Nutrition of Housebound Old People

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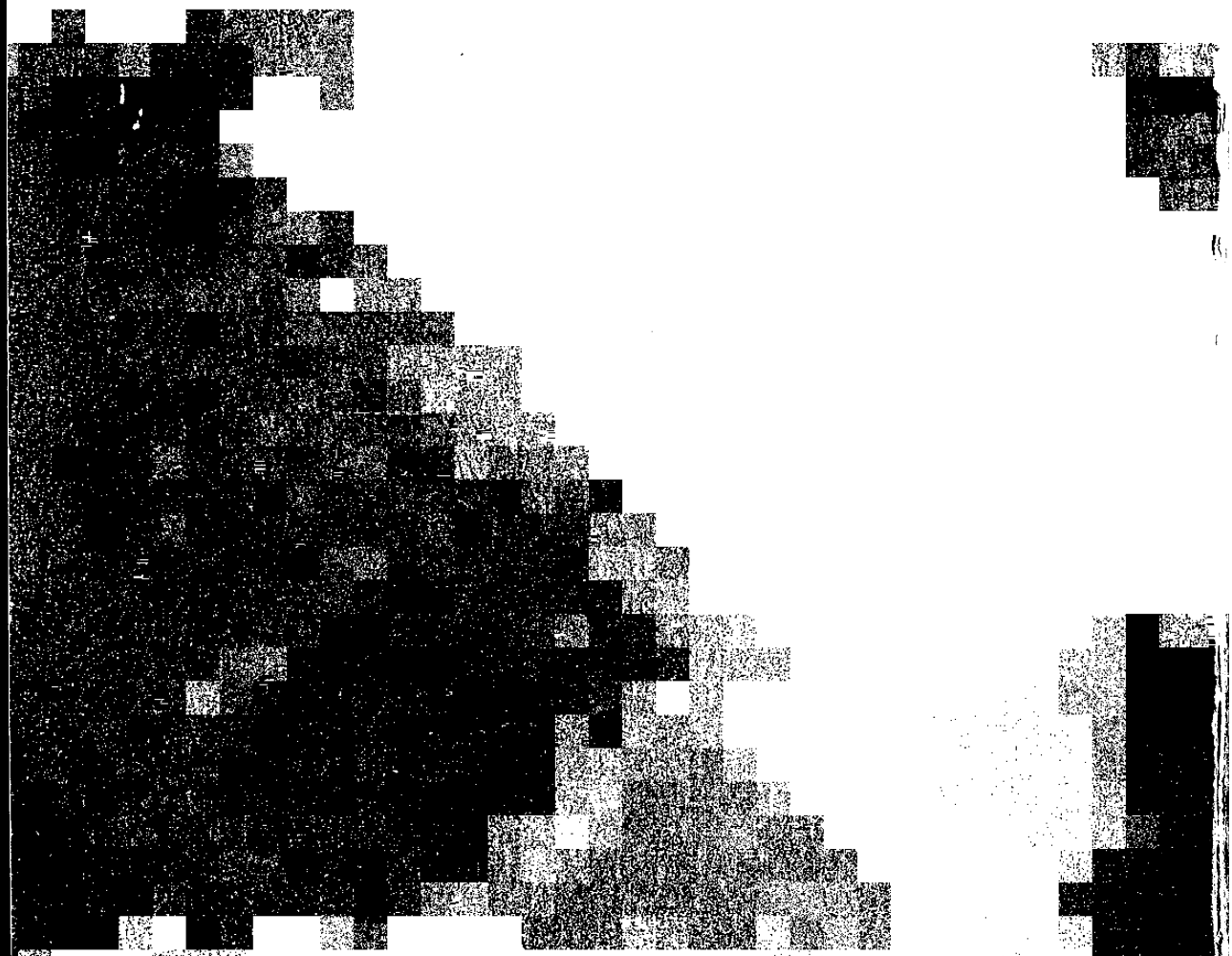

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Introduction

The dietary intakes of housebound old people have not hitherto been studied in detail. The first Report of the Panel on the Nutrition of the Elderly (Department of Health and Social Security, 1970)[8] drew attention to certain factors which may make old people especially liable to malnutrition; these include limited mobility, loneliness and social isolation. Lack of social contacts often leads to apathy, depression and impairment of appetite, and all these are likely to be found in housebound individuals when support from family, friends and the community is not available.

The present study was designed to assess the nutritional status of the housebound and to compare their dietary intakes with those of more active old people. For this comparison the results of two surveys were available:

- old people on the list of a large group practice in the London Borough of Camden (referred to as the 'active group')
- residents of two local authority residential homes for old people in Hertfordshire.

The Camden survey, which was sponsored by King Edward's Hospital Fund for London, formed part of a larger investigation carried out in six areas in the United Kingdom in collaboration with the Department of Health and Social Security.

Sheldon (1948)[14] investigated the capacity for movement of the elderly in his survey of a random sample of old people in Wolverhampton. He found that 2·5 per cent were bedfast and a further 8·5 per cent had limitation of movement which restricted their activities to the house. He demonstrated a striking increase in disability with age; in the age group 60–64 years 1·5 per cent were

housebound, but of those over the age of 85 no less than 32 per cent were confined to their houses. Moreover, to these figures must be added a rising proportion (7 per cent for those aged 85 and over) who were bedfast. Sheldon also showed a clear relationship between loneliness and capacity for movement. The bedfast were the least lonely, presumably since they had constant human contacts derived from the need for nursing attention. On the other hand, those whose activities were confined to the house had the highest incidence of loneliness, exceeding that found in the sample as a whole. This was thought to be due to the fact that many of them were sufficiently well to be left alone all day but were not capable of sufficient physical activity to keep them fully occupied.

It is clear that in this section of the population an important problem is likely to exist; restriction of physical activity, boredom and loneliness are believed to be conducive to impaired nutrition and they have a high prevalence in the very old. Attention has already been drawn to the need for medical examination of the subjects who participate in nutrition surveys of the elderly (Exton-Smith).[6] This applies especially to the housebound where the majority have physical or mental disorders which directly or indirectly affect their nutrition.

Summary

DOMESTIC ASPECTS AND FOOD CONSUMPTION

1 There was little difference between the mean nutrient intakes of those living alone and of those living with others.

2 Of the housebound subjects, 40 per cent were unable to cook for themselves but their dietary intakes were not inferior to those who were housebound but able to do their own cooking.

3 The consumption of certain main foods (meat, fish, eggs, green vegetables and non-citrus fruits) was significantly better in the active group than in the housebound group.

4 The lower dietary intakes of the housebound compared with the active group could usually be attributed to lack of an evening meal; thus 61 per cent of the housebound compared with 23 per cent of the active group did not eat a main meal in the evening.

NUTRIENT INTAKES

5 Nutrient intakes of the housebound subjects were the lowest and those of the active subjects the highest, whilst the intakes of the residents of old people's homes fell into an intermediate position.

6 The differences between the intakes of the two groups living at home, namely, the housebound and the active subjects, are highly significant.

7 The intakes of vitamin C and vitamin D for many housebound people are strikingly low.

HEALTH AND NUTRITION

8 In the housebound group, 48 per cent had more than one major reason for being housebound.

9 The commonest disability was osteoarthritis of the hips and knees affecting 43 per cent of the group.

10 Impairment in health was associated with a decrease in nutrient intake and this correlation was statistically significant.

11 A decline in weight and skinfold thickness was associated with decline in health.

12 Those who had sustained fractures of the femur had a lower mean vitamin D intake than the mean vitamin D intake for the whole housebound group.

13 Those with low leucocyte ascorbic acid levels were taking less than 30mg vitamin C a day.

SIGNIFICANCE OF FINDINGS, AND RECOMMENDATIONS

14 The study showed no decline in mean nutrient intakes with increasing age; indeed the youngest subjects often had the lowest intakes. This was thought to be due to the fact that disability was just as severe in the younger subjects as in the older. Decline in intakes is to be attributed to disease rather than to age alone.

15 The housebound, who comprise 10 per cent of the elderly population, are the largest single vulnerable group. Many are maintained at home with great difficulty and the occurrence of malnutrition would lead to an increased demand for hospital admission which would place an intolerable burden on the geriatric services.

16 The prevention of malnutrition in the housebound is the responsibility of the general practitioner assisted by the health visitor (or geriatric visitor) and the local authority social worker. Periodic assessment of dietary intakes must be made and when these are found to be low, means of increasing food intake must be explored.

17 Very low intakes of vitamin C, particularly in view of the known individual variation in requirements, are indications for vitamin C supplementation for housebound old people.

18 Low intakes of vitamin D (especially in elderly housebound women) taken in conjunction with lack of synthesis of vitamin D due to inadequate exposure to sunlight, are in part responsible for the comparatively high incidence of osteomalacia which is found in elderly women. Supplementation with vitamin D, possibly in the form of fortified milk, is desirable so that the intake is about 100iu per day.

19 Possible means of increasing nutrient intake are by transporting the housebound to day centres for club meals, by the more frequent provision of domiciliary meals, by the greater use of other welfare services, and by education.

1 The Survey

SAMPLE

Fifty-four people over retirement age and living in North London were selected from among 94 chosen by health visitors or geriatric visitors on the criterion that they were housebound.

The person was considered to be housebound if he or she did not go out. For the majority, physical disability rendered them housebound and the conditions are described below. But for eleven (20 per cent) there was no physical reason to keep them indoors. Some of these said that they were nervous of the traffic or had lost confidence, and some had lost interest in the world outside their four walls.

All 94 were interviewed but 40 did not participate in the study: 13 were not housebound; 13 refused because they were 'not interested'; 8 at first agreed but refused to continue after one or two days; the rest could not remember what they ate, said they would find the survey 'too tiring', or were very deaf.

We have no evidence that those who were housebound and refused to participate differed from those who accepted in age, sex or ability to obtain and prepare their food.

