

The food purchases of elderly women living alone: a statistical inconsistency and its investigation

By B. S. PLATT

*Human Nutrition Research Unit, Nutrition Building, National Institute
for Medical Research, Mill Hill, London, N.W. 7*

P. G. GRAY AND ELIZABETH PARR

Central Office of Information, London, S.E. 1

A. H. J. BAINES, S. CLAYTON, ELIZABETH ANNE HOBSON
AND DOROTHY F. HOLLINGSWORTH

Ministry of Agriculture, Fisheries and Food, London, S.W. 1

AND W. T. C. BERRY AND ELIZABETH WASHINGTON

Ministry of Health, London, S.E. 1

(Received 11 February 1964—Accepted 30 April 1964)

Budgetary surveys of the quantities of food obtained for consumption by whole households cannot by their very nature give direct information about the diets of individuals. This may not matter to economists; to nutritionists it is a most serious limitation. There is only one small but important group of households, those consisting of one person, for whom it is *prima facie* possible to use budgetary records to assess actual food consumption.

Some early National Food Survey records indicated that such assessments were valid. The winter of 1947–8 was one of privation, judged by current British standards. Bread and potatoes, which had been freely available throughout the war, were both rationed, and during the previous year the people as a whole had lost weight (Kemsley, 1953) and complained publicly about the food supply (Harries & Hollingsworth, 1953). The continuous survey of the diets of urban working-class households begun in 1940 was therefore suspended for 6 months (October 1947–March 1948) to allow the field workers to concentrate on those groups most likely to be affected by the shortages, especially heavy manual workers' households and old-age pensioners living alone. The sample in each group was augmented by a small initial sample of households providing fresh personal contacts for survey in the neighbourhood. The defects of the method are obvious (Ministry of Agriculture, Fisheries and Food: National Food Survey Committee, 1956, Appendix D), but a rapid survey of very restricted groups could hardly have been made otherwise. The initial sample of pensioners was based on registrations for additional tea for those over 70 years of age, but some of the added pensioners were in their sixties. The resulting sample contained 508 women aged over 60 years: the energy values of their food consumption, estimated from their own

records of food entering the household and adjusted for changes in larder stocks (but not for wastage), were:

Age...	60-69	70-79	80-89	90-99	All
No. of persons	108	301	95	4	508
Mean energy value (kcal/day)	2056	1986	1866	1619	1964

These results seemed physiologically reasonable, and they are in line with those reported by Durnin & Blake (1962) for twenty-three women who provided records of their food purchases and whose larder stocks were measured and used in precisely the same way. In 1954, another such study was made of the diets of elderly women living alone and who participated in the National Food Survey, the only material difference in technique being that changes in household larder stocks were no longer measured in the Survey after June 1951. This change appears to have caused no discontinuity in the records of the total energy value of food obtained for consumption, except in the special group of households now under discussion; and this exception went unnoticed at the time. It came to light when Baines & Hollingsworth (1955) examined the records of all the 722 women over 55 years of age who lived alone and took part in the Survey between April 1953 and March 1954. The energy value of their food was found to range from 2900 kcal/head daily at 55-64 to 2400 kcal at 80 and over, the decrease with age being on average between 8 and 9% of the value for the 60-64 age-group for each decade after 60. For each age-group the energy value of food obtained for consumption was roughly 1000 kcal/head daily greater than the requirement recommended by FAO (1957). Data for single elderly women in each income group were examined at this time and the effect was seen in all, particularly in the highest (Baines and Hollingsworth, unpublished records).

These results were received with surprise amounting to incredulity; it was clearly necessary to find an explanation for them, and this led to a series of investigations described below.

EXPERIMENTAL AND RESULTS

The investigations

1. *Data from National Food Survey 1957 and 1958*

The 1957 National Food Survey sample included 776 pensioner households (i.e. households mainly dependent on contributory or non-contributory state retirement or old-age pensions), and of these 391 consisted of one woman living alone. They recorded about 2660 kcal/head daily, compared with an estimated requirement of under 2000 kcal. This observation confirmed that a large discrepancy between purchases and needs of such persons extended to those in the lowest income groups.

A more detailed analysis by age-groups of the diet of female pensioners living alone in 1958 gave the results shown in Table 1, and established that the 1953-4 results were not an isolated occurrence.

2. *Survey of intake and energy expenditure, Paisley, 1958*

An individual dietary survey was made in 1958 on seventeen women between 60 and 69 living alone in Paisley (Durnin, Blake, Brockway & Drury, 1961). Their mean

intake and expenditure of energy over 7 days were in good agreement at about 1900 kcal/head daily. Their recorded food wastage was small, 65 kcal/head daily (Durnin & Blake, 1962), as is likely when attention is directed to wastage. They also kept budgetary records, and larder stocks were recorded by the interviewer at the beginning and end of the week, as in the National Food Survey for 1942-51. Six other women provided records of larder stocks and purchases only. These budgetary results, expressed in terms of energy value, were almost identical with those of the individual surveys, and were close to the 1947-8 National Food Survey results quoted above. In short, the study supported the view that the intakes recorded for this group of the population by the National Food Survey since 1951 were too high, but did not indicate why.

