THE INFLUENCE OF THE GROWING FAMILY UPON THE DIET IN URBAN AND RURAL DISTRICTS

By FRASER BROCKINGTON

Medical Officer of Health for Horsham and Petworth and Assistant County Medical Officer of Health for West Sussex

(With 11 Graphs in the Text)

CONTENTS

Introduction

The following investigation has been carried out to determine the effect of the growing family upon the diet in urban and rural districts. In order to obtain a fair range of family sizes and with the idea of avoiding so far as possible errors of sampling, one large urban school and four small country schools have been selected, ninety-seven out of 200 families in the urban school and eighty out of ninety-eight families in the rural schools being analysed in respect of their total weekly budgets.

The analysis has been made in respect of expenditure and is open to criticism. First, that housewives exercise a varying discretion in their purchase of foodstuffs. It is thought that this influence will make itself felt in the town where facilities for buying a variety of different quality foods exist and rather less in the country where purchases are made from travelling vans and families show greater similarity of income and mode of living. Secondly, that errors of computation must be considerable, for it is no easy matter for any housewife to detail exactly the sums expended weekly. So far as possible figures have been checked by reference to weekly bills, and it is hoped that careful balancing of the budgets has eliminated all but minor errors. This has been done by visiting at home and determining in each case (1) the total family income from all sources, (2) the total number, age, and sex of persons living in the home, (3) the total of unavoidable expenditure other than food, and (4) the total expenditure on various items of food during the week, with an estimate of the value at current prices of any food obtained free or of the value of food obtained at less than the market price.

It has been necessary to adopt a standard by which to render comparable families consisting of persons of varying age and varying dietetic needs. For

this purpose the scale of cost coefficients prepared from the British Medical Association (1933) Nutrition Report diets has been used. The scale is given below:

	Mean cost coefficients
Adult male	1·00
Boy over 14 years	1·00
Adult female	0·83
Girl over 14 years	0·83
Child 12 and under 14	0·90
,, 10 ,, 12	0·80
,, 8 ,, 10	0·71
,, 6 ,, 8	0·60
,, 3 ,, 6	0·59
,, 2 ,, 3	0·54
,, 1 ,, 2	0·47

The adoption of this is open to criticism, which in the present state of knowledge is the disadvantage of all scales. The Cathcart (1931) and other scales are based upon calorie requirements, and it seemed that for comparing expenditure upon food one based on cost would be more satisfactory. The basis of the scale is provided by diets given by the B.M.A. Nutrition Report (1933); these, as is well known, have led to controversy, but upon the score of liberality and not, I believe, balance. It is, therefore, to be hoped that the scale of cost values may be taken as representative of most balanced dietaries.

There is at present no definite standard of diet accepted as adequate. It has, therefore, been considered relevant at the outset to attempt to fix upper and lower levels of diet in terms of cost ruling in this district. This has been attempted by examining the instinct of the housewife to provide food and comparing her standards with those of the authorities.

PART I. TO DETERMINE STANDARDS OF ADEQUACY OF DIET IN TERMS OF COST

Adequacy according to natural instincts of the housewife

Cathcart & Murray (1936) record that "a marvellous instinct seems to direct the purchase of food by so many housewives". If this is true, and further evidence in its favour will be given later in this paper, it should be possible to show in a sufficiently varying series of families standardized in respect of income, the point at which insufficiency of food and upset in balance occur. The ninety-seven families from the one urban school have, therefore, been standardized upon a unit income basis by dividing the total income by the cost coefficients of the family. This method of standardization must be looked upon as falling considerably below the ideal. If the only charge upon the family income were for food, then the ratio I/K, where I is the total family income and K is the total cost coefficient of the family, would be a satisfactory "statistic" for comparing different families. But this coefficient does not take into consideration the other essentials of existence, e.g. shelter and clothing. It should be possible to find other cost coefficients in respect of other necessary charges

upon income, e.g. I/M for clothing, but it is not easy to define a statistic in the form of some ratio which would measure simultaneously all the factors which are necessary charges upon income. In the absence of such a comprehensible statistic the scale of cost coefficients based upon food alone has reluctantly been used for the standardization of incomes.