There were 44 women in the survey, whose mean age was 82 years, and 10 men with a mean age of 87 years. Their nutrient intakes were compared with those from two other groups.

Active Group:

105 active old people living in the London Borough of Camden were recruited from a group practice by taking every tenth patient on the list over retiring age. There were 32 refusals.

Residential Home Group:

40 people in two local authority residential homes for old people situated in Hertfordshire, about 30 miles from London (20 volunteers from each home).

We were able to show that the mean nutrient intakes of the volunteers were similar to those of the whole group of residents.

AGE AND SEX COMPARISON

	men	women	total	average age in years (both sexes)
housebound group	10	44	54	83
active group	37	68	105	75·6
residential home group	15	25	40	81

It will be seen that in all groups women outnumbered men – the biggest disproportion being in the housebound group, which was also the oldest.

METHODS

In Individuals' Own Homes

To establish usual meal patterns, individuals were interviewed a few days before the measured survey was due to start, and were questioned extensively about their meals and the amount of foods eaten, expressed as spoonfuls or slices. To check this information, the type and amount of food normally purchased in a week was obtained. Any discrepancy between these two was further questioned. On first and subsequent days of the measured food survey a simple form was left with the subjects on which they were asked to record the type and amount of food eaten at mealtimes. Scales were also left, although few subjects were able to weigh their food. However, all were capable of recording the type and amount of food eaten.

The investigator weighed jars and packets of food daily, and by difference established the amount used since the previous visit. Where the individual was one of a family, his/her butter, sugar, jam, and so on, were kept in separate containers and these were weighed daily; or the individual was asked to measure quantities of food similar to that consumed, which were then weighed by the investigator. Recipes for made-up dishes were obtained and/or manufacturers' analyses were

used. Meals taken away from home were either assessed from description, or the cafes and restaurants were visited and similar meals purchased. In the case of food provided by old people's clubs or meals on wheels, kitchens supplying the meals were visited and test weighings made.

On completion of the week's survey, meals and quantities obtained by measuring were checked against the usual meal pattern and, in most cases, the two were found to relate well.

In Residential Homes

Meals were eaten in a communal dining-room which made it possible to weigh the food served and the amount left on the plate and, by deducting the latter from the former, to arrive at the weight of the food eaten. Residents were questioned about food eaten between meals, and most were scrupulous in keeping records, even bringing fruit peel as proof. Records of menus and amounts of food purchased for six months before the survey were examined and compared with the menus and quantities of the survey week. No discrepancies were found. Only two people ate meals (one each) away from the home. These meals were recorded by the subjects, one by weight and one by homely measures.

Vitamin C values of most fruits and vegetables served in the two homes were obtained by chemical analysis, and these figures have been used in calculations. Other values, including vitamin C, have been obtained from food tables.

Completed Individual Records

group	people		days	totals
housebound	51	×	7	
	1	×	6	
	1	×	5	54
	1	×	4	
active	98	×	7	
	1	×	6	
	4	×	5	105
	2	×	4	
residential homes	40	×	7	40

Table 1 Nutrient intakes of those living alone and of those living with others

nutrient	men		women	
	alone	with others	alone	with others
calories	1910	1660	1355	1167
protein g	55	58	43	40
calcium mg	730	880	683	620
iron mg	7·6	8·2	7·6	6·0
Vit C mg	36	29·5	31	31
Vit D iu	120	65	57	44

2 Domestic Aspects and Food Consumption

MODE OF LIVING

Three of the ten men lived alone, five lived with relations or friends and two with their wives; 34 of the 44 women lived alone, nine women lived with friends or relatives and one with her husband.

Differences in the average nutrient intake of those living alone and those living with others were small: if anything, those living alone fared rather better (Table 1).

ABILITY TO PROCURE AND PREPARE FOOD

Shopping

None of the 54 was able to shop but one woman living in a luxury block of flats telephoned food orders which subsequently were delivered.

Shopping for the remainder was done by:

neighbours	17
home helps	19
relatives or friends	17

For the majority, shopping presented no problem, as it was done daily or as often as required. Seven, however, received supplies only once weekly and, as none of these had a refrigerator, buying and storing perishable goods was difficult.

Cooking

Thirty-two people (60 per cent) cooked for themselves, although for eight of these cooking was of the simplest kind, or was confined to weekends when meals on wheels were not delivered. Of the remainder, home helps or neighbours cooked for six and relatives or friends for 13.

Table 2 Main foods: average consumption in ounces per week

	men		women	
	active	housebound	active	housebound
meat	23	16	16	11
fish	7	4	5	3·5
eggs	10	3	9	3
cheese	4	3	4·5	2
milk	87	98	85	84
bread	28	21·5	19	13
potatoes	28	26	19	14
green vegetable	14·5	7	14	8
root vegetable	14	9	10	6·5
citrus fruit	2	0	6	4
non-citrus fruit	8	2	11	5

The average nutrient intakes of those able to cook were compared with those unable, but no major differences were seen. It appears that ability to cook is of less importance than the ability to persuade others to cook for you.

Three people, living alone, did no cooking. Two of them had low intakes of vitamin C due to an almost complete lack of fruit or vegetables in the diet. The third, a woman of 93 years had a low iron intake (daily average 2·2mg): she ate no eggs, fruit or vegetables and took an average of 1oz of meat per day. Her only means of cooking was a primitive gas ring; there was a water tap on the landing above her room; she had refused meals on wheels and her son brought sandwiches daily which she ate during the day.

Meals on Wheels

Twenty-six people received meals on wheels. There was little difference between average nutrient intakes of those receiving meals on wheels, and those not, whether or not they lived alone. However, if the average intakes for men are looked at separately, the differences for some nutrients are considerable. Thus, for men receiving meals on wheels, the mean intakes were 2007 calories, 65g protein and 10mg iron, compared with 1590 calories, 53g protein and 7mg iron for those not receiving meals on wheels. The numbers, however, are too small for these differences to be significant.

CONSUMPTION OF MAIN FOODS

It will be seen in Section 3 that there are considerable differences between the average nutrient intakes of the active and the housebound elderly. An examination of the average consumption of some of the main foods in each group points to some causes for these differences (Table 2).

The average weekly consumption of meat, fish and eggs, the main protein-containing foods, was significantly greater in the active group than in the housebound. Both men and women in the active group ate more meat than those in the housebound group: men ($p < \cdot 01$) and women ($p < \cdot 001$). The active elderly women ate more fish than the housebound women ($p < \cdot 01$), and more eggs ($p < \cdot 001$). The housebound group ate less bread than the active people. Amounts of milk and cheese eaten, however, were similar in the two groups.

Differences in vegetable and fruit consumption between the two were also interesting: there was little difference in the amounts of potatoes

Table 3 Number of people in active and housebound groups taking main meals

	active			housebound		
		total	per cent		total	per cent
breakfast						
daily	20	34	34	10	17	31
4 to 6 days	14			7		
none	48	66	66	24	37	69
1 to 3 days	18			13		
midday						
daily	68	98	98	30	48	89
4 to 6 days	30			18		
none	1	2	2	1	6	11
1 to 3 days	1			5		
high tea/supper						
daily	40	77	77	6	21	39
4 to 6 days	37			15		
none	5	23	23	14	33	61
1 to 3 days	18			19		

eaten by the men but the active elderly women ate more potatoes than the housebound women ($\cdot 05 > p > \cdot 01$). There were significant differences in the consumption of other vegetables: both men and women in the active group ate more green vegetables than the housebound ($p < \cdot 01$). Amounts of root vegetables eaten by the men were about the same in both groups, but for the women a fairly significant result ($\cdot 05 > p > \cdot 01$) was obtained which showed the intake of active women to be higher than housebound women.

Consumption of non-citrus fruit for the active group was significantly higher than for the housebound for both men and women ($\cdot 05 > p > \cdot 01$) but no difference was found for citrus fruits.

It must be borne in mind when examining results of consumption of individual foods that there was only a small number of men in the housebound group.

MEAL PATTERNS

The extent to which these differences in food consumption might be due to differences in meal pattern was examined. Comparison between the groups was made on the basis of frequency of main meals during a week. A meal was classed as 'main' if it contained, for breakfast, an egg or a portion of bacon (or meat), fish or cheese, and for midday meal or supper, a portion of meat, fish, eggs or cheese with bread and butter or vegetables or salad.

Two men and three women in the active group had no set meal pattern and have been discounted. The main meals of the remainder, 65 women and 35 men in the active group, and 44 women and 10 men in the housebound group, have been compared in Table 3.

There was little difference in breakfast and midday meals between the two groups but far fewer housebound ate a main meal in the evening – 39 per cent compared with 77 per cent in the active group. Furthermore, 15 (28 per cent) took very little, no more than tea or another beverage with biscuit or bread and butter, after the midday meal. It would appear that, if an improvement in the dietary of this group is necessary, it would be well to encourage them to eat a more substantial meal later in the day.

Eleven people had low calorie intakes (below 1000 calories daily, and four of these were below 800). Five of them were on diets likely to

limit food intake: two were on reducing diets, one on a low fat diet and two were on diets for 'gastro-intestinal trouble'. The remaining six had small appetites due, either wholly or in part, to lack of exercise. For example, two sisters spent most of the day sleeping in bed. Six people had low vitamin C intakes (below 10mg daily). All ate, through choice, very little or no fruit or vegetables. Four of them were provided with meals on wheels five days a week but much of the meal, including vegetable, was wasted.

