steeply. For all groups, the diet contained 0·8 mg thiamine/1000 non-fat Cal. (after allowing for assumed 15% destruction of thiamine on cooking) compared with the recommended figure of 0·6 mg, and 0·7 mg riboflavin/1000 Cal. compared with the recommended figure of 0·6 mg. On the average, the diet contained just over 5 mg of nicotinic acid per 1000 Cal., compared with the recommended figure of 4 mg (the actual figures were 5·7 mg at 55–59, falling to 4·9 at 75–79 and rising again to 5·1 at 80 and over). Thus, for all groups the diets were satisfactory when compared with the B.M.A. recommendations for thiamine, riboflavin and nicotinic acid.

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Food and Family Size

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Since 1950 the National Food Survey has provided analyses of the diets of two-adult households with varying numbers of children, but the childless households differed from the remainder in important respects. They included a high proportion of elderly people, most of whom were in social class D (Ministry of Food: National Food Survey Committee, 1954), whereas the couples with children consisted almost entirely of younger people, very few of whom were in class D. This meant that the average social class, measured by the income of the head of household, was lower in the childless group than in the others. An analysis showed that this discrepancy could be removed by excluding households containing a person aged 55 or over from the childless group. Such persons were so rare in the groups with children that they could be ignored. The sample limited in this way was nearly homogeneous in adult age and in social-class distribution, and each family-size group had about the same average net family income. It was also found that size of family did not materially affect the number of meals eaten away from home, or the uptake of school meals and school milk by those entitled to them, which were respectively about 44 and 78% of entitlement. It has therefore been possible to make a direct comparison of the domestic food consumption and expenditure of the different family-size groups, and to attribute the differences to the number of children.

The sample comprised 4081 households containing one man and one woman both aged between 21 and 55 years, with no other adult, and either without family

or with all their children aged under 14. The size distribution was: no family 25·3, one child 32·6, two children 27·8, three children 9·8, four or more children 4·5%. (The average number of children in this last group was 4·4.) The social-class distribution was: class A 6·5, class B 33·9, class C 51·1, class D 8·5%. The total number of persons involved was 13,779 including 5617 children. The average age of children was between 5 and 6 years in all groups with children. All groups took 4–5% of their food in meals away from home. This paper briefly summarizes the main conclusions; limitations of space do not allow the detailed results to be reproduced.

