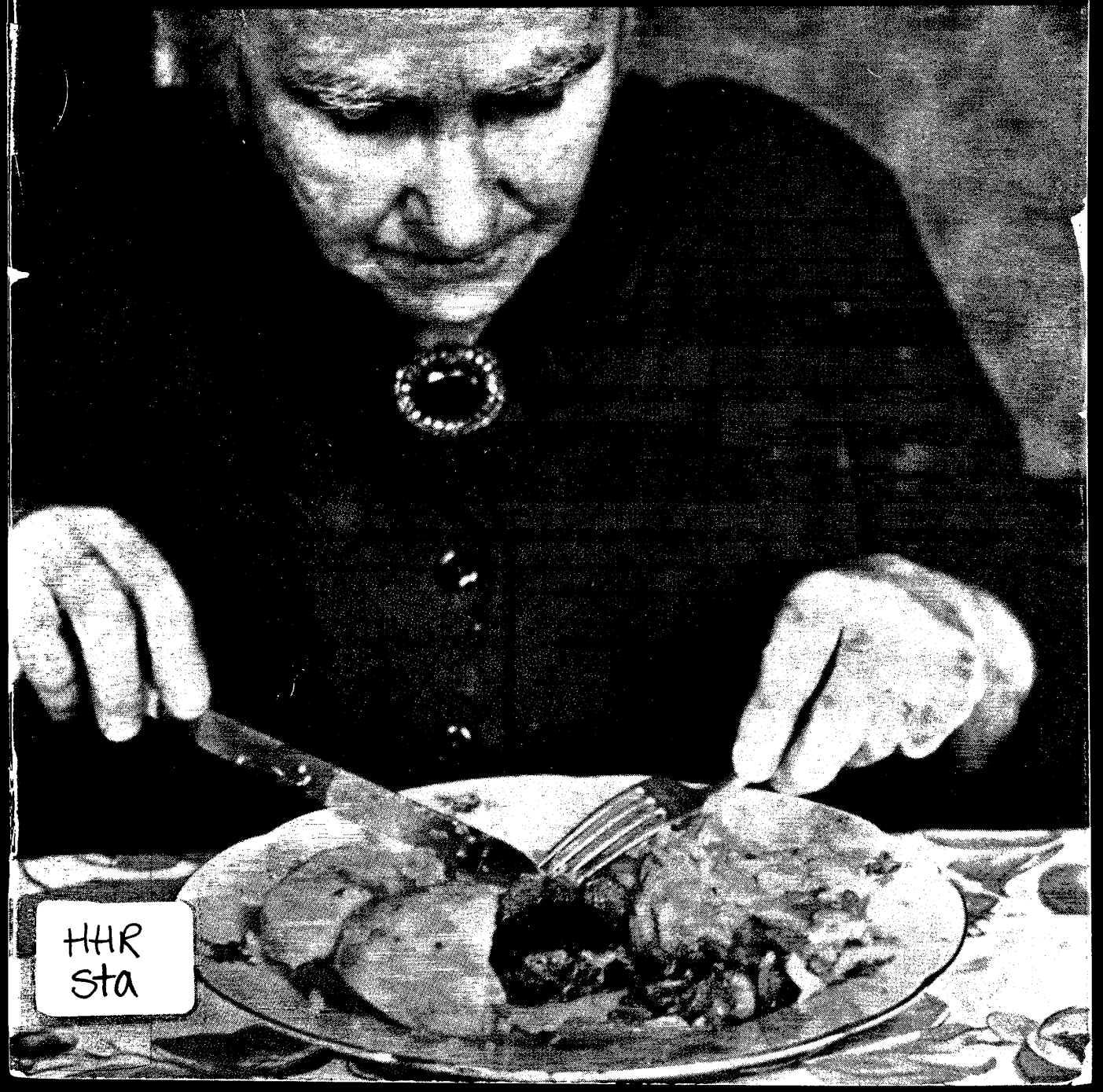
A Longitudinal Study of the Dietary of Elderly Women



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Report of the first longitudinal study of old people to be carried out in this country. It is a follow-up to *Report of an Investigation into the Dietary of Elderly Women Living Alone*.

