, 1972) (DHSS survey) and one recently published in Glasgow (Macleod, Judge & Caird, 1974*a*, *b*, 1975).

In both the DHSS survey and the Glasgow survey, as in the present study, mean energy intakes in men exceeded those in women, and in both sexes energy intake decreased with age. Mean values were similar in the three surveys and although mean values for men were similar to recommended values those for women were less than recommended values. Recommended energy intakes are based on the decrease known to occur in the basal metabolic rate as age increases (Bender, 1971). In the present study, the percentage of subjects taking less than the recommended amount were 42–54% for men and approximately 75% for women. In view of the known good

health of many people with energy intakes less than the recommended amount, this may only indicate that the values recommended for women are too high. Alcohol supplied 6·3 and 3·2 % respectively of the energy intakes of younger and older groups of men in our survey but less than 0·5 % of the energy intake of women.

Mean values for total protein intake in the present study were similar to those in the DHSS survey and the Glasgow survey. Minimum daily protein requirements are given as 45 g for men and 38 g for women (Department of Health and Social Security, 1969). In the present study values for 2·5 % or less of the men and 5 % of the women were below the minimum.

For other nutrients in Tables 2 and 3, mean intakes are similar in the three surveys. For ascorbic acid mean intakes in our study are similar to those found in the northern areas surveyed in the DHSS survey. A government report on household food consumption states that diets in Scotland and in northern England contain comparatively little fresh fruit and fresh green vegetables (Ministry of Agriculture, Fisheries and Food, 1973). Other studies mention the probability of reduced intakes of ascorbic acid in the elderly (Brin, Dibble, Peel, McMullen, Bourquin & Chen, 1965; Exton-Smith, 1968; Bender, 1971). Mean values for vitamin D intake were lower in our survey than in the DHSS survey, although in both surveys and in the Glasgow survey, the men had a higher mean intake than the women. In our survey this could be because, on the whole, more men than women eat margarine. Low intakes of vitamin D were also found in the Glasgow survey. Exton-Smith (1968) commented on the frequency of low intakes of vitamin D in the elderly.

We believe that the present study showed inadequate intakes of vitamin D and ascorbic acid in a considerable proportion of elderly subjects in Edinburgh in 1968–9. With respect to the low intake of vitamin D, this agrees with the high prevalence of osteomalacia reported in Scotland (Anderson, Campbell, Dunn & Runciman, 1966; Chalmers, Conacher, Gardner & Scott, 1967). Recent work on the effects of high intake of ascorbic acid in protecting against the common cold and alleviating its symptoms (Wilson, 1971; Hume & Weyers, 1973) suggests that it may be needed in larger amounts than 30 mg daily. The DHSS survey report suggests giving fortified foods or prophylactic vitamins to some 'high-risk' groups of the elderly; in particular, fortified milk in containers capable of preserving milk against the effects of sunlight is mentioned. Health education for the elderly, as advised in the report of the DHSS survey, is obviously important where diet is concerned.

The present study associates disability with possible malnutrition in respect of deafness and dyspnoea in men and mental illness in women. The association of mental illness with reduced intake has been described by others, particularly with dementia (Exton-Smith, 1971) and depression (Exton-Smith, Stanton & Windsor, 1972) as in the present study. Malnutrition has also been associated with locomotor disorders (Exton-Smith, 1971), bereavement and regular medical attention (Bender, 1971) but the present study does not support these relationships. More sophisticated analysis of diet in certain disabled groups is needed.

The acceptance rates are similar in the three surveys being 70 % in the DHSS survey and the Glasgow survey, and 65 % in our study. This relatively high refusal

rate is common to other surveys of the elderly (Cochrane, 1954; Seiler, Welstead & Williamson, 1958; Cartwright, 1959) and perhaps has to be accepted as an inevitable disadvantage of surveying this part of the population. Some evidence in the present study suggested that non-respondents were marginally more healthy (Milne *et al.* 1971).

Finally the authors agree with the report of the DHSS survey that there is need for follow-up studies of subjects with different extents of adequacy of dietary intake. Stanton & Exton-Smith (1970) have shown that despite apparent reductions in intake with increasing age in cross-sectional surveys, longitudinal studies suggest that decreasing intake with increasing age is associated with disability; healthy subjects maintain the same intakes as they grow older. The present study is prospective to allow follow-up of the health of survivors. It will also be possible to relate survival to dietary intake at the first examination thus investigating the possible prognostic value of the dietary survey.

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