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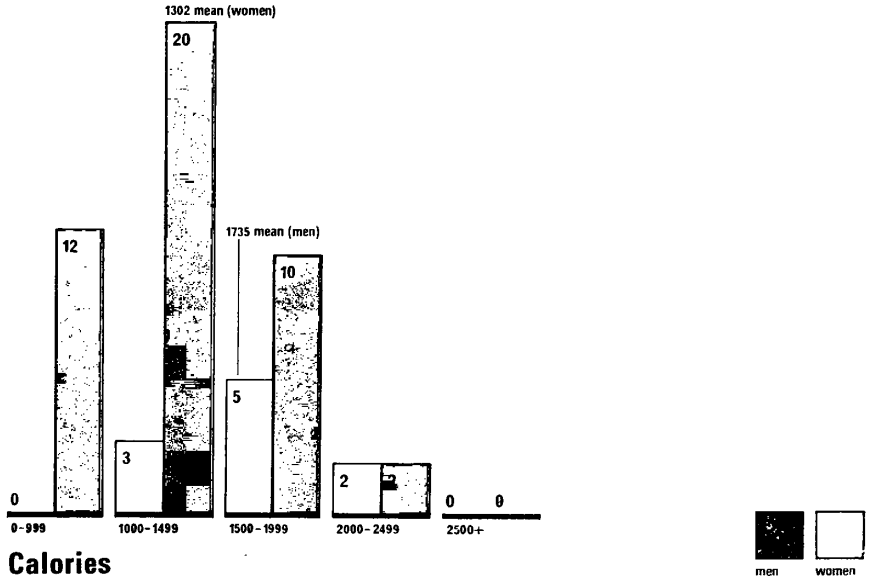
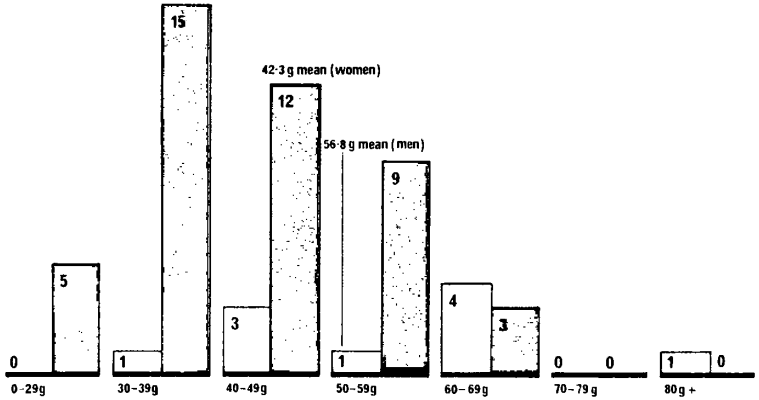
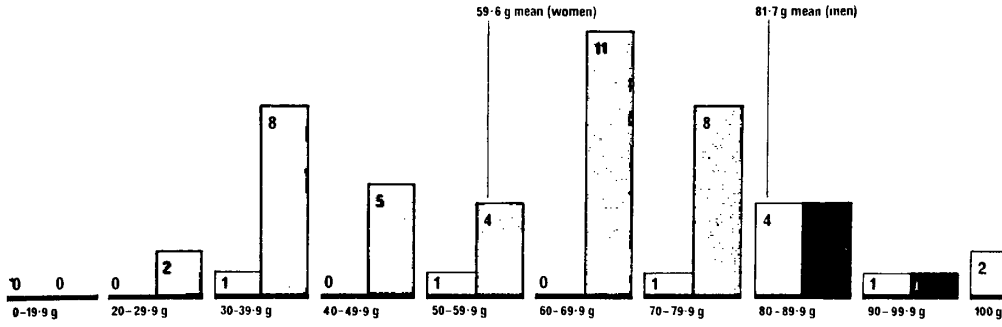
Figure 1 Distribution of nutrients: housebound group: calories, protein, fat, calcium, iron, vitamin C, vitamin D



Calories



Protein



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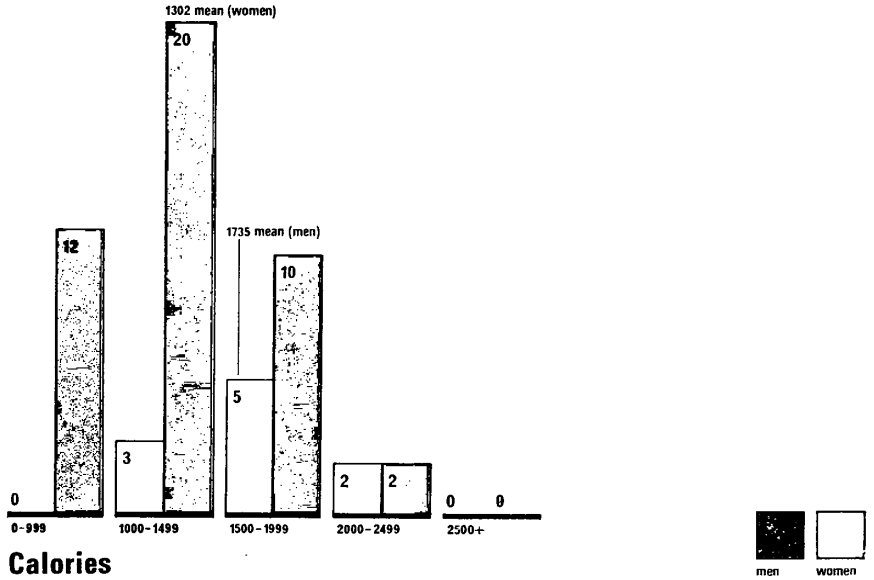
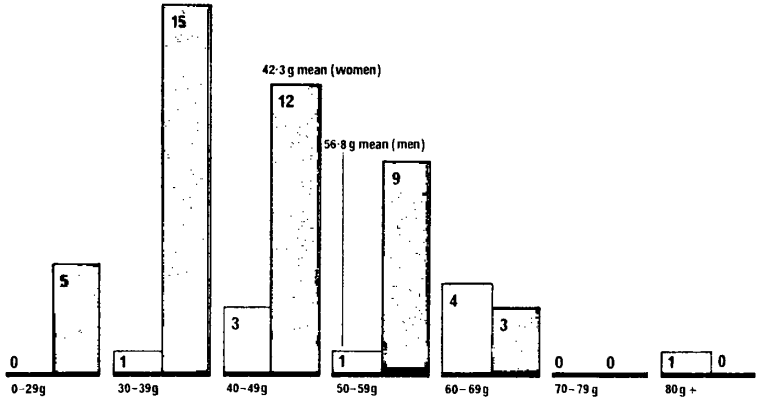
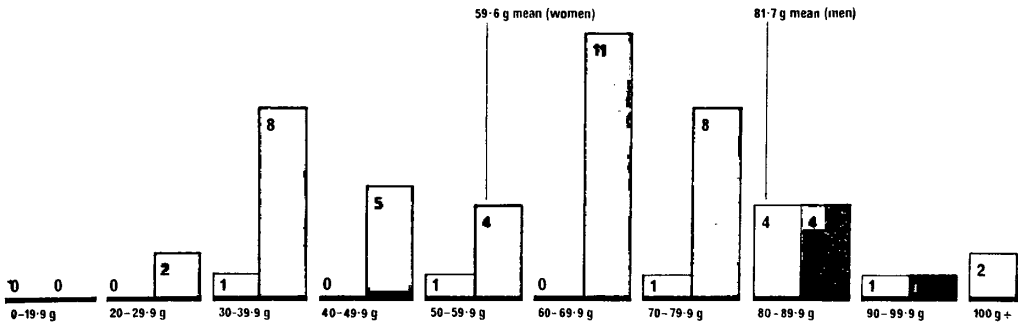
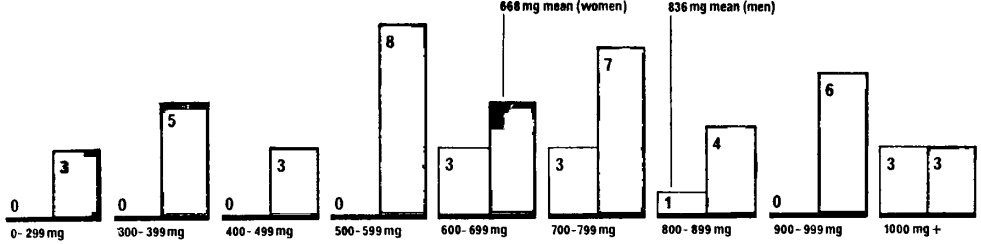