Table 1. *Expenditure on food, and energy value and nutrient content of food obtained for consumption by female pensioners living alone, 1958*

Age (years)...	60-64	65-69	70-74	75-79	80 or more
No. of persons	52	72	85	68	58
Expenditure on food/week	34s. 0d.	30s. 5d.	29s. 4d.	26s. 3d.	24s. 5d.
Energy value (kcal/day)	2916	2742	2562	2480	2292
Protein (g/day)	82	75	74	71	64
Fat (g/day)	127	117	111	110	94
Carbohydrate (g/day)	361	348	317	302	298
Iron (mg/day)	14.8	13.7	13.4	12.1	10.7

3. *First Greater London Inquiry*

Possible reasons for the difference between the Paisley results and those of the post-1951 National Food Survey were that the small group in Paisley was unrepresentative, or that food recorded differed from that eaten. To test these possibilities an individual dietary survey was done in January 1959 on eight women aged 60-69 who lived alone in Greater London and who had participated in the National Food Survey between July 1957 and June 1958.

Procedure. Twenty-two women were eligible for inclusion. One had died, and two were in employment which made it impossible to reach them. Each of the others was first asked by a Survey field worker to take part in a further individual dietary survey, to be done by a Ministry of Health dietician. Seven refused to co-operate, mainly because they had found the first survey too complicated, and two were no longer living alone. The remaining eight completed the individual dietary survey, and said that they found it easier to understand and less troublesome than the previous inquiry.

As in Paisley, the method was that of Garry, Passmore, Warnock & Durnin (1955) and Durnin, Blake & Brockway (1957). Amounts of sugar for tea (but not for cooking), jam, marmalade and butter were weighed and left in receptacles for use during the week, the receptacles being replenished when necessary by the dietician. At the end of the week, the quantities remaining were weighed. For milk, an amount sufficient for a day was put into a jug, and the dietician weighed the quantity remaining at her daily visit. She inquired about sweets and snacks, food given to visitors, meals eaten outside the home, how food was cooked, how dishes were made up, and whether any food was uneaten after it had been weighed. The names and composition of proprietary

foods as stated on the labels were noted. For sauces and gravies, which could not be weighed, the informant was asked to estimate the size of the portion. Wastage was not mentioned until 4 days' food intake had been recorded, but during the last 3 days the informants were asked to record the amount of edible waste on the plate, and to keep food discarded during preparation until the dietician's next visit; its weight was then estimated. At the same time informants were questioned about food given to domestic pets and how uneaten bread had been disposed of (e.g. crusts thrown away or made into puddings or given to birds).

Table 2. *Elderly women, aged 60-69, First Greater London Inquiry: mean daily energy value and content of protein, fat and carbohydrate in each individual's diet*

Subject no.	First 4 days	Last 3 days	Mean	First 4 days	Last 3 days	Mean
	Energy value (kcal)			Protein (g)		
1	2200	1617	1949	103	53	82
2	2197	2099	2155	76	65	71
3	1924	2089	1995	79	71	75
4	2796	2178	2531	84	77	81
5	1786	1547	1684	74	54	65
6	1314	2050	1629	38	65	50
7	718	584	660	32	30	31
8	2277	2314	2293	75	69	72
Mean	1902	1810	1862	70	60	66

Subject no.	Fat (g)		Carbohydrate (g)			
	First 4 days	Last 3 days	First 4 days	Last 3 days	Mean	
1	108	84	97	208	164	189
2	97	106	101	256	221	241
3	104	126	116	162	169	165
4	146	108	130	282	216	254
5	75	69	70	212	179	198
6	43	86	61	194	247	216
7	27	36	31	85	75	81
8	92	96	94	287	298	292
Mean	86	89	87	211	196	204

Results. Table 2 gives results in terms of calories, protein, fat and carbohydrate for these eight women. Neither set of intake values incorporates any allowance for preparation or plate wastage. There was no evidence that the women changed their normal food habits during the survey week; even no. 7, with a very low intake, appeared to be following her usual pattern of meals. No. 6 was ill for 2 days, and took only milk beverages, so that her daily intake was 1314 kcal for the first 4 days compared with 2050 kcal in the last 3. Preparation and plate waste were exceedingly low (Table 3). There was some fall in individual intakes between the first 4 days and the last 3, when information on wastage was being collected; excluding no. 6, the decrease averaged about 10%, but on these numbers it did not attain statistical significance. Three of the women owned cats, but bought special food, other than milk, for them. One subject had one meal outside the home and recorded it; six 'visitor meals' occurred and food consumed by the visitors was excluded.

Discussion. Table 3 compares the results of this individual survey with the National Food Survey records for those aged 60–69 in the 1953–4 sample (Baines & Hollingsworth, 1955), for all women aged 60–69 living alone who provided Survey records in January–March 1958, and for the eight subjects described here when they took part in the Survey in 1957–8. The Paisley results (from Durnin *et al.* 1961) are also shown. All the National Food Survey values are at one level, around 2900 kcal, about 1000 kcal higher than the individual dietary results, which at Paisley were supported by conformity to actual energy requirements as indicated by calorimetry. This finding suggested that different survey methods led to differences in buying behaviour by the same group of women.

Table 3. *Surveys on elderly women aged 60–69 years: mean daily energy value and content of protein, fat and carbohydrate in diets of National Food Survey samples compared with corresponding ranges for individual dietary surveys*

	National Food Survey			Individual dietary surveys		
	Apr. 1953– Mar. 1954	Jan.– Mar. 1958	1957–8, Greater London	First Greater London Inquiry, 1959		Paisley, 1958 (Durnin <i>et al.</i> 1961)
				Intake	Wastage	Intake
Energy value (kcal)	2867	2901	2907	1862	36	1894
Total protein (g)	89	79	91	65·8	1·3	62·4
Fat (g)	119	131	129	87·4	0·8	85·7
Carbohydrate (g)	380	351	344	204·5	5·8	232·1
No.	320	50	8	8	8	17
Ranges						
Energy value (kcal)	—	—	—	660–2531	0–114	1107–2283
Protein (g)	—	—	—	30·7–81·5	0–4·2	29·2–85·0
Fat (g)	—	—	—	31·1–130·0	0–2·9	50·4–105·2
Carbohydrate (g)	—	—	—	80·6–291·8	0–22·5	143·0–313·1