B R Stanton SRD
A N Exton-Smith MD FRCP

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B R Stanton
A N Exton-Smith
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Table I. Follow-up of 60 subjects from 1962 survey

condition	number	percentage of total	Hornsey (33 subjects)	Islington (27 subjects)
dead	18	30	8 (25)*	10 (37)*
unable to trace but probably dead	5	8	1 (3)	4 (14)
moved away from district	3	5	2 (6)	1 (4)
in hospital or residential care	7	12	3 (8)	4 (15)
living alone at same address or in same district	27	45	19 (58)	8 (30)
total:	**60**	**100**	**33**	**27**

*Percentage in brackets.

IN 1962, SIXTY WOMEN LIVING ALONE TOOK PART IN A SEVEN-DAY weighed diet survey. Their ages ranged from 70 to 80 with the exception of three who were 89, 90 and 94 years old. When the results of this survey were analysed[1] a comparison was made between the dietary intake of a group of women in their late seventies and that of another group in their early seventies. During the eighth decade there was found to be a remarkable decline in dietary intake amounting to as much as 30 per cent in the case of some nutrients.

The decline in intake could be caused by any of the following:

a reduction in physiological requirements due to ageing, affecting all individuals;

a rising incidence during the seventies of disease or locomotor disorders which impair appetite or limit energy expenditure in some subjects;

secular differences between the two groups in that the life-long dietary pattern of the subjects in the older group may have been different from that of their younger contemporaries;

the failure of certain individuals, namely the obese, to reach extreme old age so that the late seventies group was composed of a higher proportion of thin women with a lower dietary intake.

It was not possible to assess the relative importance of these various factors from a cross-sectional study. It was therefore decided to follow up, with a longitudinal study, the women who took part in the 1962 survey.

THE INVESTIGATION

The original study was conducted from May 1962 to January 1963. All the subjects lived in two north London boroughs: 33 in Hornsey; 27 in Islington. In 1969, six and a half years later, the second study was carried out between January and March.

It will be seen from Table I that more Islington than Hornsey subjects had died, were in hospitals, residential care or could not be traced. This is reflected in the fewer Islington subjects who took part in the second study. In addition, the Islington subjects were frailer or less mentally alert than those in Hornsey and consequently less willing to cooperate.

Table II. Subjects taking part in 1969 survey

Hornsey subjects	13 gave seven-day weighed food records 2 gave diet histories	total 15: 45 per cent of original 33
Islington subjects	3 gave seven-day weighed food records 4 gave diet histories	total 7: 26 per cent of original 27

Twenty-seven of the sixty women were still living in their own homes and two were in old people's homes (total 29); of these, sixteen agreed to a second week's weighed survey and six more gave detailed diet histories. Of the remaining seven, four were confused or too ill to cooperate and three refused to take any further part.

Except for two women who were confused, all those interviewed remembered the former survey and the majority could remember the name of the dietitian who supervised the field study. Two of the women were now in old people's homes and two were in the same area but had moved to other addresses. All, apart from those in residential care, were still living alone. The average age of the group of 22 subjects was 80·9 years with a range of 76·5 to 86·5 years.

METHOD

Although different dietitians supervised the field studies for the first and second surveys, the same methods, as far as possible, were used in both studies. The subjects themselves were a great help because they remembered what was expected of them.

At the start of the 1969 investigation, the two supervising dietitians left with each subject scales, paper and pencil. Thereafter, they called at least once a day for seven consecutive days. A few of the women were able to weigh the food themselves: the remainder were cooperative in allowing the investigators to weigh bread, packaged foods, biscuits, jam and so on, daily, and to note the quantities used. By visiting at the appropriate times, cooked food for the main meal(s) was weighed by the investigators or raw foods weighed, as purchased, and the necessary calculations made for preparation waste.

Some of the women received meals-on-wheels and for these sample weighings were made at each kitchen providing the meals. Those who ate in old people's clubs had their food weighed for them there. Restaurant meals and other meals taken away from home (which amounted to less than one per cent of all meals) were assessed from careful description of the type of food eaten and the amounts in slices, spoons or similar homely measures. The food of the two women in residential homes was weighed or measured by the investigators in the homes.