Calories

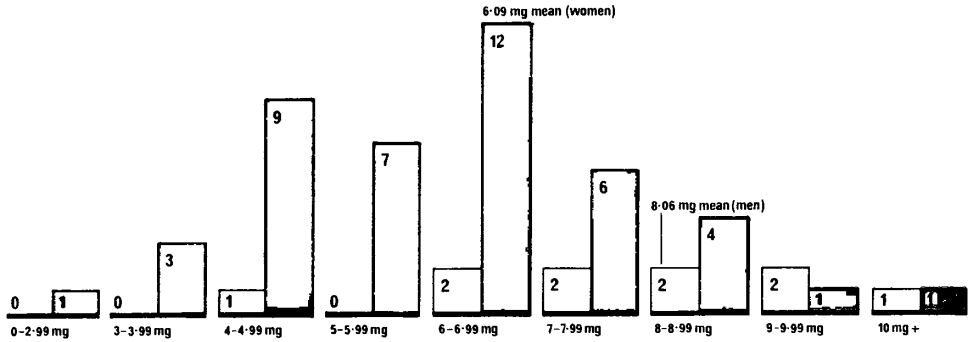


Protein

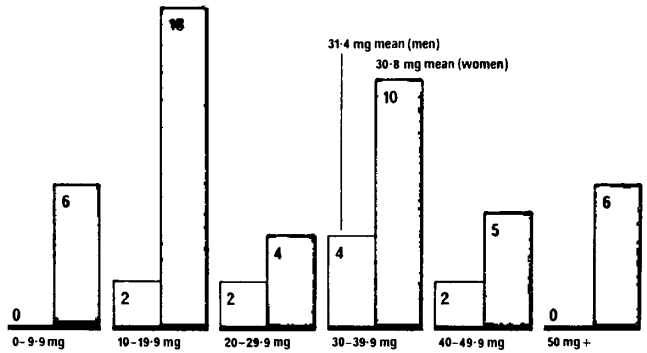




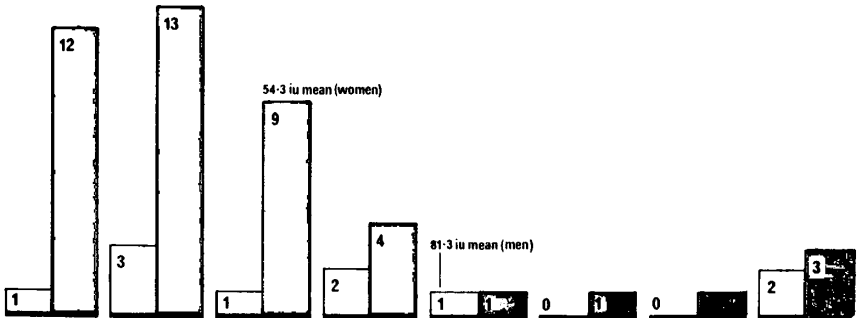
Calcium

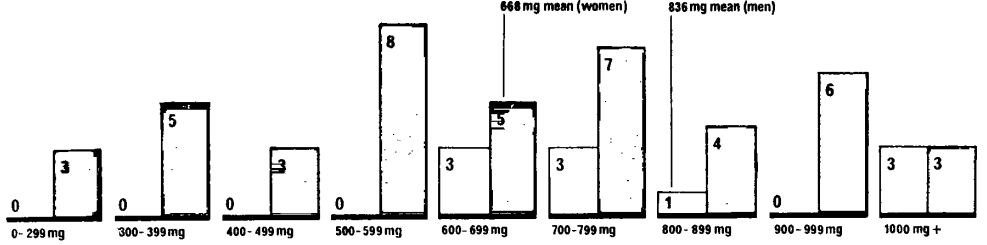


Iron

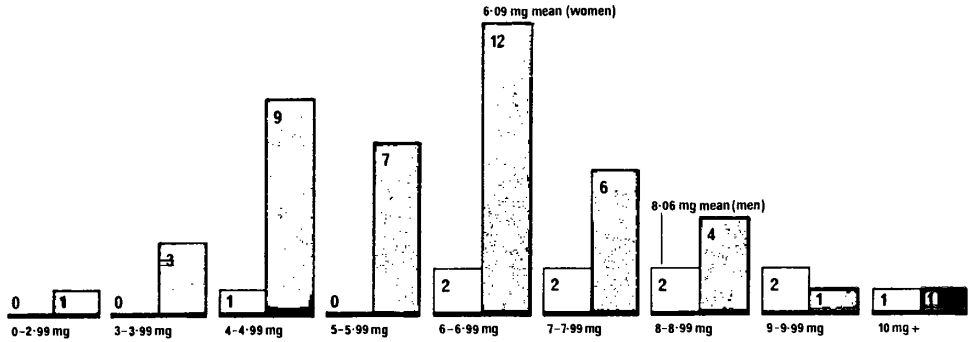


Vitamin C

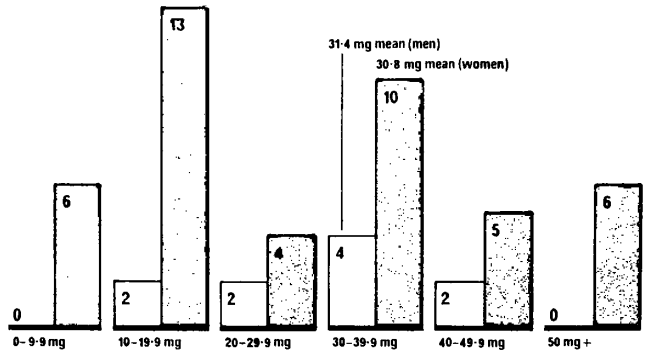




Calcium



Iron



Vitamin C

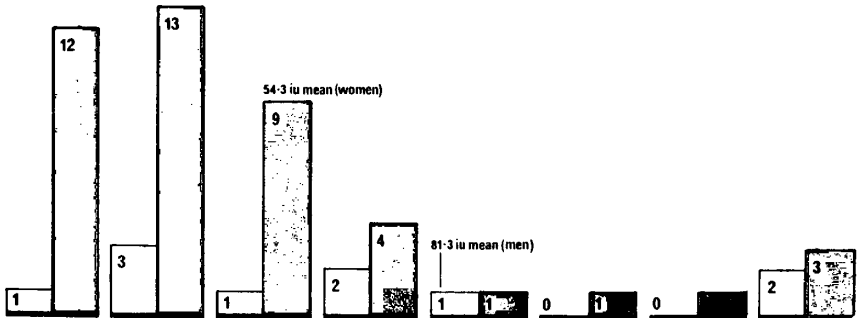
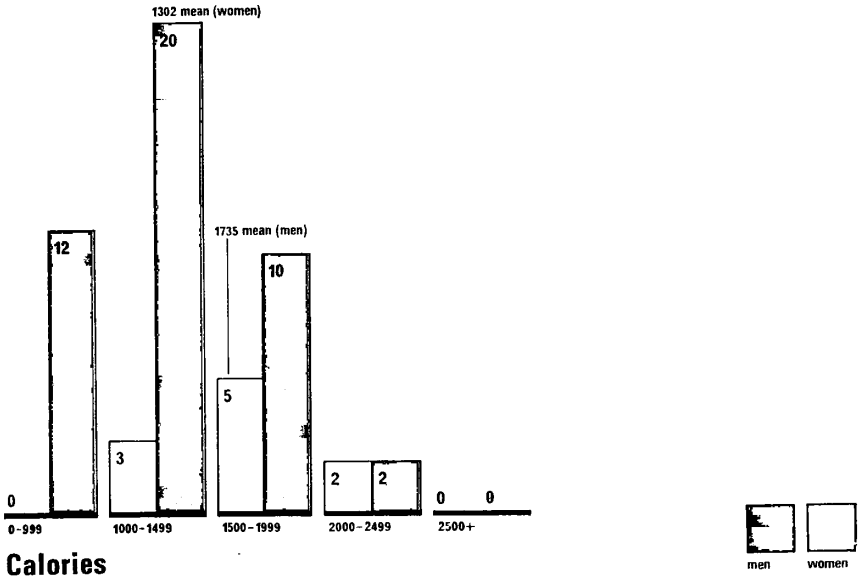
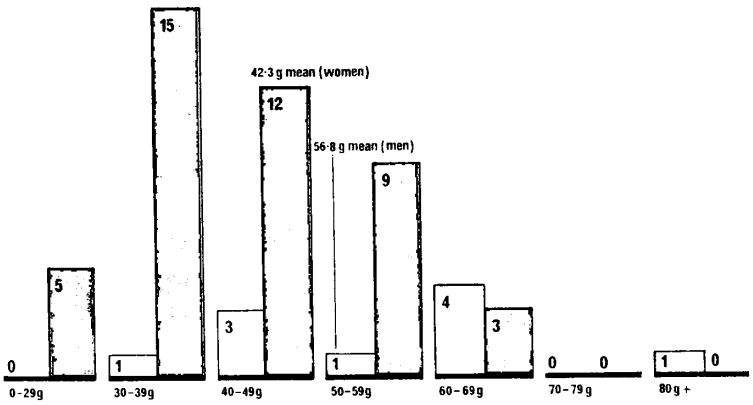


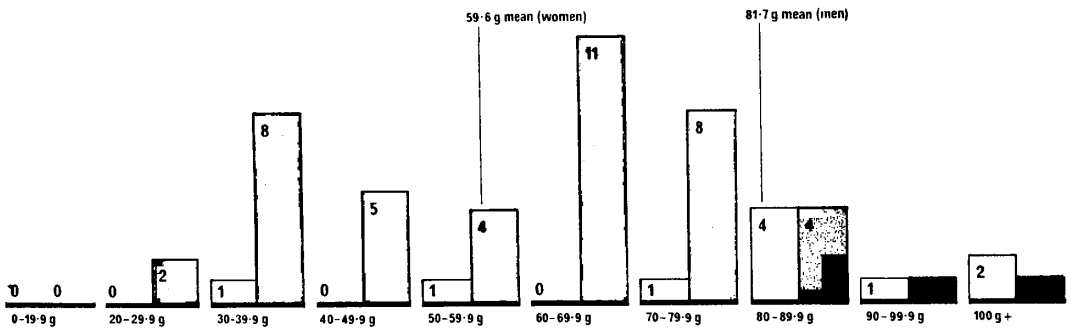
Figure 1 Distribution of nutrients : housebound group : calories, protein, fat, calcium, iron, vitamin C, vitamin D



Calories



Protein



Fat

3 Nutrient Intakes

ANALYSIS OF INTAKES

The distribution of nutrient intakes in the housebound group is shown in Figure 1. Numbers at the heads of the columns refer to numbers of people.

Calories

The mean calorie intake (1302) of the housebound women was low. Eleven subjects (25 per cent) had intakes of less than 1000 calories per day and for two the intakes were very low (600–700). Although the mean intake of the men was also low (1735) none was below 1000.

Protein

The mean protein intake for the women was low (42·3g) and five had intakes of less than 30g per day. The intakes for the men were higher and only one had less than 40g per day.

Iron

The intakes were lowest for women. Thirteen (30 per cent) had less than 5mg per day.

Vitamin C

The mean intakes for both men and women were similar (31·4mg and 30·8mg respectively). Six women, however, had intakes of less than 10mg per day and over half the total group (27 men and women) had intakes of less than 30mg per day.