Table 4 indicates where these differences lay. The adjustment of the quantities recorded in the Greater London individual survey to weights 'as purchased' is subject to errors, but these could not obscure the large differences found for the storable foods, fats, sugar, flour and potatoes. National Food Survey results for all women aged 60–69 living alone who provided records in the first quarter of 1958 are given for comparison; allowing for seasonal and geographical differences, they show that the food consumption of the eight women was typical of the group from which they were drawn. When they were recording their meals they 'consumed' less than half as much sugar and potatoes and about half as much fats as when they were simply recording their purchases; and in particular they used almost no flour, margarine or cooking fats. The corresponding differences for milk and bread, which are commonly thought to be wasted, were quite small. Those for fresh fruit and fresh green vegetables should be discounted as being largely seasonal, and they contribute little to the energy value of the diet. The Paisley inquiry also showed much lower consumption of fats, sugar, flour and potatoes than the National Food Survey samples. Fats, sugar and flour are normally used in large amounts where there is much home baking. All the eight London women had their own gas cookers, on which they cooked meat, savoury

Table 4. *Surveys of elderly women, aged 60-69: mean weekly consumption of specified foods (oz/head unless otherwise stated)*

	No. in sample...	First Greater London Inquiry	
		Great Britain NFS, 1st quarter 1958	Individual dietary survey, 1959, adjusted to 'as purchased' weights
		NFS 1957-8	
Liquid milk (pint)	50	8	8
Condensed milk (pint equivalent)	5.8	5.3	4.6
Total milk and cream (pint or pint equivalent)	0.2	0.1	0.1
Cheese	6.0	5.4	4.7
Carcass meat	3.1	5.6	3.8
Bacon and ham	19.1	29.5	22.5
Other meat	5.6	5.4	9.3
Total meat	10.9	7.2	10.1
Fish	35.6	42.1	41.9
Eggs (no.)	10.0	19.8	12.1
Butter	4.4	5.0	3.8
Margarine	8.7	6.0	6.3
Other fats	2.9	3.0	0.1
Total fats	5.0	3.3	0.4
Sugar	16.6	12.3	6.8
Preserves	18.9	20.0	8.0
Total sugar and preserves	7.0	4.0	3.1
Potatoes	25.9	24.0	11.1
Fresh green vegetables	45.4	58.0	26.2
Other vegetables	12.3	28.5	7.3
Total vegetables	21.3	9.4	2.5
Fresh fruit	79.0	95.9	36.0
Other fruit	19.1	34.8	10.4
Total fruit	6.4	2.0	3.0
Bread	25.5	36.8	13.4
Flour	45.8	33.3	37.5
Cakes and biscuits	11.5	12.0	0.6
Other cereals	14.4	14.6	10.9
Total cereals	6.0	10.0	3.4
Tea	77.7	69.9	52.4
Coffee	4.7	3.5	na
Cocoa	0.8	2.0	na
Branded food drinks	0.1	1.0	na
Total beverages	1.6	3.0	0.2
	7.2	9.5	na

NFS, National Food Survey; na, not available.

dishes, vegetables, milk puddings and fruit, but during the survey week none baked cakes, although two had done so in the previous week, and only three made puddings containing flour. This suggests that a time-consuming individual dietary survey may lead to some simplification of cooking procedures. It is possible, too, that the use of

containers for measuring such foods as sugar may cause the subject to use abnormally small amounts of the food in the container or to fail to record additions made to the container during the week of survey.

Conclusion. These inquiries did not resolve the problem of the discrepant 1000 kcal, though they did show that the reason for the conflicting findings must lie in the methods used, especially in relation to easily stored, cheap sources of energy, such as fats, sugar, flour and potatoes, rather than in the samples surveyed. The next step was to scrutinize the technique of the National Food Survey.

4. *Studies from National Food Survey records*

Before June 1951, food consumption was estimated by summing recorded purchases, quantities entering the household without payment ('free' food) and the change in larder stocks between the beginning and end of the survey week. If the amount of food bought was not exceptional during that week, addition to and withdrawals from larder stocks should cancel out over the year, given a large enough sample. In fact the housewife could, and did, save herself trouble by postponing shopping until after the survey week, and meanwhile drew on the stocks to which her attention had been directed. Accordingly, in June 1951 the weighing of larder stocks was discontinued. For the sample as a whole, the new technique improved the estimates of expenditure on food and did not worsen those of food consumption (Ministry of Food: National Food Survey Committee, 1953, Appendix A); but at the time the effect of the change was not examined for separate groups of the population.

Procedure. The next step was therefore to compare the energy value of food consumption for corresponding groups during the first half of 1951, before the change of technique, and the first half of 1953 (Ministry of Agriculture, Fisheries and Food: National Food Survey Committee, 1961). For the same periods, the average consumption of individual foods by single female old-age pensioners was compared, and a similar comparison was made for all households (Ministry of Agriculture, Fisheries and Food, unpublished records).

Results. Table 5 shows that for single female old-age pensioners, the estimated energy value of food consumption rose by 500 kcal/head daily after the change in technique. The only other groups to exhibit marked increases were pensioner households as a whole and the remainder of the lowest income group, both of which contain large proportions of elderly women living alone.