Diet histories were taken by questionnaire: the subjects were asked

about the type of meal and quantities of foods in slices or homely measures, as had been done in the case of the other subjects questioned about food eaten away from home. This information was cross-checked against a shopping list which enquired in detail into the sorts of food, the amount in pounds, pints, packets or other containers bought weekly and the cost of each item. The dietitians had collected much information about the weight and price of foods in the local shops. They were thus able to form accurate assessments of weekly consumption from which nutrient intakes could be calculated.

All the 1962 survey records had been kept and in each case (weighed survey or diet history) it was possible to compare the present results with those obtained in the original study.

HEALTH

After the completion of the dietary survey the subjects were asked if they would have a clinical and a radiological examination. All the clinical studies were carried out by one observer (A N E-S). These examinations were similar to those carried out during the 1962 study, but on this occasion the clinical assessment was made at home and the subject only attended hospital to have an x-ray of the left hand.[2] For the assessment of the state of health the following information was recorded.

1 Clinical

a subject's own opinion of health
b assessment of physical condition
c assessment of mental state
d assessment of activity
e assessment of nutrition

2 Physical

a weight
b skin-fold thickness

3 Radiological

X-ray of the left hand under standard conditions and estimation of the amount of bone in the shaft of the second metacarpal by calculation of the ratio cortical area/surface area.[2]

No laboratory investigations were carried out. Nineteen subjects

Table III. Assessment of health

Subject's own assessment		
a		**4** – excellent, very well indeed
		3 – good for age, only minor complaints
		2 – fair, more specific complaints
		1 – poor, anxious about health
Physician's assessment		
b	**General condition**	
		4 – excellent, normal plus
		3 – good, normal for age
		2 – fair, minor disabilities present
		1 – poor, more serious disabilities
c	**Mental state**	
		4 – excellent, lively, full of spirits
		3 – good, alert, normal
		2 – apathetic or depressed
		1 – impaired, mild deterioration
d	**Activity**	
		4 – walks several miles per day
		3 – normal, adequate for independence
		2 – limited outside house
		1 – largely confined to house
e	**Nutritional state**	
		4 – normal
		3 – obese
		2 – thin
		1 – wasted, specific deficiencies

took part in this assessment of health.

Assessment of Health

For each assessment the subjects were placed in one of four grades under five headings, see Table III.

Although this method gives rather a crude assessment, it enables a comparison to be made between the health of the women in 1962 and that of the same women in 1969. In this scheme a subject in excellent physical and mental health, who enjoys social activities, could score a maximum of 20, whereas at the other end of the scale the minimum score would be 5 for a person confused and in poor health, with disabilities that confine her to the house and with signs of nutritional deficiencies.

The comparison between states of health in 1962 (A) and 1969 (B), with clinical scores and weights, is shown in Table IV, overleaf.

Table IV. Clinical assessment and weight: 1962 status compared with 1969

A – 1962 B – 1969

subject number	clinical score		weight in kilos	
	A	B	A	B
8	19	19	55	
9	20	19	48	49
14	17	18	63	66
16	19	17	52	54
17	20	20	53	52
18	17	18	55	50
21	16	15	69	76
24	17	12	46	41
25	18	15	70	70
26	15	12	61	44
27	20	18	65	65
28	18	14	64	60
29	19	15	49	
33	18	18	62	61
38	12	11	47	44
39	19	18	63	63
41	17	15		71
53	13	13	62	62
54	14	12		

RESULTS

The validity of comparing two weekly intakes with so wide a time lapse between may be questioned. Follow-up studies, especially among the elderly in this country, are rare. Marr *et al*[3] found that among middle-aged men there was good correlation between intakes obtained during two weeks separated in time. This method has also been used successfully in America where follow-up studies over fourteen years were conducted.[4, 5, 6]

Furthermore, dietary patterns of the elderly tend to be stable so that changes observed in the results of the present survey and those of the 1962 study are likely to be real and not merely chance fluctuations (with the exception of vitamin C, the intake of which is subject to seasonal variation).

Table V compares the average daily intake of nutrients of individual subjects for the 1962 and 1969 studies.