Vitamin D

The intake of vitamin D was strikingly low, and the mean of 54iu per day for women and 81iu per day for men was only attained because of the comparatively high intakes of five individuals. Over a quarter of the women had intakes of less than 20iu per day.

Table 4 Nutrient intakes of housebound people (grouped according to age)

	men			women		
age range	70–79	80–89	90+	70–79	80–89	90+
number of people	2	5	3	10	23	9
calories	1406	1990	1527	1190	1350	1243
protein g	64	62	43	38	43	39
protein per cent calories	18	12	11	13	13	12
fat g	59	97	72	56	61	58
carbohydrates g	160	223	184	137	164	147
calcium mg	944	802	822	634	687	594
iron mg	8·3	9·2	5·9	5·6	6·0	6·1
vitamin C mg	27	30	37	27	29	36
vitamin D iu	73	103	50	68	46	48

Tables 5 to 8 and Figures 2 to 4 appear on pages 36 to 43.

NUTRIENT DISTRIBUTION ACCORDING TO AGE

The distribution of nutrient intakes of the housebound group related to age is shown in Table 4.

There was no consistent trend in nutrient intake with age; indeed many of the youngest people (70–79) had the lowest intakes. The percentage of calories derived from protein showed some fall with age, especially in men, but this is not a statistically significant decrease.

COMPARISON BETWEEN RESIDENTIAL HOME GROUP, ACTIVE GROUP AND HOUSEBOUND GROUP

As no-one in the active group was over the age of 90, two age groups have been used, 70–79 years and 80 years and over. The results are shown in Tables 5 and 6.

It will be seen that in each age group the nutrient intakes of the housebound are lowest and those of the active group highest, while the intakes of the residential home group fall into an intermediate position. The differences between the intakes of the two groups living at home are shown diagrammatically in Figure 2. When the mean intakes of the active group are taken as 100 per cent, the corresponding intakes of the housebound group are shown as a percentage on the histograms. For women, these differences are highly significant (for vitamin D, $p<0{\cdot}01$, and for other nutrients, $p<0{\cdot}001$).

INTAKES OF VITAMINS C AND D

Vitamin C intakes for the housebound and for the active group are further analysed in Table 7 and Figure 3. Very low intakes of vitamin C (less than 10mg per day) were much more prevalent in the women in the housebound group. Vitamin D intakes for the housebound and for the active group are further compared in Table 8 and Figure 4. The intakes were lower for women than for men and for both sexes they were markedly lower in the housebound compared with the active group of subjects.

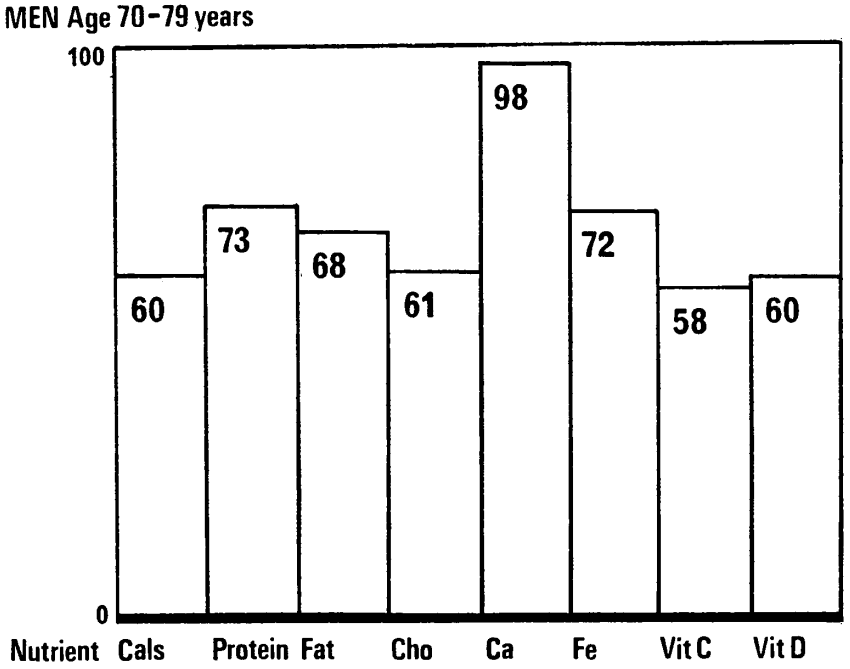
Table 5 Mean nutrient intakes of 70-79-year-olds in the three groups

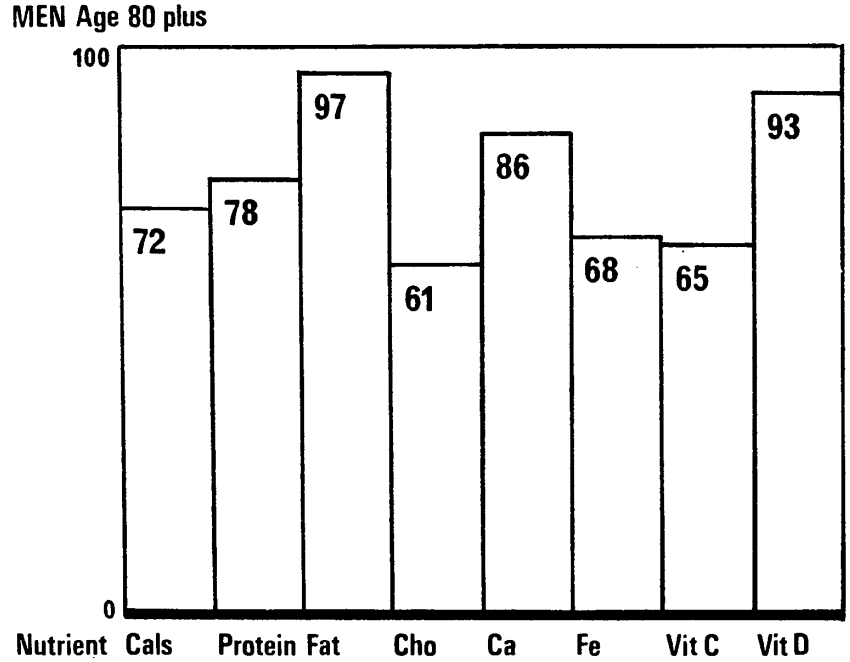
	men			women		
	residential homes	active	house-bound	residential homes	active	house-bound
number of people	8	32	2	6	53	10
calories	1846	2345	1406	1715	1745	1190
protein g	55·8	87·0	64·0	52·4	57·6	38·5
protein per cent calories	**12**	**14·8**	**18**	**12**	**13**	**13**
fat g	80	102	59	76	82	56
carbohydrates g	245	261	160	217	199	137
calcium mg	835	922	944	747	778	634
iron mg	8·6	11·5	8·3	8·3	9·3	5·6
vitamin C mg	30	46	27	39	50	27
vitamin D iu	85	123	73	75	99	68

Table 6 Mean nutrient intakes of those over 80 years in the three groups

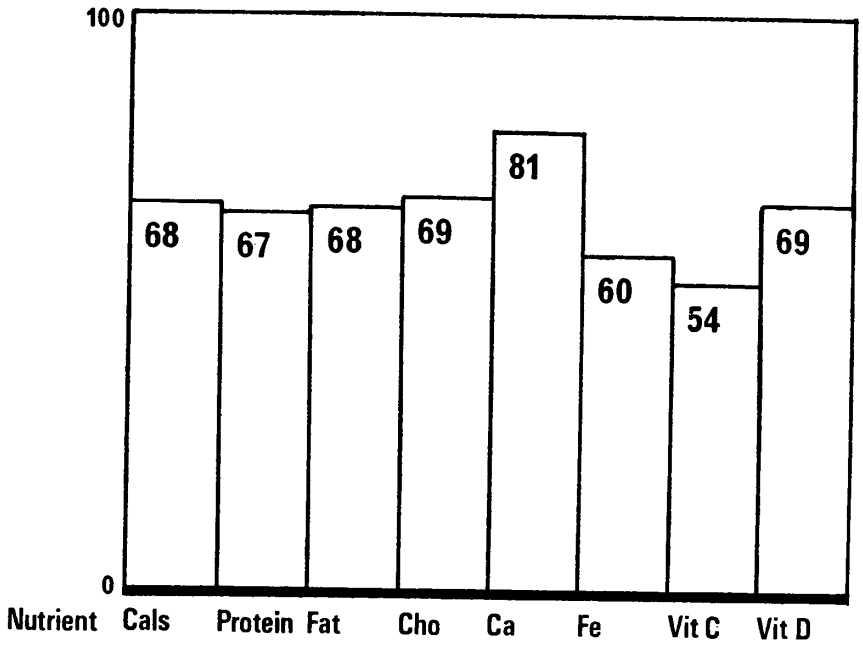
	men			women		
	residential homes	active	house-bound	residential homes	active	house-bound
number of people	6	5	8	17	15	32
calories	1858	2535	1816	1496	1656	1320
protein g	50·9	70·3	55·0	46·4	54·0	42·0
protein per cent calories	11	11	12	12	13	13
fat g	69	91	87·6	68	77	60
carbohydrates g	274	340	208	187	188	160
calcium mg	920	944	810	688	807	660
iron mg	6·7	11·8	8·0	7·2	8·2	6·0
vitamin C mg	16	49	32	37	37	31
vitamin D iu	100	89	83	58	76	47

Figure 2 Mean intakes of housebound group (expressed as percentages of corresponding intakes of active group)