When larder stocks were measured, pensioners, like others, tended to draw upon them, especially for fats, eggs, preserves, canned meats, potatoes, fruits, cakes and biscuits. For a few foods, however, they differed from the general sample in purchasing more than they consumed; these items included sugar, syrup and treacle, flour and bread (Ministry of Agriculture, Fisheries and Food, unpublished records).

Average purchases in the two periods are not strictly comparable, because of changes in available supplies and the increase in the basic pension from 26s. a week in the first half of 1951 to 32s. 6d. in the corresponding months of 1953. Nevertheless, it is remarkable that estimated consumption by pensioners in 1953 exceeded their

measured consumption in 1951 for all foods except butter, suet and dripping, cooked and canned meats, fish and miscellaneous items. The differences were mostly large; those for carcass meat, bacon, eggs, sugar and tea are associated with relaxations in rationing, but improved supplies do not explain the recorded increases for syrup and treacle (a threefold rise), flour (also particularly large), bread and other cereal foods, fruit, potatoes and other vegetables. There seems to be a tendency for the more detailed survey to accentuate the pensioners' well-known preference for butter rather than margarine; this is in line with the corresponding finding in the First Greater London Inquiry (Table 4).

Table 5. *National Food Survey: mean daily energy value (kcal/head) of household diets of particular groups, before and after the weighing of larder stocks was discontinued*

Class	1951		Excess 1953 over 1951
	Jan.-Feb. and Apr.-May	1953 Jan.-June	
All households	2480	2470	- 10
Class A	2500	2340	- 160
Class B	2510	2440	- 70
Class C	2500	2520	+ 20
Class D (excluding old-age pensioner households)	2370	2480	+ 110
Old-age pensioner households	2190	2480	+ 290
Single female old-age pensioners	2140	2640	+ 500
Households with 1 man and 1 woman: only	2810	2830	+ 20
+ 1 child	2540	2490	- 50
+ 2 children	2390	2260	- 130
+ 3 children	2230	2130	- 100
+ 4 or more children	2150	2090	- 60
+ adolescents	2710	2770	+ 60
+ children and adolescents	2450	2420	- 30

Gross weekly income of head of household

Class	Gross weekly income of head of household	
	1951	1953
A	£13 or more	£15 or more
B	£8 but under £13	£9 but under £15
C	£4. 10s. but under £8	£6 but under £9
D	Under £4. 10s.	Under £6

Conclusion. The earlier technique caused understatement of purchases, as opposed to consumption, in all types of household; the later technique corrected this but seems to have induced single elderly women to depart from their usual buying habits during the survey week.

5. *Second Greater London Inquiry*

The next step was to test the hypothesis, that a survey that places the emphasis on purchases rather than actual use will cause single elderly women to increase their purchases of certain storable foods.

There are three ways in which a change of habits may bias the results of a survey: the household may diminish or increase its larder stocks; eating habits may change;

or more or less food may be wasted, when the household is under observation. Any or all of these changes may occur, to an extent depending on the method used.

It was decided to do a food budgetary survey with recording of larder stocks, with special precautions to eliminate end-effects. Ideally, the interviewer should arrive before breakfast on the 1st day of the survey and make the final inspection at bedtime on the 7th day. In practice, the log-book used when larder stocks were weighed contained records for 8 days and the instruction was to time the two weighings to fall between the same two meals.

Procedure. In this experiment, made in October 1959 by the Social Survey Division of the Central Office of Information, special record books containing pages for 9 days were used. The housewife was asked to continue the record until the interviewer returned to collect the book and measure larder stocks, usually on the 8th day. The ninth page might be necessary if the first call occurred late on the 1st day; the final stock check might then have to be deferred until the 9th. In practice it has been found impossible to carry out two larder inspections exactly 7 days apart, but corrections were made for the end-effects by allowing for any purchases made and food consumed between the required end-points and the actual larder inspections, i.e. between the beginning of the 1st day and the first larder inspection sometime on that day, and between bedtime on the 7th day and the final larder inspection, usually on the 8th day. To assist in making these end-corrections, the times of all shopping expeditions and of the two weighings were noted, and the interviewer was instructed to draw a line across the record book below any purchases made before her arrival on the 1st day, so that they would not be included in the estimated 7 days' consumption. Some additional details of ingredients and quantities were obtained, by questioning, for meals involved in either of the end-corrections.

The recording of larder stocks was limited to the foods for which the largest discrepancies had been found in the previous experiments, namely, margarine, cooking fats, sugar, flour and potatoes, together with butter, to cover all fats, and eggs, because they were easy to measure. The interviewers were particularly careful about the purchases and use of these foods, without drawing the housewife's attention too obviously to them.

For each food, except potatoes and eggs, the description and weight in ounces of each separate packet or container of food, whether opened or unopened, were recorded at the first inspection, and again at the last. Containers (e.g. bowls) had often been replenished from the packets. The weight of all potatoes in stock and the number of eggs were also recorded. The presence of any home-made cakes, biscuits or pastry was noted, since it provided evidence of the use of flour and fats.

After the final larder stock check, the interviewer asked questions on shopping habits, in general, and, in particular, on buying habits and use of sugar, flour and fats. She also recorded, if possible, how much sugar the informant was observed to take in her tea.