The mean daily intakes of the sixteen women for whom weighed dietary studies were made were:

P g	F g	Cho g	Cals	Ca mg	Fe mg	C mg
52	77	204	1680	876	8·9	32

The average age of the women was 81 years with a range of 77·5 to 86·5 years.

Table V (overleaf). Daily average nutrient value of food taken by 22 subjects in 1969 compared with average values found in 1962 study

A – 1962 B – 1969

	B	60	108	272	2250	1024	10·5	34	96
9	A	60	84	288	2114	1000	9·0	15	90
	B	47	72	244	1777	1150	7·1	28	30
14	A	49	70	259	1833	1026	8·0	39	10
	B	45	62	230	1620	734	7·0	16	25
17	A	55	74	257	1916	809	9·5	25	73
	B	60	73	236	1813	780	10·0	32	69
18	A	43	79	130	1392	574	10·4	34	78
	B	54	69	166	1520	647	12·7	32	73
24	A	61	73	165	1549	1038	11·0	27	88
	B	35	56	124	1125	589	7·2	20	10
25	A	71	112	183	2017	988	15·0	80	75
	B	58	67	173	1500	797	9·5	47	38
26	A	49	108	206	1980	1024	8·0	43	47
	B	45	74	145	1460	822	7·0	17	37
27	A	74	108	249	2264	1323	12·5	117	77
	B	59	85	202	1720	1127	8·4	25	118
29	A	66	98	142	1712	788	10·0	53	54
	B	55	78	170	1580	919	8·0	67	55
32	A	58	109	143	1807	937	13·0	63	174
	B	49	80	173	1545	728	10·0	35	127
33	A	70	102	227	2083	1008	13·0	104	89
	B	70	117	258	2330	1242	11·6	63	106
38	A	36	66	172	1453	390	6·0	8	69
	B	26	42	147	1053	377	5·5	13	74
39	A	70	112	239	2219	1085	15·0	60	114
	B	59	95	245	1990	1130	10·5	36	54
41	A	69	87	250	2104	1251	12·0	35	118
	B	58	68	226	1760	1070	8·4	20	137
53	A	48	85	159	1580	661	8·6	17	56
	B	49	80	254	1915	885	8·4	23	21
16*	A	62	80	240	1900	1030	7·7	20	
	B	No significant change							
21*	A	59	86	282	2131	981	10·2	35	
	B	No significant change							
36*	A	39	65	119	1208	545	5·4	24	
	B	No significant change except in vitamin C						13	
42*	A	56	98	310	2300	719	11·3	52	
	B	59	–	–	1850	1070	8·8	32	
46*	A	42	47	156	1194	598	6·0	32	
	B	32	–	–	1004	484	5·0	24	

Table VI. Relationship between changes in dietary intake, health score and weight A – 1962 B – 1969

Group I. Subjects showing minimal change in dietary intake

subject number	change in percentage protein	calories	health score A	B	weight in kilos A	B
14	−8	−11	17	18	63	66
16	0	0	19	17	52	54
17	+9	−5	20	20	53	52
18	+25	+10	17	18	55	50
21	0	0	16	15	69	76
33	0	+12	18	18	62	61
36	0	0		15		
42*	+5	−19				
53	0	+21	13	13	62	62
Average:	**+3·5**	**+1**				

Group II. More marked change in dietary intake

subject number	change in percentage protein	calories	health score A	B	weight in kilos A	B
1	−14	−8				
9	−22	−17	20	19	48	49
24	−43	−26	17	12	46	41
25	−18	−20	18	15	70	70
26	−8	−25	15	12	61	44
27	−20	−22	20	18	65	65
29	−16	−8	19	15	49	
32	−15	−14	19	15		
38	−28	−27	12	11	47	44
39	−16	−10	19	18	63	63
41	−16	−16	17	15		71
46	−21	−16				
54	−18	−15	14	12		
Average:	**−20**	**−17**				

* This subject was found to have diabetes after the survey in 1962 and in consequence her diet had been changed to one containing a lower proportion of carbohydrate.