The average weekly household food expenditure found in the sample was

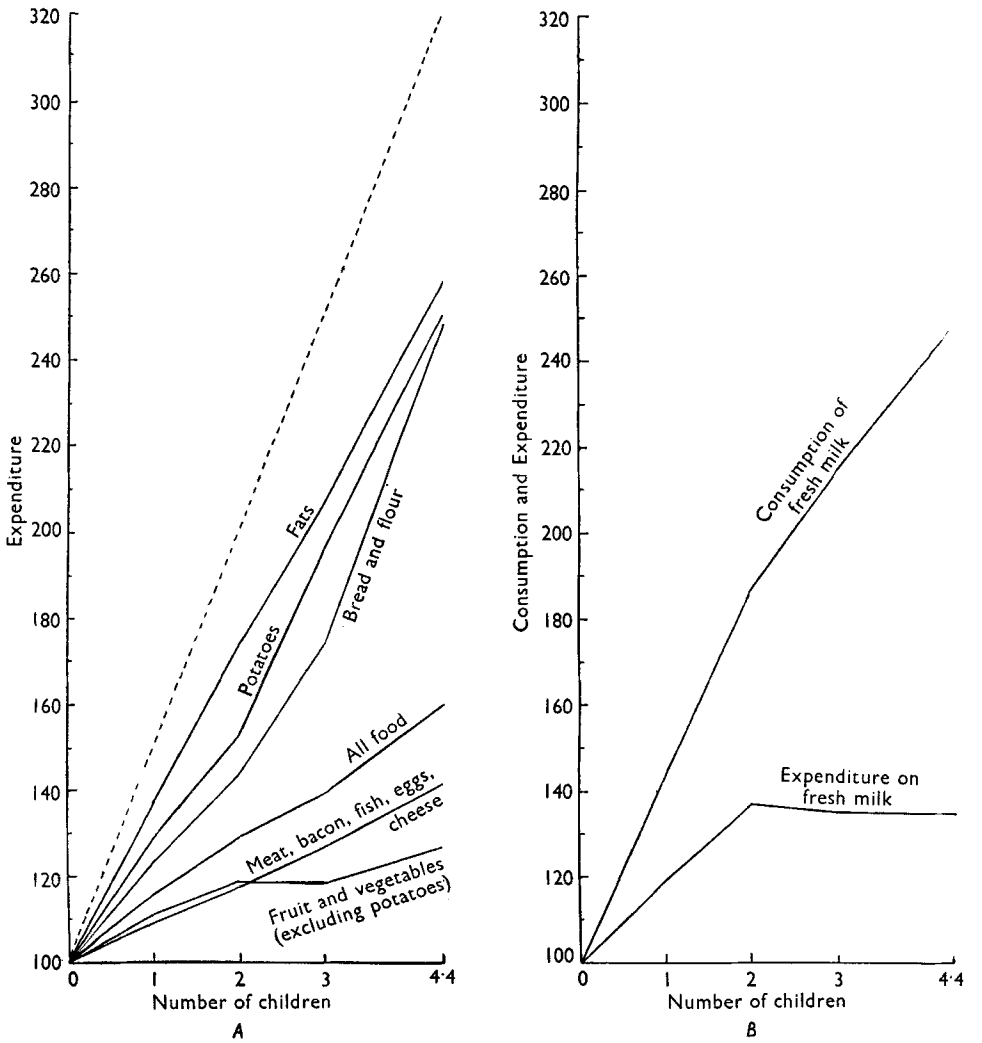

Fig. 1. (*A*) Expenditure on food and (*B*) consumption of and expenditure on fresh milk of two-adult households, with and without children, expressed as percentages of the values for a childless household. The dotted line shows what expenditure would have been if each child cost as much as an adult.

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62s. 0d. for childless couples, 71s. 10d. for those with one child, 80s. 3d. for those with two, 86s. 8d. for those with three, and 99s. 3d. for those with four or more. Fig. 1 shows expenditure for each size of family as a percentage of that for childless households. The dotted line shows what expenditure would have been if each child cost as much as an adult. Expenditure on particular groups of foods is shown in the same way; and it can be seen that expenditure per household on animal-protein foods, fruit and vegetables increased little with size of family, whereas expenditure on the cheaper foods (bread and flour, potatoes and fats) rose sharply.

Fresh milk is exceptional, since welfare and school milk are included, and is shown separately. Expenditure per household decreased for households with more than two children, whereas consumption increased considerably. This strikingly illustrates the value of welfare and school milk to large families. For all other foods consumption showed the same pattern as expenditure.

A general method of summarizing these results was sought and was found in the fact that the graphs were nearly straight lines; that is to say, the average expenditure increased by roughly the same amount for each additional child. This finding was confirmed by fitting regressions by the method of least squares. To simplify computation the regression estimates were obtained on the assumption that standard deviations of household expenditure did not increase with size of family. This assumption is not always justified, and the resulting regression estimates, to a varying extent, give too great a weight to the larger families. The effects, however, are small and the results are not biased by the assumption. The regressions were found to be approximately linear. Expenditure could then be theoretically divided into two parts: a constant component attributable to the adult couple, and a variable component relating to the children. Since the child component varied directly with the number of children, the average increment could be treated as approximately the same for each additional child. The regression estimate gave an average total expenditure of 62s. 9d. for a couple (standard error 6d.), with an addition of 8s. 5d. for each child (standard error 4d.). It agreed well with the observed values, the deviations falling within the sampling error. It must not be taken to mean that the cost of a child was only 27% of that for an adult at the same standard of living; naturally the standard of living falls if the size of family increases and income remains constant. The adult component is in effect a notional constant introduced in order to measure the actual increase in household expenditure when a child is added to the household. Thus the figure of 62s. 9d. represents the notional sum which the two adults would have spent on themselves if they had no children; the 8s. 5d. represents the notional average addition to expenditure associated with each child.

The method was extended to individual foods. Sampling errors were of course larger and there were some departures from linearity, but the approximations were good enough to permit reasonably reliable conclusions. For bread, potatoes and fats the additional notional expenditure per child was in the region of 60–70% of the amount per adult; for meat and bacon it was only 18%; for cheese and eggs about

25%. For fresh fruit and fresh green vegetables it was low, about 13%, and for fish only 6%.

Differences in consumption were not quite as large as in expenditure, since the large families bought cheaper varieties of food, but the pattern was the same. For bread, potatoes, butter and margarine, the notional addition per child was in the region of 70 or 80% of the amount per adult; for meat and bacon it was about 25%; and for cheese and eggs about 30%; for fish, fresh fruit and fresh vegetables it was between 10 and 14%.

As already explained, fresh milk was an exception; the notional additional expenditure per child was only 21% of that for an adult, but additional consumption was 70%. This is of particular interest, as in general the foods specially valuable for children are relatively expensive. They tend, therefore, to form a smaller proportion of the diets of large families.

The regression estimates of consumption of the main foods are given in Table 1.