As elderly women aged 60-69 surveyed in Greater London between July 1957 and June 1958 had already been revisited, the sample consisted of women aged 58-67 when interviewed between July 1956 and June 1957 and those aged 60-69 when inter-

viewed between July 1958 and March 1959. The fifty-nine women in these categories provided twenty-three usable records; the remainder are accounted for as follows:

Dead	2	Refused to participate	12
No longer living alone	4	Interviewer fell ill	3
Not traced	7	Record book considered unreliable	4
Not contacted	4	Total	36

Results. In this study, apart from the 1st day which was usually fully recorded by the interviewer, 41% of the items were recorded solely by the informant, 50% were recorded by the informant but elaborated by the interviewer after questioning and 9% were recorded by the interviewer—these were purchases remembered when the meals were being entered or discussed, or revealed when the interviewer probed for likely purchases. Even so, items may have been omitted, or perhaps entered twice. This procedure was an elaboration of that used at the intermediate and final interviews in the National Food Survey.

Estimates of consumption of the seven foods under consideration are given in Table 6, with estimates from previous inquiries. Line (a) is based solely on the purchases recorded as having been made in the first 7 days of record-keeping. Line (b) gives the extent to which stocks of the foods in the larder ran down between the two inspections. Line (c) is the sum of (a) and (b) and thus estimates consumption as the pre-1951 National Food Survey did. In line (d) this estimate is adjusted to allow for the fact that the first inspection was not made at the beginning of the 1st day or the second at the end of the 7th, so that (b) covers a somewhat different period from (a). Line (e) gives estimates for sugar and flour based on the informant's view on how long her normal purchase was thought to last. Line (f) gives the purchases recorded by the same women for the National Food Survey up to 3 years previously (one woman whose purchases then contributed 1.4 oz. to the average sugar purchases shown for line (f) had since been put on a sugar-free diet).

Line (g) is based on National Food Survey records for January–March 1958 of fifty elderly women living alone.

Line (h) gives the purchases recorded by the first ten women surveyed in Paisley during 7 days (J. V. G. A. Durnin, E. C. Blake, J. M. Brockway & E. A. Drury, unpublished results). In line (j) these figures are adjusted for the diminution of larder stocks and for the unusually high proportion of meals taken away from home.

Lines (k) and (l) relate to the eight elderly women who took part in the First Greater London Inquiry. Line (k) gives 'as purchased' weights derived from the individual dietary survey in January 1959, line (l) the purchases which the same women recorded in the normal National Food Survey during July 1957–June 1958.

Standard errors are given whenever possible; they emphasize the fact that the sample could with advantage have been larger, but even so the differences are very striking. The right-hand column gives the total energy value of the seven foods in kcal/day. All the National Food Survey records give kcal equivalents between 1023 and 1107 ((f), (g) and (l)). A similar approach with recording of larder stocks gives about 760 kcal (d); the net effect of the adjustments for changes in larder stocks and end-corrections is small ((a), (c) and (d)). Finally, the individual dietary surveys show much

Table 6. Consumption of certain foods by elderly women aged 60-69 living alone

Survey		Mean value with its standard error* (oz./week)						Energy equivalent (kcal/day)			
		Sugar	Potatoes	Eggs	Butter	Margarine	Other fats				
Second Greater London Inquiry (sample size 23), Oct. 1959 except for (f)	(a)	Estimate based solely on first 7 days' purchases in record book	13.9 ± 3.0	34.8 ± 6.1	4.3 ± 0.8	7.3 ± 1.3	2.7 ± 1.0	2.4 ± 0.8	4.2 ± 2.2	767	
	(b)	Extent to which larder stocks had been diminished, i.e. larder contents at first inspection minus those at second	3.7 ± 3.2	0.7 ± 2.9	0.8 ± 0.4	-1.8 ± 1.1	0.6 ± 0.9	0.0 ± 0.7	-1.6 ± 2.1	9	
	(c)	Estimate based on (a) + (b) as would have been made in pre-1951 NFS	17.6 ± 3.3	35.5 ± 7.0	5.1 ± 0.9	5.5 ± 1.3	3.3 ± 1.3	2.4 ± 0.6	2.6 ± 0.7	776	
	(d)	Fully corrected estimate allowing for the fact that (b) does not cover exactly the same period as (a)	15.3 ± 2.2	34.2 ± 6.5	5.1 ± 0.7	6.5 ± 1.1	2.9 ± 0.8	2.6 ± 0.7	2.4 ± 0.7	761	
	(e)	Estimate based on how long the normal purchase was thought to last	17.7 ± 2.0	no	no	no	no	no	9.3 ± 1.6	—	
	(f)	Estimate from normal NFS records kept up to 3 years earlier by the same women	23.7 ± 3.5	48.7 ± 9.6	6.1 ± 1.0	9.1 ± 0.9	4.4 ± 1.2	1.4 ± 0.8	8.7 ± 3.0	1101	
	National Food Survey: Great Britain (sample size 50), 1st quarter 1958	(g)	Estimate from normal NFS records for 7 days' purchases	18.9	45.4	4.4	8.7	2.9	5.0	11.5	1107
		(h)	Estimate based on record of 7 days' purchases. Informants were also carrying out an individual dietary survey and keeping a minute by minute record of their activities	4.8 ± 3.4	35.2 ± 9.9	3.9 ± 0.8	5.6 ± 1.1	1.6 ± 1.1	0.8 ± 0.8	1.6 ± 1.6	447
	First Greater London Inquiry (sample size 8), Jan. 1959 except (l)	(i)	As (h) but adjusted for change in larder stocks and for the unusually high proportion of meals taken away from home	6.9	30.3	5.0	7.5	1.4	0.8	0.4	517
		(k)	An individual dietary survey was conducted and the quantities used to estimate 'as purchased' weights	8.0	26.2	3.8	6.3	0.1	0.4	0.6	426
		(l)	Estimate from normal NFS records kept up to 18 months earlier by the same women	20.0	58.0	5.0	6.0	3.0	3.3	12.0	1023

NFS, National Food Survey; no, not obtained.