Diet and Health

For the purpose of studying the relationship between diet and health, subjects have been divided into two groups. Group I consists of those who showed a minimal change in dietary intake during the six and a half years between the two studies and Group II, those who showed a marked decrease (greater than 10 per cent) in protein and calorie intakes. There were nine subjects in the first group and thirteen in the second. The relationship between dietary intake, clinical assessment score and weight are shown in Table VI.

It will be seen that in Group I subjects the constancy of dietary intake was associated with maintenance of a similar state of health and weight. On the other hand, the majority of Group II subjects showed a deterioration in health (although not always loss of weight) associated with a lower intake of food. For the most part the decline in clinical assessment score was due to a gradual reduction in physical activity although three subjects (24, 26 and 32) were suffering from diseases with constitutional disturbances when they were examined in the 1969 study.

Table VII. Average daily nutrient intakes of 13 subjects aged 78 years+ in the present study compared with 19 of the same age in the 1962 study

	1969	1962
	Average age 81·9 years	Average age 80·9 years
Pg	50	48
Fg	70	71
Cho g	197	213
Cals	1600	1670
Ca mg	848	760
Fe mg	8·4	8
Vit C mg	29	29

Age and Nutrient Intakes

The 1962 study revealed a sharp fall (19 per cent) in calorie intake during the years between seventy and eighty, when the intakes of the women in their early seventies were compared with those of the women in their late seventies. In the present study thirteen women, for whom weighed food records were obtained, were in the age group 78 years and over. If the average nutrient intakes of these thirteen are compared with nineteen of the same age group in the original study, certain striking similarities are observed, see Table VII.

The close similarities between the two groups provide some evidence of the consistency and accuracy of the dietary survey techniques used on the two separate occasions.

CHANGE IN MEAL PATTERNS

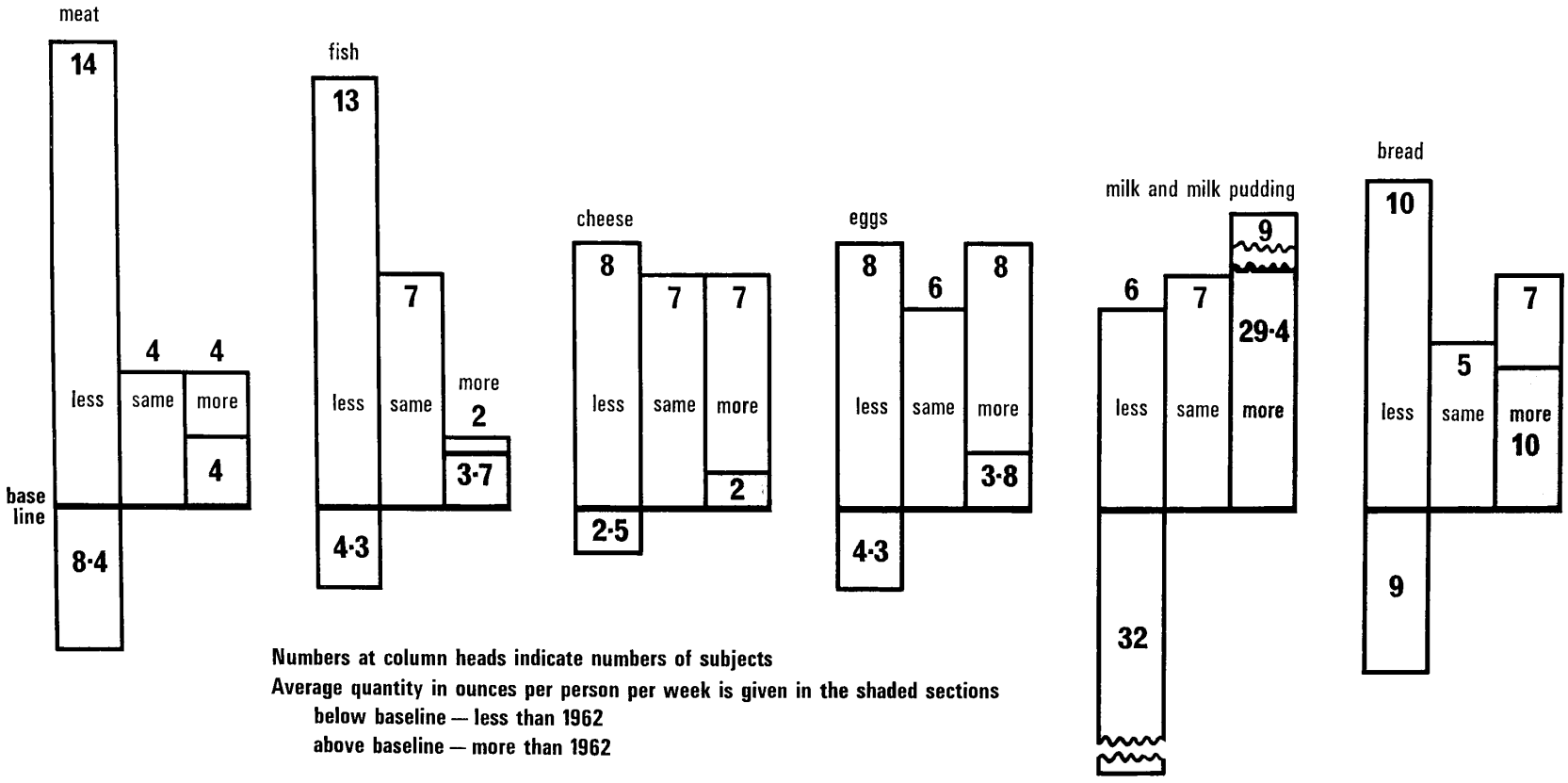
What caused the variations in nutrient intakes shown in Tables V and VI? Were they due to changes in meal patterns, in the consumption of specific foods, or both? A comparison of 1962 meal patterns with those of 1969 and of the total consumption of the chief food sources of protein and vitamin C in the same two periods, shows the following facts.