WOMEN Age 70-79 years



WOMEN Age 80 plus

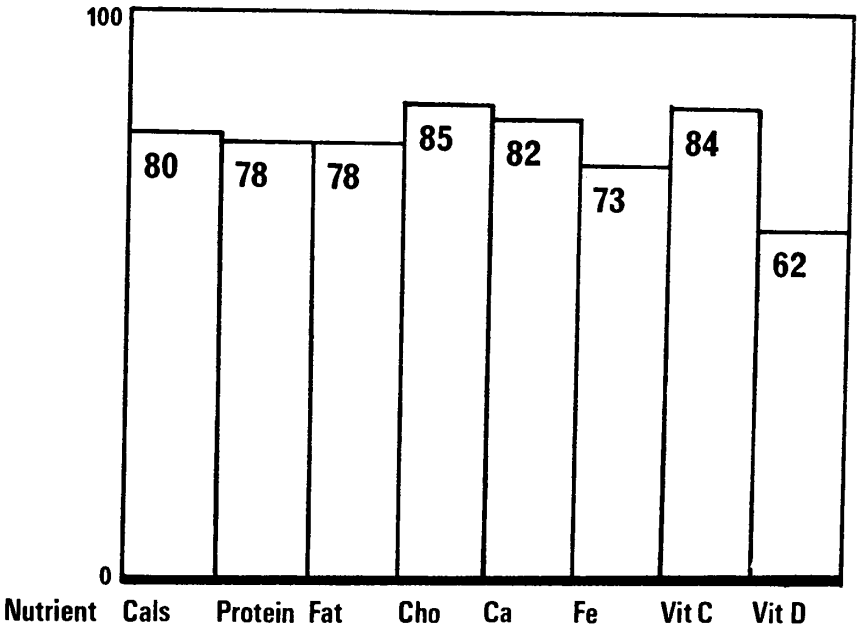


Table 7 Vitamin C intakes of housebound and active groups

		0–10mg		11–30mg		31mg and over	
		number	average age (years)	number	average age (years)	number	average age (years)
housebound	women	7	77·7	18	82	19	83·7
	men	–	–	4	85·5	6	88·1
active	women	2	81·5	17	73	49	75
	men	–	–	8	74	29	78

Figure 3 Vitamin C intakes of housebound and active groups (proportion in each group)

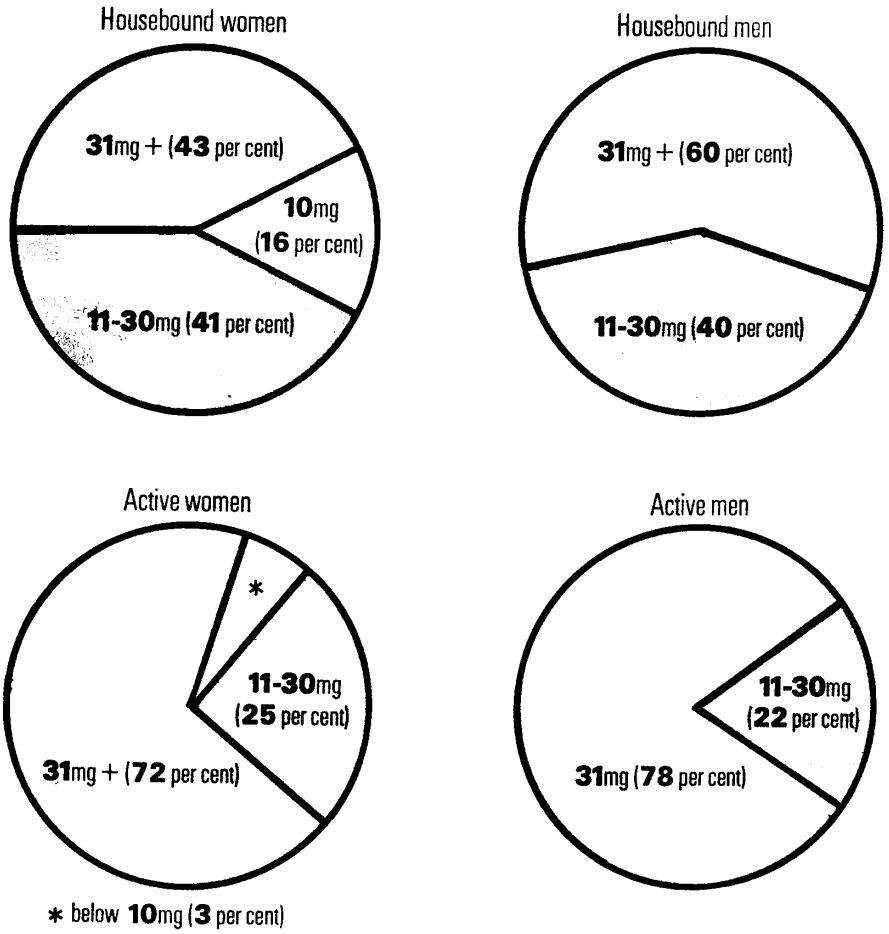
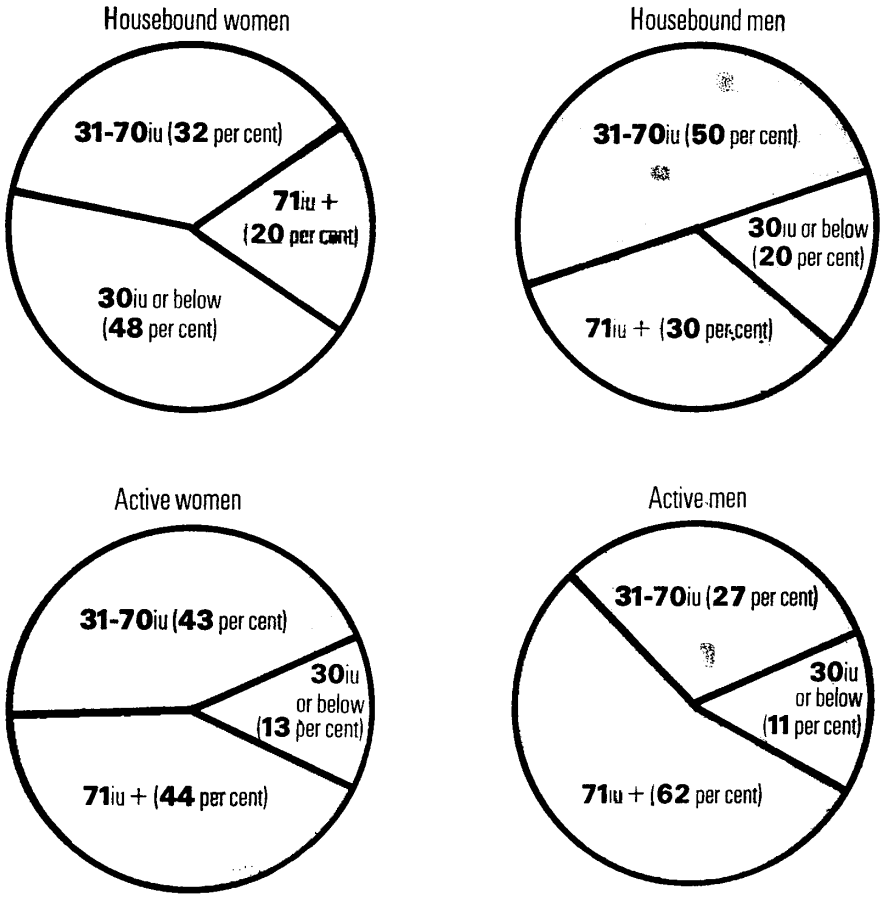


Table 8 Vitamin D intakes of housebound and active groups

		iu 30 or below		31–70		71+	
		number	average age (years)	number	average age (years)	number	average age (years)
housebound	women	21	82·7	14	82	9	82
	men	2	89	5	87·8	3	84·7
active	women	9	78	29	77	30	75
	men	–	–	8	74	29	75

Figure 4 Vitamin D intakes of housebound and active groups (proportion in each group)



4 Health and Nutrition

In the housebound group, 42 people (35 women and seven men in an age range of 65–97 years) consented to a full physical and psychological assessment; 29 of those examined had biochemical and haematological investigations which included a full blood count, ESR, serum vitamin B12 and folate, serum calcium, inorganic phosphorus, alkaline phosphatase and leucocyte ascorbic acid levels.

REASONS FOR BEING HOUSEBOUND

The clinical examination was directed at ascertaining physical and mental disability, clinical state of nutrition, and factors influencing housebound condition and dietary intakes. None of the patients showed clinical signs of malnutrition.

The main clinical reasons for being housebound were:

osteoarthritis of hips and knees	43
cataracts and glaucoma	21
heart disease	19
mental disease	17
hemiplegia	17
fractured femur	15
deafness	15
chronic bronchitis	15
obesity	15
miscellaneous factors	15

(figures are percentages of the group of 42 people assessed).

It should be noted that 48 per cent of the group had more than one major clinical reason for being housebound. Miscellaneous factors included lower limb amputation, rheumatoid arthritis, drop attacks and falls. No severe physical disability was found in 20 per cent of the group; these people were housebound mainly because they had lost confidence and were fearful of venturing out of doors alone.

Table 9 Mean nutrient intakes of clinically assessed subgroups

clinical assessment	number	Cal	P g	Ca mg	Fe mg	Vit C mg	Vit D iu
subgroup 1	3	1722	49·0	823	6·7	51	24
subgroup 2	11	1625	49·7	731	7·2	31	63
subgroup 3	16	1247	41·2	640	5·9	30	53
subgroup 4	6	1183	43·1	732	5·6	23	42

Table 10 Intakes (expressed per 1000 calories) of clinically assessed subgroups

	number	P g	Ca mg	Fe mg	Vit C mg	Vit D iu
subgroup 1	3	28·4	478	3·9	30	14
subgroup 2	11	30·5	450	4·4	19	39
subgroup 3	16	33·0	513	4·7	24	42
subgroup 4	6	36·4	619	4·7	20	36

Table 11 Mean weight and triceps skinfold thickness of clinically assessed subgroups

subgroup	number	weight kg	triceps skinfold thickness mm
1	3	65	18
2	11	53	9
3	16	55	10
4	6	47	8

Table 12 Nutrient intakes of three obese people not on a therapeutic diet

	weight kg	triceps skinfold thickness mm	Cal	P g	CHO g	fat g
Mrs A	76·5	30	1838	53·8	226·8	71·1
Mrs B	73	18	1179	42·6	153·0	47·7
Mrs C	63	17	1874	43·9	278·5	72·3

RELATIONSHIP BETWEEN CLINICAL DISABILITY AND NUTRIENT INTAKE

Clinical Assessment

The housebound group was classified into four subgroups according to the physical and mental assessment of their health, mobility and general condition. Subgroup 1 was defined as well above average, subgroup 2 as above average, subgroup 3 as average, and subgroup 4 as below average. Table 9 shows mean nutrient intakes in the four groups. Four subjects on therapeutic diets are excluded from the table.