● When available.

lower kcal equivalents of about 400–500 ((*h*), (*j*) and (*k*)). The largest differences between (*d*) and (*j*) or (*k*) occur for sugar, flour, margarine and other fats, and these will be discussed separately.

Use of sugar. Of the twenty-three women in the present inquiry, twenty said that they normally bought sugar in 2 lb packets, two in 1 lb packets and one said that she bought a 2 lb and 1 lb packet in alternate weeks. Since the normal purchase was 32 oz, it is not surprising that the standard errors for estimates (*a*) and (*c*) are about 50% greater than that for the fully corrected estimate (*d*). The non-correspondence of the period between larder inspections and the 7 days' purchases produced an apparent consumption of 60 oz for one woman.

The average (*a*) of 13.9 oz purchased is much less than the purchases (*f*) of 23.7 oz recorded previously in the National Food Survey by the same women. The fully corrected estimate (*d*) of 15.3 oz lies between them, and is fairly close to the estimate (*e*) of 17.7 oz based on how long the women thought their normal purchase lasted. It seems reasonably certain that the weekly consumption of sugar by such subjects as these is of the order of 1 lb/head, not $\frac{1}{2}$ lb as found in the individual dietary surveys (*j*) and (*k*).

The state of the larder at the first inspection helps to explain this difference. Of the twenty-three women, thirteen had enough sugar to last for 2 weeks or more, six for over 1 week and only four had less than a week's supply; with their attention drawn to these stocks, some of the other nineteen might well defer purchasing further sugar. The individual dietary surveys in which sugar was measured into a container also drew the housewife's attention to her stocks. Only two of the ten Paisley women bought any sugar (one 2 lb, one 1 lb); the rest were consuming their stocks, and it is difficult to be sure that stock changes are fully recorded. In the study now described, only seven of the twenty-three women kept all their ordinary sugar (excluding icing and preserving sugar) in one lot. Six had two lots, ten had three or more; of these, one had four, two had seven and another eleven. In the pre-1951 National Food Survey the measurement of stocks was probably simpler, because of sugar rationing.

At the final interview the informants were asked about the hot drinks they had taken the previous day. They consumed an average of $36\frac{1}{2}$ teaspoonfuls of sugar a week in this way, equivalent to 7–9 oz, or about half their total. Eight of the twenty-three women also used sugar on cereals. Other appreciable uses were with fruit dishes and milk puddings; only two baked cakes.

Use of flour. Of the twenty-three women, eight said they normally bought their flour in 3 lb packets, thirteen in 1 lb packets, and two said they normally did not buy flour. The average (*e*) of 9.3 oz based on the time they thought a packet usually lasted does not agree with the fully corrected estimate (*d*) of 2.4 oz but is compatible with the average (*f*) of 8.7 oz which the same subjects recorded in the National Food Survey. In the two individual dietary surveys only 0.4 and 0.6 oz (*k*) were recorded; this finding suggests that cooking procedures are simplified during such surveys.

Only two of the twenty-three larders contained home-made cakes and scones at the first inspection. Five women baked cakes, scones or pastry during the week, and the larders of three of these contained home-baked goods at the final inspection. There

is thus no indication that the survey had prevented home-baking, and the figures seem consistent with the estimate (*d*) of 2.4 oz. If this is accepted, the much higher National Food Survey figures must be explained by stocking-up, and even in the experiment described now, larder stocks increased slightly. The estimate based on habit of 9.3 oz would have to be discounted as representing past rather than present habits; it carries less weight than for sugar, since sugar is used much more regularly than flour.

Use of margarine and cooking fats. Margarine and cooking fats are associated with baking, but the latter fats are used particularly for frying. Four of the twenty-three women said they never fried, but seventeen said they used cooking fat, lard or dripping for frying and one also used margarine. There is ample evidence of fried foods in the menus. Five women used margarine instead of butter on bread and toast, and one used butter and margarine mixed together. The evidence of this inquiry suggests that use of margarine and cooking fats in the two individual dietary studies was unrealistically low.

Conclusions. Even from this small sample, it appears that the National Food Survey as at present conducted causes elderly women living alone to record too great a consumption of certain storable foods of relatively high energy value, particularly flour and sugar. Most of the discrepancy probably arises from a build-up of stocks during the survey week, rather than overstatement of actual purchases or a change in eating habits. In contrast, individual dietary surveys appear to underestimate consumption of sugar, flour and margarine and cooking fats.

6. *Further examination of National Food Survey records*

It thus appears to be well established that if larder stocks are not recorded at the first interview, elderly women living alone tend to make abnormal purchases of certain foods, a conclusion which provides at least part of the explanation sought unsuccessfully by Durnin & Blake (1962). The next step was to examine whether this disturbance of their normal buying behaviour operated uniformly over the period of the survey or whether it could be associated with any particular days of the survey week.

The purchases of sugar recorded by 214 female old-age pensioners living alone surveyed by the National Food Survey during the second and third quarters of 1960 are given in Table 7. Entries in bold-face type relate to the day on which the survey began. No records were begun on Sunday during the period, and only four on Saturday; the latter have not been included in the analysis. No purchases took place on Sunday.

To establish the normal pattern of purchases, the rows of Table 7 were combined so as to give equal weight to the five 'cohorts' beginning on Monday, Tuesday, Wednesday, Thursday and Friday. The resulting estimates of the percentages of pensioners making a purchase on each weekday are given in the final row of the table.