On the whole, meal patterns in 1969 differed little from those in 1962 and in only three subjects (53, 24 and 38) could nutrient increases or decreases be clearly related to change in pattern.

Subject 53 was taking more carbohydrate, in the form of sweetened fruit squash, which increased her average calorie intake by more than 300 a day.

Subject 24 was eating porridge with milk in 1962 but not in 1969. Her weekly milk consumption had fallen from 160 ounces to 70 ounces which helped to decrease both protein and calcium intakes.

Subject 38 had no set meal pattern in 1969. She had greatly deteriorated since 1962 when she was eating three meals a day and a snack at bedtime. Her diet, never good, was now the lowest with an average daily calorie intake of 1053 and 26 g protein. She did not eat breakfast. Part of the meals-on-wheels, which she received seven



Numbers at column heads indicate numbers of subjects

Average quantity in ounces per person per week is given in the shaded sections

below baseline — less than 1962

above baseline — more than 1962

days a week, was eaten as soon as delivered; the remainder was wasted. For the rest, she ate slices of bread and butter, boiled eggs and jelly babies at odd times throughout the day. Lack of meal pattern was, however, only one facet of her general physical and mental deterioration.

Other changes in meal pattern had no consistent effect on nutrient intake. For example, eight of the women were taking one or two more snacks each day than formerly, yet for all but two the calorie intake was less than in 1962.

FOODS

The decreased protein content of the diet was mainly due to the women eating less meat, fish and, to some extent, eggs. This loss was offset in some cases by a small increase in milk (or milk puddings) and cheese. Figure I shows differences between the two periods in intakes of the main protein-containing foods.

Among the possible reasons for these differences were: the rising cost of food – prices of meat and fish in particular have risen steeply since the original study; difficulty of cooking – cheese and milk need no cooking whereas meat and fish do; the decreasing ability of the elderly to chew meat.

The fall in vitamin C intake was only partly due to seasonal variation. As has been said, the original study on these particular women was carried out during May to September, while the follow-up study took place in January, February and March. Even so, there is evidence of a decrease in intakes of citrus fruits and potatoes which are not influenced to the same extent by seasonal changes in price or availability, see Figure II, overleaf.

MEAL SERVICES

The need for meal services is shown by the following. Of the 22 women seen:

two are now in residential care;

four are receiving meals-on-wheels (two more than previously);

three are attending Darby and Joan clubs for midday meals (two more than formerly);

Figure I (below flap). Differences in average intake of main foods containing protein, between 1962 and 1969 studies.