It can be seen from the table that the housebound with better clinical assessments had, in general, higher nutrient intakes than those in the lower subgroups. The numbers in subgroups 2 and 3 were roughly similar. The mean intakes of those in subgroup 2 were significantly higher than those in subgroup 3, with the exception of vitamin C. (Levels of significance, $p < \cdot 01$ for vitamin D, and $p < \cdot 001$ for the other nutrients.)

When, however, nutrient intakes are expressed per thousand calories (see Table 10), the differences are found to be quantitative rather than qualitative.

Weight and Skinfold Thickness

Associated with the decline in nutrient intake was also a decline in mean weight and skinfold thickness of the triceps as shown in Table 11.

While mean weight and skinfold thickness remained roughly similar in subgroups 2 and 3, there was a marked decline in both indices between subgroups 1 and 4 associated with the decline in health and nutrient intake.

Seven people were considered to be obese. All had a triceps skinfold thickness of above 16 mm and weighed above 63 kg. Three were on a reducing diet and one was a diabetic on a high protein/low carbohydrate diet. Table 12 shows the nutrient intakes of the other three subjects.

Mrs A and Mrs C had nutrient intakes well above average for women in the housebound group. Despite their ages (Mrs A was 84 and Mrs C 80) they were fully mobile and above average in health.

Table 13 Calorie and protein intakes of those suffering from dementia and depression

	number	Cal	P g
dementia	4	1491	44·7
depression	2	859	22·5

Table 14 Mean intakes of vitamin D and calcium of six people with femoral fracture compared with the whole housebound group

	vitamin D iu		calcium mg	
	femoral fracture	housebound	femoral fracture	housebound
men	19·2	81	795	836
women	28·1	54	682	668

Table 15 Biochemical tests: mean values

serum calcium mg/100ml	serum phosphorus mg/100ml	serum calcium phosphorus product	haemoglobin g per cent	serum folate ng/ml	leucocyte ascorbic acid ng/10^6wbc
mean:					
9·7	3·29	31·73	12·7	6·31	30·54
SEM:					
0·51	0·6	6·13	2·9	2·79	16·78

Mrs B suffered from severe cardiac disease which impaired her mobility. In addition, she was taking diuretics. Although she was obese these two factors may well have accounted for her reduced nutrient intake.

Mental Disease

Among the housebound group examined, four were suffering from dementia and two from depression. Table 13 shows their mean calorie and protein intakes.

The calorie and protein intakes of the two depressed subjects were well below average, but the intakes for the four suffering from dementia compared favourably with the average intake for the whole housebound group. It is possible that reduced nutrient intake only occurs in an advanced state of dementia and particularly when the patient is receiving no help or medical supervision.

Fractured Femur and Vitamin D Intake

Six people, four women and two men, had sustained a fracture of the neck of the femur. Table 14 shows their mean vitamin D and calcium intakes compared with the mean intakes for the whole housebound group.

Both men and women with fractures had a vitamin D intake well below the average for the housebound group, but there were no consistent differences in calcium intake. The possible importance of lack of vitamin D causing osteomalacia and osteoporosis (Nordin)[13] and the relationship between these diseases and fractures in old age, need further investigation.

BIOCHEMICAL RESULTS

Mean values and standard errors of the means have been completed for the 29 people who had blood tests. The results are shown in Table 15.

Serum calcium (corrected for protein levels), inorganic phosphorus and calcium-phosphorus product all showed a decrease in mean values with advancing age, but none of these decreases was significant except for the difference in calcium-phosphorus product between people of 70–79 years and those over 90 years. The mean value for the former was 34·47 and for the latter 29·99 ($p < ·05$).

Table 16 Low leucocyte vitamin C levels related to vitamin C intakes

patients' reference numbers	leucocyte ascorbic acid microgrammes/10^8 wbc	daily vitamin C intake mg
7032	7·2	26
7044	12·4	17
7015	13·1	19
7001	15·2	36
7019	17·0	19

There was no significant correlation between vitamin D intake and corrected serum calcium level. Similarly, no statistical correlation was found between haemoglobin level and iron intake, vitamin C intake and protein per cent of calories. One of the group had a haemoglobin of 7·6g associated with essential thrombocythaemia and another had an aplastic anaemia with a haemoglobin of 7·1g.

In Table 16 are listed the vitamin C intakes of the five people whose leucocyte ascorbic acid levels were below 20 microgrammes/10^8 wbc.

It can be seen that only one patient with a low leucocyte ascorbic acid level was receiving more than the recommended intake of 30mg daily of vitamin C. A recent course of tetracycline probably accounted for the low leucocyte ascorbic acid. Another patient had a leucocyte ascorbic acid of 13·1 microgrammes/10^8 wbc despite claiming to take vitamin supplements.

Nine women and two men had serum folate levels below 6ng/ml, the lowest serum folate was 2·9ng/ml. One lady with a folate level of 4·7ng/ml ate no potatoes, green vegetables or root vegetables during the week. However, there was little correlation between serum folate levels and vegetable intake. This is not surprising, since serum folate levels of 3–6ng/ml are commonly found with complicating disease in the elderly and do not necessarily indicate nutritional deficiency or reduced body stores of folate.

5 Significance of Findings, and Recommendations

LOW INTAKES OF THE HOUSEBOUND

A previous study of the dietary of elderly women living alone[7] showed a marked decline in the intakes of nutrients in three age groups: 70–73, 74–76 and 77–80+ (three women were over 80). When the intakes of those in their late 70s were compared with those in their early 70s the decline amounted to 19 per cent for calories, 24 per cent for protein, 30 per cent for fat, 8 per cent for carbohydrate, 29 per cent for iron and 31 per cent for vitamin C. It was also shown that dietary intake could be closely related to health; those whose health was assessed to be worse than average had a poorer diet. Thus it was suspected that declines in intake were associated with the deterioration in health, which, Sheldon[14] has shown, often occurs about the middle of the eighth decade. To confirm this, a longitudinal study was carried out and women who were subjects of the original study were followed up six and a half years later.[17] This showed a marked decrease in intakes of those whose physical and mental health deteriorated; whereas those who maintained their health and physical activities also maintained their nutrient intakes at a remarkably constant level.

The present study of the housebound adds further evidence that low intakes of nutrients are associated with deterioration in physical and mental health in old people. There is no decline in intake with age, indeed the youngest people often had the lowest intakes. This is because, for the housebound, in contrast with the active group, disability was just as severe and as frequent in the younger as in the older people. Thus, decline in intakes is to be attributed to disease rather than to the effects of age alone.

Physical disability in old age not only affects the mode of living but

also leads to an alteration in the dietary pattern. Two of the housebound group were bedfast; although the others were capable of greater degrees of physical activity, 20 per cent of the group were housebound mainly because they were fearful of venturing out of doors alone. Thus, apart from a few patients with diseases which had constitutional effects or which required a special diet, the low intakes of the housebound were due to immobility and limited energy expenditure. The lack of an evening meal was also notable. Generally, the intakes of the old people in the two residential homes were intermediate between those of the housebound and those of the active groups; an evening meal was eaten by all residents but their energy expenditure was limited by lack of physical activity, although few were severely handicapped and none was bedfast.

RECOMMENDATIONS

The prevention of malnutrition requires not only information on the dietary intakes and the special requirements of old people, but also an understanding of their way of life and of the reasons why inadequate intakes occur. The survey of the active subjects in Camden formed part of a larger study carried out in six centres in the United Kingdom, the aim of which was to assess the incidence and types of malnutrition occurring in the elderly population. The results of this study,[9] which are to be published, show a small incidence of frank malnutrition; a proportion of the elderly population, however, have very low intakes of certain nutrients and, under the stress of additional adverse circumstances, malnutrition might develop. For most old people leading an active life, the state of nutrition was satisfactory. Thus, unless the risk of developing malnutrition is confined to one or more groups of the elderly population which can be identified, preventive measures will need to be applied to all, even though the vast majority of them would never suffer from malnutrition. It is, therefore, desirable to define subgroups in which the risk is particularly high since prevention in these smaller groups is a more manageable proposition than in the whole elderly population.

The First Report of the Panel on the Nutrition of the Elderly[8] drew attention to certain factors occurring singly or in combination which make the elderly especially vulnerable; limited mobility, loneliness and social isolation were considered to be important. Lack of social contact often leads to apathy, depression and impairment of appetite and it is likely to be a consequence of impaired mobility when there is no, or too little, support from family, friends and community. The present study of the housebound in whom impairment of mobility

was often of severe degree has clearly shown that their dietary was significantly poorer than that of active old people of comparable age. The housebound comprise approximately 10 per cent of the elderly population at home and they, therefore, constitute one of the largest vulnerable groups of old people. Since for many the situation at home is maintained with difficulty, the elderly housebound present a potential demand for institutional care. It is clearly important that their precarious state should not be aggravated by the occurrence of nutritional deficiencies, since the admission of only a small proportion to hospital would produce an intolerable burden on the geriatric services. Possible means of preventing malnutrition amongst the housebound can be considered under three headings – periodic assessment of their health and nutrition, methods of increasing nutrient intakes, and supplementation to prevent specific deficiencies.