Thus the survey indicates that in a representative week 25.5% of pensioners would not buy any sugar but would draw on their larder stocks. This percentage is remarkably uniform for the five cohorts beginning on each weekday. (For the whole

Table 7. *Purchases of sugar recorded by female pensioners living alone, April-September 1960*

Day survey commenced	No. of persons	Percentage of persons making purchases on						Total
		Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	
Monday	57	7.0	14.0	3.5	12.3	21.1	14.0	71.9
Tuesday	41	7.3	4.9	12.2	22.0	12.2	19.5	78.0
Wednesday	37	2.7	2.7	8.1	18.9	24.3	16.2	73.0
Thursday	41	7.3	9.8	4.9	17.1	26.8	7.3	73.2
Friday	38	0	13.2	5.3	7.9	34.2	15.8	76.3
Unweighted mean percentages		4.9	8.9	6.8	15.6	23.7	14.6	74.5

Day survey commenced	No. of persons	Average quantity purchased (oz per head)						Total
		Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	
Monday	57	1.96	3.93	0.84	3.37	4.77	3.65	18.52
Tuesday	41	2.34	1.56	3.51	6.63	3.90	5.85	23.79
Wednesday	37	0.86	0.86	3.03	5.19	6.49	4.76	21.19
Thursday	41	2.73	2.34	1.17	6.63	5.85	1.56	20.28
Friday	38	0	2.95	1.68	2.11	8.84	2.95	18.53

Entries in bold face type relate to the day on which the survey began.

Table 8. *Sugar purchases by female pensioners living alone, April-September 1960: 1st and 2nd days of survey week compared with 3rd-6th days*

Day survey commenced	Observed no. of persons purchasing		Expected no. of persons purchasing		Total
	1st and 2nd days	3rd-6th days	1st and 2nd days	3rd-6th days	
Tuesday	7	25	6.7	25.3	32
Wednesday	10	17	8.1	18.9	27
Thursday	18	12	15.8	14.2	30
Friday	19	10	14.9	14.1	29
Total	66	93	53.2	105.8	159

National Food Survey sample, the proportion of households buying sugar during the week of the survey was 84.4% in the second and third quarters of 1960.)

If the inception of the survey did not disturb the normal pattern of purchases, or disturbed it in a manner which operated uniformly throughout the week, the pattern found above would be reproduced in each of the five cohorts, subject of course to random deviations. In fact the difference between the theoretical and observed frequencies appear to be systematic, as Table 8 shows. In all five cohorts, more purchases of sugar were made on the first and second shopping days of the survey week than would have been expected on those days of the week; the differences do not individually attain statistical significance, but if the 5 starting days are taken together the excess of purchases in the first 2 shopping days is significant ($P < 0.05$) and the results for the five cohorts are compatible.

The increased frequency of purchases of sugar on the first 2 shopping days is not accompanied by any increase in the average size of individual purchases, which was 27.39 oz for those 2 days compared with 27.35 oz for the remaining 4. The average

quantity bought on the first 2 days was 8.45 oz a head and on the last 4, 11.89 oz, making 20.34 oz in all. Assuming 6 purchasing days a week, if the rate of purchase in the first 2 days was maintained throughout the week the total weekly purchases would amount to 25.35 oz/head. If the last 4 days are regarded as typical, the estimate for a normal week would be 17.84 oz instead of 20.34 oz, a result much more nearly in line with the other evidence, and especially with informants' estimates of how long they think a lb of sugar lasts them.

Inspection of the findings suggests that the excess is greater on the 1st day than on the 2nd; and this is the more striking since the log-book may have been placed at any time on the 1st shopping day, and the later the initial interview, the shorter the period of time in which it could affect buying behaviour on that day.

General conclusion

This series of studies leads to the conclusion that elderly women living alone buy an excess of certain storable foods when participating in the National Food Survey as conducted since 1951, and that for sugar, at least, the abnormally heavy buying is concentrated in the first 2 days of the survey. Their behaviour is probably different if their attention is drawn to their larder stocks, because they then realize that they have a considerable reserve in store. If this conclusion is true, then the fact that in their experiment Durnin & Blake (1962) measured changes in larder stocks even though they did not use them in all their calculations explains their inability to parallel the National Food Survey finding of abnormally high calorie consumption by elderly women living alone. In particular, it illuminates the uniquely low assessment of calorie intake by the allegedly current National Food Survey method in the comparison of different methods shown in their Table 2: the fact that attention was drawn to larder stocks probably meant that purchases were reduced (as in the pre-1951 National Food Survey) and were supplemented from larder stocks, so that because these were not taken into account in their calculation a lower estimate of intake was made.

On the other hand, the technique of individual dietary survey may lead to some underestimate of calorie consumption, possibly because of the use of containers for certain foods in frequent use. The close agreement between calorie intake and calorie expenditure in the Paisley survey does not necessarily invalidate this conclusion. There are unavoidable limitations on the accuracy with which either intake or expenditure of energy can be assessed, and the numbers surveyed were small in relation to the differences commonly encountered between measurement of intake and measurement of requirement in individuals during one week. In any event, the hypothesis is untested, perhaps untestable, that behaviour is relevantly altered by the experiment itself. Keeping a record of one's activities may change these activities. We do not think the possibility can be excluded that the individual dietary surveys underestimated normal calorie consumption by perhaps 100–150 kcal/day, and that the energy requirement of these women was about 2000 kcal/day.

If so, about 900 kcal remain to be accounted for. The estimates of wastage obtained in the Paisley study and the First Greater London Inquiry were extremely low: 65 and 36 kcal/day respectively. Presumably when there is no survey more is wasted.