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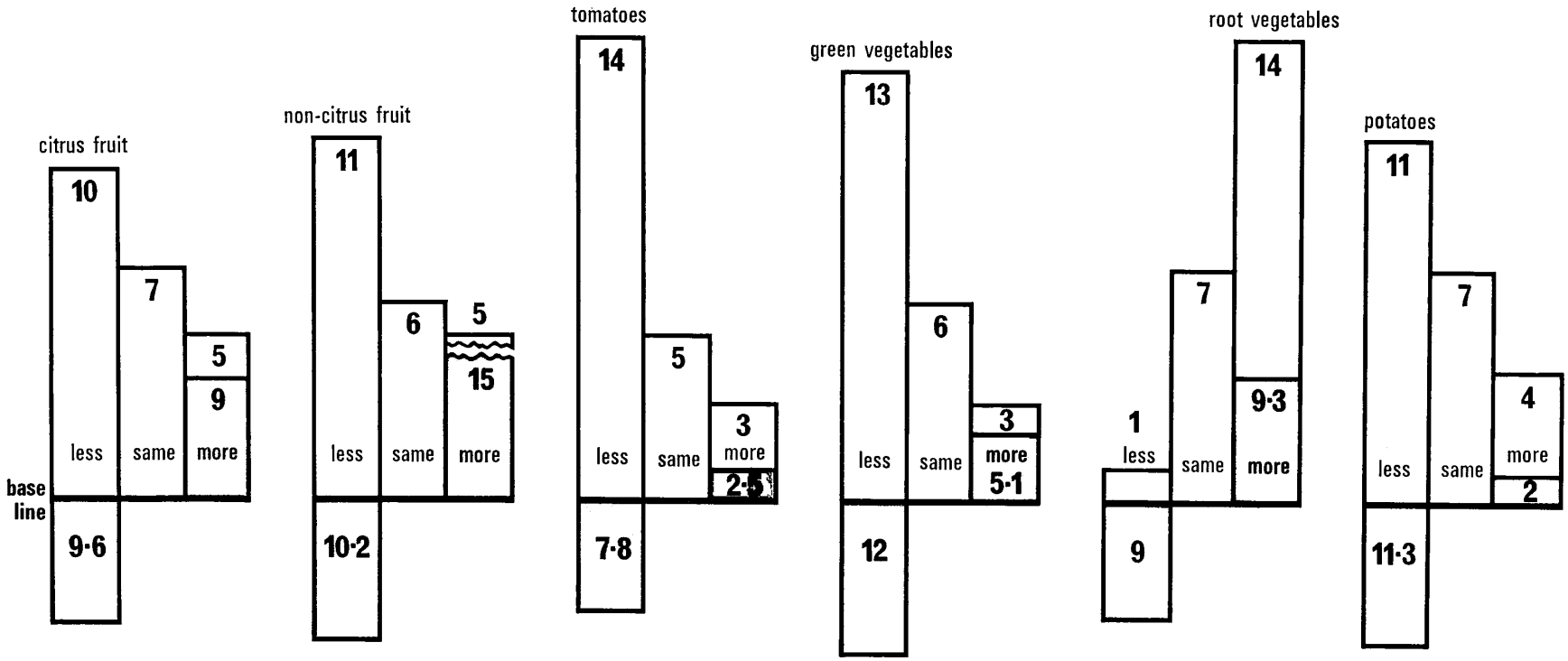

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hence, nine of the 22 (or 41 per cent) are receiving either total or supportive care.

DISCUSSION

Shock[7] has drawn attention to the importance of distinguishing between age *differences* and age *changes*. Age differences can be established by cross-sectional or comparative studies; that is, by comparison of measurements made on groups of people of different ages. Thus, in the original study a comparison was made between the dietary intake of a group of subjects in their late seventies with that of another group consisting of individuals in their early seventies. The investigation of age changes, however, requires serial measurements in the same individual for at least two different points of time. This is the only method which will clearly identify those changes which are due to ageing. It must be emphasised that old people are not just random survivors of a general population, nor are those who attain extreme old age merely random survivors of the population of seventy-year-olds. They are, in fact, people whose special characteristics have enabled them to outlive their contemporaries. It is likely that longitudinal studies will be the best means of identifying these characteristics and should also give information about those who fail to reach old age and the reasons for failure.