PERIODIC ASSESSMENT

It is now recognised that considerable disability exists in the elderly population which is unknown to general practitioners.[19] Since many old people do not report illness to their doctors, reliance on the self-reporting of illness imposes a severe handicap for the early detection of disease in old age. Various means have been suggested for overcoming this handicap[5] and a method which is offering considerable promise of success is the use of health visitors (or geriatric visitors) for the first tier of screening. They act on behalf of general practitioners and pay particular attention to those old people who are thought to be especially at risk. They could bring under medical supervision those who are liable to become socially isolated and housebound through increasing impairment of mobility. For all old people who are becoming increasingly incapacitated, a thorough medical examination is necessary to discover causes. In some cases, when a treatable cause is discovered the condition can be ameliorated so that special hazards of the housebound state can be avoided. In other instances, when no improvement is possible, regular medical supervision is essential, particular attention being paid to the possible appearance of evidence of nutritional deficiency. The mere fact that calorie and nutrient intakes are low is not proof of malnutrition but it may alert the doctor to the possibility. Thus, a periodic assessment of dietary intakes of housebound old people would be highly desirable; moreover, the finding of low intakes would be an indication for instituting means of attempting to increase the intake.

The assessment of dietary intakes should ideally be carried out by dietitians, but few health authorities have the service of a dietitian and

the periodic assessment of all housebound people would be a formidable task. It has been possible to devise a scoring system based on the number of main meals and the frequency of consumption of the other main foods containing protein (meat, cheese, eggs, milk and bread) to give a simple means of assessing protein intakes.[11,12] The intake of protein from mixed sources of animal foods is used as a rough guide to the quality of the whole diet. The system can be readily applied by a health visitor, geriatric visitor or social worker in contact with the housebound patient.

MEANS OF INCREASING INTAKES

Club Meals

The Stockport survey of the over 80s[4] and other studies of the nutrition of old people have shown that dietary intakes can be related to the number of outside interests. In this respect, housebound old people are at a great disadvantage since most of them are unable to enjoy outside activities and have few interests. Intake is improved when old people eat at clubs in the company of others. In the present survey, it is thought that 20 per cent of the subjects had no incapacity which rendered them housebound, but they tended to remain indoors, sometimes for many years, because they dare not venture out alone. Voluntary bodies, such as the local old people's welfare committee, could be useful in arranging for voluntary workers to visit old people regularly and in arranging transport to day centres and old people's clubs on several days a week. This increase in physical activity would undoubtedly have considerable benefits, both physical and psychological, as well as promoting better food intake. The value of club meals has already been stressed[7] and the extension of club facilities for frail old people would do much to prevent loneliness and malnutrition amongst the physically handicapped.

Meals on Wheels and Invalid Meals

Townsend and Wedderburn[18] estimated that just over one per cent of the population over the age of 65 received a cooked meal at least once a week from the mobile meals services; another five per cent said they would like to receive them. In a social survey[10], over half of those who took meals on wheels said they would like to receive more meals than they were presently receiving. Since 1962, when local authorities were empowered to give financial support to voluntary bodies supplying meals on wheels there has been a gradual expansion in the service and in 1967 it was officially estimated that 95 381 (1½ per cent) old people were receiving meals on wheels.[8] It has been emphasised[7] that at least

four meals a week must be provided if a significant contribution is to be made. Moreover, the meal must be as nutritious as possible since the recipient tends to regard it as the main one of the day and often takes only snacks throughout the rest of the day.

The value of domiciliary meals has been discussed elsewhere[16] and has not been assessed in the present study. Regular visits to housebound old people by voluntary workers do much to prevent social isolation. Other advantages of the present system are that existing facilities in school, local authority and hospital kitchens can be used. Undoubtedly, the main disadvantage is, in some cases, that the meal has to be cooked three or four hours before it reaches the old person's home. By this time, the meal is often unattractive and has certainly lost some of its nutritive value. Chemical analysis has shown[7] that the loss of vitamin C in cooking, and during the time the meal is kept hot in containers, can be as much as 90 per cent. Some domiciliary meals services have experimented with frozen meals. When the seven days' supply of food is delivered only once a week, the service is economical in personnel and each meal can be cooked immediately before serving.

There are, however, serious disadvantages of the system. Facilities must be provided for storage but very few old people have refrigerators (none in the present survey). The old person may be incapable of cooking the meal unaided. Of the housebound old people in the present survey, 36 per cent (15 of the 42 medically examined) had physical disabilities which prevented them preparing their own meals. The old person is visited by a voluntary worker much less frequently than are other groups so that there is greater danger of social isolation.

It seems, therefore, that the present commonly used system of taking advantage of existing kitchen facilities will continue but there is a great need for the expansion of the service for those old people who must remain housebound in spite of attempts at rehabilitation.

Other Welfare Services

Malnutrition rarely occurs in isolation; there are nearly always other unmet social needs. Similarly, most housebound old people require many services to maintain them at home without deterioration in their health or nutrition. Almost invariably, the home help plays a valuable role in shopping and often in preparing meals. The housebound and those old people living alone need small portions of readily prepared nutritious foods. It is uneconomical to buy large joints or amounts of

food which are more suitable for the family. Undoubtedly, the food industry could make a useful contribution here.

Education

Old people in general show very little interest in food and cookery. Food propaganda put out by the press, radio and television or talks at old people's clubs seem to have very little impact.[7] The very low dietary intakes of some of the old people in the survey led the investigators to believe that advice on food, especially on what to buy with a limited income and how to store and cook it, would be useful for the housebound and for many old people generally. Where there are appropriate facilities, arrangements could be made to bring housebound and infirm old people to day hospitals and day centres periodically for instruction by dietitians. Although more time-consuming, in other instances it would be necessary for a dietitian or home economist to visit the old person's home to assess need and to give individual instruction.

Supplementation

The most satisfactory means of improving the nutritional state is to increase the consumption of foods containing appropriate nutrients. This is usually practical, but, in a few cases, especially when the housebound state is caused by illness affecting the general health of the individual, the total dietary intake may remain low. The comparatively high incidence of low intakes of vitamin C and vitamin D, revealed in the present survey, must raise the question of possible supplementation with these nutrients. Twelve per cent of the housebound subjects had a vitamin C intake of less than the 10mg per day known to be the amount required for the prevention or cure of scurvy.[2] Moreover, there is evidence of considerable individual variation in vitamin C requirements – Srikantia and his colleagues[15] found that although 10mg per day of vitamin C are sufficient for most people, others require as much as 22mg per day to re-establish the leucocyte vitamin C levels after these have been reduced by deprivation of vitamin C. When assessment of the diet shows that the vitamin C content is low, intake should be increased either in the form of food (citrus fruit, blackcurrant juice, rose hip syrup, tomatoes or green vegetables) or, less desirably, by supplementation with vitamin C tablets. It is uncertain to what extent the health of old people would benefit by such supplementation but this is at present being investigated in a feeding trial conducted by Berry and Darke.[3]

Similar considerations apply to the intake of vitamin D but there are

additional factors. In the housebound there is deficient synthesis of vitamin D in the skin because of inadequate exposure to sunlight. The importance of this is difficult to assess, but it is known that rickets in children can be prevented by sufficient exposure to ultra-violet light. Also, it is known that when osteomalacia has been reported in the elderly[1], cases have not uncommonly been observed in the housebound. The present survey shows that very many housebound old people have low vitamin D intakes. Although the precise requirements are unknown, comparison with the active group shows a statistically significant difference in the high proportion of the housebound group who have low intakes.

Probably the easiest way to provide additional vitamin D would be to fortify the milk. There is, however, no indication for supplying fortified milk to most old people who have an intake of vitamin D comparable to that of the general population. The evidence of this survey suggests that it is desirable to supply fortified milk to many of the housebound who comprise about 10 per cent of the elderly population. A start could be made by distributing fortified milk in conjunction with the meals on wheels service. Such a scheme would require careful assessment by preliminary trials and evaluation of the results. Moreover, it must be borne in mind that the real need for meals on wheels is much greater than that represented by the 1·5 per cent of the elderly population at present receiving them.

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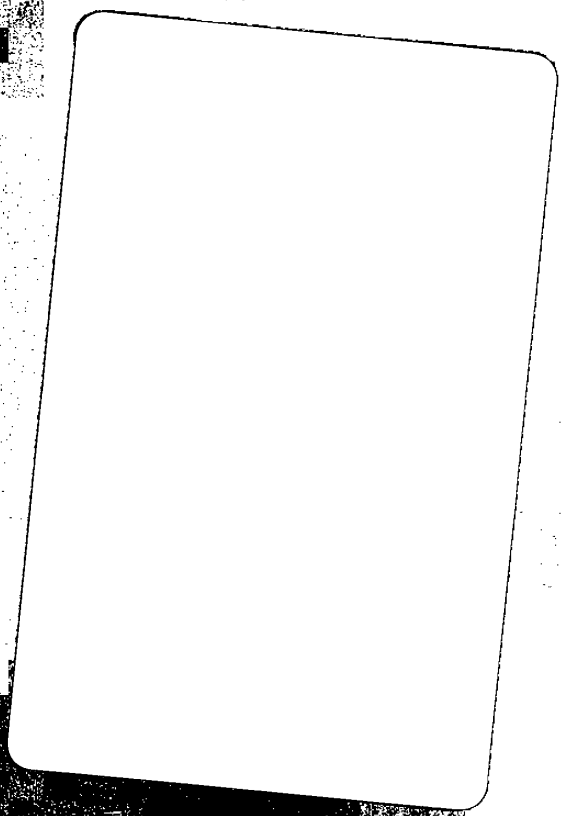

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