A figure of waste of 10% is usually accepted: in this instance, some 200 kcal. A higher figure is by no means excluded. The build-up in larder stocks of the storable foods to which the study reported on p. 420 was limited could account for some 340 kcal daily. This would leave no more than 360 of the discrepant 1000 kcal still to be accounted for. These non-perishable foods supply less than half the energy intake, and it could well be that overpurchase of other foods occurs to some extent during the survey week. It might be inferred from the difference between the 500 kcal jump between 1951 and 1953 (Table 5) and the 340 kcal attributed to stocking-up of certain storable foods that overpurchase of the remaining foods is not likely to have been less than 160 kcal. The balance left unexplained is thus no more than 200 kcal. It must be emphasized that the errors involved in this sequence of calculations all affect this final residual, and in view of the degree of approximation involved a close reconciliation was not to be expected.

Only 1% of the persons taking part in the National Food Survey are elderly women living alone, and their overpurchase of storable and perhaps of other foods when under observation does not appear to extend to other types of household (Ministry of Agriculture, Fisheries and Food: National Food Survey Committee, 1961).

SUMMARY

1. Food consumption of elderly women living alone, as assessed by the National Food Survey as at present operated, is about 1000 kcal/head daily greater than that assessed by individual dietary survey. A series of studies was made to investigate the cause of the difference.

2. In 1957, 391 female old-age pensioners who lived alone provided National Food Survey records. The energy value of their consumption was about 2660 kcal/head daily. In 1958, 335 such women provided records. Their food consumption ranged in energy value from 2900 kcal/head daily for the 60-64 age-group to about 2300 kcal/head daily at 80 and over.

3. The diets of eight women aged 60-69 who lived alone in Greater London and who participated in the National Food Survey about a year previously were investigated by individual survey in January 1959. The mean value of their daily intake was 1862 kcal/head. Preparation and plate wastage was measured during the last 3 days of the survey and amounted daily to 36 kcal/head.

4. Much greater consumption of certain storable foods, fats, sugar, flour and potatoes, was recorded by the eight women in the National Food Survey than in the individual dietary survey. Their National Food Survey pattern of consumption was very similar to that recorded by all elderly women aged 60-69 living alone in the National Food Survey for the first quarter of 1958.

5. Before June 1951 changes in larder stocks of foods were measured as part of the routine of the National Food Survey. This was not done after that date. For the whole National Food Survey sample, the value of food obtained for consumption appeared to be unaffected by the change, but for single old-age pensioners it rose by 500 kcal/head between the first half of 1951 and the first half of 1953. 'Consumption' in 1953

exceeded that in 1951 in most foods. It was concluded that the present National Food Survey technique causes such women to depart from their usual buying habits during the survey week.

6. In October 1959 a food budgetary survey was made on twenty-three elderly women aged 60–69 living alone in Greater London who had previously participated in the National Food Survey. Larder stock changes were measured for fats, sugar, flour, potatoes and eggs. The results of this survey were compared with those of individual dietary surveys and it was concluded that the National Food Survey as at present conducted causes elderly women living alone to record too great a consumption of certain storable foods, particularly flour and sugar. In contrast, individual dietary surveys appear to underestimate consumption of sugar, flour, margarine and cooking fats.

7. The purchases of sugar recorded by 214 female old-age pensioners living alone and surveyed by the National Food Survey in the second and third quarters of 1960 were examined according to the day of the week on which they were made. Significantly more purchases were made on the 1st and 2nd shopping days of the survey week than would have been expected.

8. Of the discrepant 1000 kcal, individual dietary surveys on such women may underestimate consumption by 100–150 kcal/day; wastage may account for more than that recorded, possibly 200 kcal/day; the build-up in larder stocks of storable foods can account for 340 kcal/day; overpurchase of other foods is not likely to be less than 160 kcal/day. The energy value left formally unexplained is thus no more than 200 kcal/day. This is a balancing item, affected by the approximation necessarily involved in each step of the calculation, and no exact reconciliation was to be expected.

9. Only 1% of all persons taking part in the National Food Survey are elderly women living alone, and their anomalous buying behaviour when under observation does not appear to occur in other groups when surveyed.

REFERENCES

- Baines, A. H. J. & Hollingsworth, D. F. (1955). *Proc. Nutr. Soc.* **14**, 77.
 Durnin, J. V. G. A. & Blake, E. C. (1962). *Brit. J. Nutr.* **16**, 261.
 Durnin, J. V. G. A., Blake, E. C. & Brockway, J. M. (1957). *Brit. J. Nutr.* **11**, 85.
 Durnin, J. V. G. A., Blake, E. C., Brockway, J. M. & Drury, E. A. (1961). *Brit. J. Nutr.* **15**, 499.
 FAO (1957). *F.A.O. nutr. Stud.* no. 15.
 Garry, R. C., Passmore, R., Warnock, G. M. & Durnin, J. V. G. A. (1955). *Spec. Rep. Ser. med. Res. Coun., Lond.*, no. 289.
 Harries, J. M. & Hollingsworth, D. F. (1953). *Brit. med. J.* **i**, 75.
 Kemsley, W. F. F. (1953). *Ann. Eugen., Lond.*, **18**, 22.
 Ministry of Agriculture, Fisheries and Food: National Food Survey Committee (1956). *Studies in Urban Household Diets 1944–49*. London: H.M. Stationery Office.
 Ministry of Agriculture, Fisheries and Food: National Food Survey Committee (1961). *Domestic Food Consumption and Expenditure, 1959*. London: H.M. Stationery Office.
 Ministry of Food: National Food Survey Committee (1953). *Domestic Food Consumption and Expenditure, 1951*. London: H.M. Stationery Office.