Ideally, in longitudinal studies, repeated measurements should be made of the same individual at standardised time intervals throughout life. This is possible in animals with short life spans, but in the study of human ageing repeated measurements at short intervals for a period of about twenty years is the best that can be achieved. Thus, it would be preferable for a longitudinal survey of people in old age to start with observations during their late fifties or early sixties, and to follow them up for as long as possible. The present limited longitudinal study, however, gives valuable information since it has been conducted in part of a decade during the middle of which a considerable increase in the prevalence of disease and disability occurs.[8] The original cross-sectional study was not able to identify the importance of these factors in causing changes in dietary intake. It drew attention to the marked fall in intake which occurs during the eighth decade; moreover, it showed that the percentage decline was more rapid in the second half of the decade.

Of the 22 subjects followed up over a period of six and a half years

Figure II (below flap). Differences in average intake of main foods containing vitamin C, between 1962 and 1969 studies.

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Of the 22 subjects followed up over a period of six and a half years

in this longitudinal survey nine showed minimal change in their diets and this was associated with constancy in their health scores and weights. We know that 30 per cent of the women included in the original study had died during the six and a half year period and a further 20 per cent had probably either died or developed illness which necessitated their admission to hospital or residential care. These nine subjects represent the élite of the original sample and constitute approximately one-sixth of the total. Not only have they reached their late seventies but they have done so with little change in their health and physical activities. Thirteen of the subjects who survived to the second half of the eighth decade showed a decline in health and activity; this was associated with a fall in nutrient intakes, the mean decrease for protein being 20 per cent and for calories 17 per cent, when a comparison is made with their intakes in 1962, see Table VI, Group II.

Thus, in a group of women whose average age was just over 70 and whose expectation of life was approximately eleven years the subsequent course was as follows.

1 A large number died before they reached their late seventies.

2 About a quarter developed illnesses which impaired their state of health, physical capacity and (probably in consequence) nutrient intakes.

3 About one-sixth retained their health and independence and maintained their long-established dietary intake.

In addition there were seven individuals who, because of unwillingness or mental impairment, could not cooperate in a dietary survey. Groups 2 and 3 above (total 22 subjects) together constituted the series for the 1969 survey; their average age was 80·9 years and their mean dietary intake was very similar to that of the oldest group (mean age 80·9 years) studied in our 1962 survey.

In this country there have so far been no longitudinal studies in the elderly with which to compare these results. However, a longitudinal investigation of the nutritional status of the aged has been carried out in San Mateo, California. The initial survey[4] was conducted in 1948 in healthy subjects aged 50 and over. When the data from this initial cross-sectional study were analysed, with the subjects placed in three age groups 55–64, 65–74, and 75 and over, it was found that there was a progressive fall in intake with age,

especially in the over seventy-fives; these results, although over a different age range, were comparable to those of our 1962 study. Further surveys were conducted four, six and fourteen years after the original study[5, 6] and slightly less than one-third of the sample participated in all four surveys. It was found that there was a group of individuals who showed little alteration with age in the intake of animal protein. Those subjects with low intakes in 1948 tended to maintain the same pattern through to 1962. The results of this longitudinal investigation indicate that the differences between the intakes of the age groups noted in the cross-sectional studies were not entirely due to age changes, but might, in part at least, represent characteristics of the particular individuals alive in the oldest age groups. As Watkin[9] points out, it has not yet been determined whether the life-long nutrition pattern of those who reach advanced old age has, in fact, contributed to their longevity or whether their heredity has not only enabled them to survive but has also, in some manner, characterised their nutrition.

CONCLUSION

It is to be concluded from this longitudinal study and from that conducted in San Mateo that there is a group of individuals whose nutrient intakes change little with age. These subjects are the fortunate élite who reach extreme old age with little impairment in their health and physical capabilities. The falls in intakes during the eighth decade revealed by the cross-sectional study probably do not represent true age changes; rather we would refer to them as age differences which can be accounted for by the consequences of increasing physical and mental disabilities which afflict a large proportion of people during this decade.

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