Table 1. *Notional average weekly food consumption per adult and addition per child*

Food	Each adult	Addition for each child	Addition per child as percentage of adult consumption
Fresh milk (pt.)	5·7	4·0	70
Meat and bacon (oz.)	43·6	10·9	25
Fish (oz.)	8·3	1·1	13
Cheese (oz.)	3·2	1·0	31
Eggs (no.)	5·6	1·7	30
Fresh fruit (oz.)	32·5	4·6	14
Fresh green vegetables (oz.)	24·0	2·7	11
Potatoes (oz.)	68·3	55·2	81
Other vegetables (oz.)	21·0	9·4	45
Bread (oz.)	59·3	42·8	72
Butter (oz.)	3·9	3·0	77
Margarine (oz.)	4·4	3·8	86
Sugar (oz.)	15·0	11·4	76

Consumption and expenditure data are, however, only part of the story; an examination was then made of what they mean in terms of nutrient content. This was calculated as described in our Annual Reports (Ministry of Food: National Food Survey Committee, 1953, 1954) except that no allowances for plate or other wastage of edible materials were made, so that the data which follow represent the values that would be obtained if all food as purchased were eaten by the households. Estimates of the allowances of nutrients needed for the maintenance of good health and growth have been published by the British Medical Association: Committee on Nutrition (1950). In these estimates the allowances for fat, protein, thiamine, riboflavin and nicotinic acid are related to the energy value of the diet, though it was stated that the recommendations were put forward tentatively and should be regarded as provisional until more evidence became available. Examination of the observed data suggests that the nutritive value of the household diets was sufficient to meet these recommendations for nearly all groups of households.

It was found that the percentage contribution from fat exceeded even the highest recommended level (35% for heavy manual workers) for all groups of households except those with four or more children, for whom fat contributed 34% of the total energy value; the percentage contribution from protein decreased from 12·8% to 11·8% as family size increased, so that the larger families did not quite reach the recommended level based on 11% for adults and 14% for children; for thiamine, riboflavin and nicotinic acid the amounts per 1000 Cal. were greater than those recommended although, as for fat and protein, there were decreases as family size increased.

Meals eaten away from home were excluded from the consumption data because detailed information was not available; but as the number and type of such meals were known for each individual it was possible to assess the proportion of total consumption represented by meals at home (generally 95–96% for the households under discussion). The recommended allowance for each type of household was adjusted accordingly. The validity of the method of adjustment received some confirmation from a special study of the effects of meals out made in 1952, which is fully described in the Annual Report for that year (Ministry of Food: National Food Survey Committee, 1954).

Regression estimates of the nutritive value of food obtained for consumption were made in the same way as those for expenditure. The greatest deviations from the regression lines were found in values for households containing four or more children and in all types of households for vitamins A and D. Reference has already been made (Readman, 1955) to the high coefficients of variation for these two nutrients, and to the fact that households containing four or more children are relatively few, so that higher sampling errors for these nutrients and for the larger families are to be expected. Regression estimates of the recommended allowances have also been made and are included with those for notional intakes in Table 2. In interpreting the data in this table it must be remembered that the calculations are based on food consumption records both of adults living alone and of households

Table 2. *Notional nutritional value of daily domestic food consumption and corresponding recommended allowances* per adult and per additional child*

Nutrient	Each adult		Addition for each child	
	Intake	Allowance*	Intake	Allowance*
Energy value (Cal.)	2982	2431	1674	1656
Total protein (g)	96	67	46	58
Animal protein (g)	53	—	20	—
Calcium (mg)	1237	779	750	993
Iron (mg)	16·5	11·5	7·5	8·5
Vitamin A (i.u.)	5043	2392	2136	1464
Thiamine (mg)	1·59	0·96	0·78	0·64
Riboflavin (mg)	2·10	1·47	1·01	1·02
Nicotinic acid (mg)	16·72	9·62	6·73	6·42
Vitamin C (mg)	69	19·4	29	17

* Based on the recommended allowances of the British Medical Association: Committee on Nutrition (1950).

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consisting of adults plus children. Since the average family income remains roughly constant, the standard of living falls with the addition of each child, and in consequence the pattern of the adult diet may be presumed to change also. In the present study it has not been possible to measure this change, since the survey itself throws no light on the diet of individual members of households.

The most striking finding is that for all nutrients* the amounts notionally attributable to the adult far exceed the corresponding allowances. The excess in energy value for adult households might mean that such households were consuming in excess of their real requirements; alternatively there may have been a higher food wastage or the allowances chosen may be low in comparison with actual activity. The notional increments for each child are nearly equal to, or exceed, their allowances for energy and vitamins; but their notional increments for protein, calcium and iron are below the recommended allowances. In practice, however, the household must be considered as a unit. Thus, even when the notional increment per child is below the allowance, the total allowance for the household may still be met. It can be calculated from Table 2 that this would be true for all nutrients and groups except for calcium in households with four or more children and for protein in households of five children or more.

Throughout the calculations in the present paper no account has, however, been taken of the wastage of food within the home, and it is clear that in practice this cannot be ignored. Unfortunately, no reliable data exist for the assessment of such wastage, which may very well vary in households containing different numbers of children. If such wastage were assumed to be of the order of 10% for all households and all nutrients, the exceptions which apply to households with four or five and more children would, in theory at least, be extended to those containing three or more children. This possibility re-emphasizes the value in the diets of the larger families of the existing schemes for the provision of cheap welfare milk and for the addition of calcium to flour.

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* If the results were calculated on the recommendations of the (U.S.A.) National Research Council: Food and Nutrition Board (1948) the average vitamin C content of the diets of all groups of households would be less than is considered desirable.