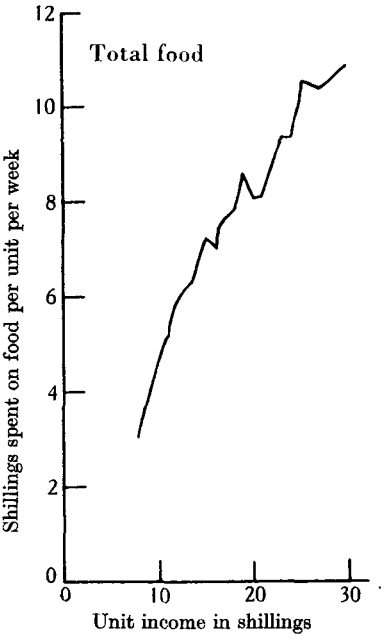
The ninety-seven families from which data have been obtained were a random selection from an elementary school in a prosperous urban township constituting half the total families and half (183) the total children in the school. Graph 1 shows their average expenditure upon food plotted against their unit income.

It will be seen that:

(1) There is a variation in unit incomes from 7*s.* to over 30*s.*

(2) The expenditure upon food rises steeply with the unit income in each group.

(3) The expenditure upon food per unit increases from about 3*s.* at the lowest unit income to about 11*s.* at the highest.



Graph 1

The determination of sufficiency

It is, therefore, clear that since expenditure upon food declines uniformly with unit income, there must be a point upon the graph at which the unit income will be sufficient, and below which expenditure upon food is insufficient. The relationship to unit income of three other forms of expenditure may offer some indication of the "sufficiency" point, namely, (1) the balance maintained between expenditure upon meat and upon bread, (2) a similar balance between expenditure upon energy foods and first-class proteins, and (3) the expenditure upon household necessities other than food (to determine at what level these are "cut"). Finally, the figure resulting from this evidence may be compared with the physiological needs which have been suggested by the various authorities.

Balance as a guide to sufficiency

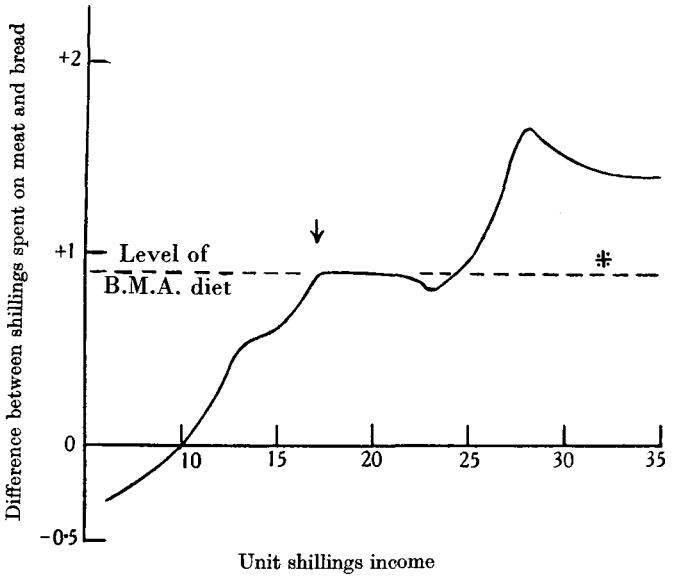
At levels of income where a normal balanced diet is possible the difference between the consumption of meat and bread might be expected to remain constant, excepting in so far as more expensive cuts of meat are substituted in the higher income groups. On Graph 2 the average difference in each income group is shown in cost unit shillings in relation to unit income.

Table I shows these figures.

https://doi.org/10.1017/S0022172400032630 Published online by Cambridge University Press

Table I

	Unit income group									
	6–10	10–12	12–14	14–16	16–18	18–20	20–22	22–24	24–26	26–30	30+
erence in shillings per unit ıt on bread and meat	−0·3	0·098	0·5	0·6	0·9	0·9	0·88	0·8	0·95	1·66	1·4



Graph 2. Average difference between expenditure on bread and meat in relation to unit income.

* The level of the B.M.A. diet marked at 11*d.* is equal to an expenditure of 1*s.* 1*d.* on bread and 2*s.* on meat. It will be seen that in this area the expenditure upon bread of 1*s.* 1*d.* is less than the 1*s.* 4*d.* of the B.M.A. diet on account of the greater consumption of potatoes, while the meat [1*s.* 10*d.* in B.M.A. diet] is costing 2*s.*

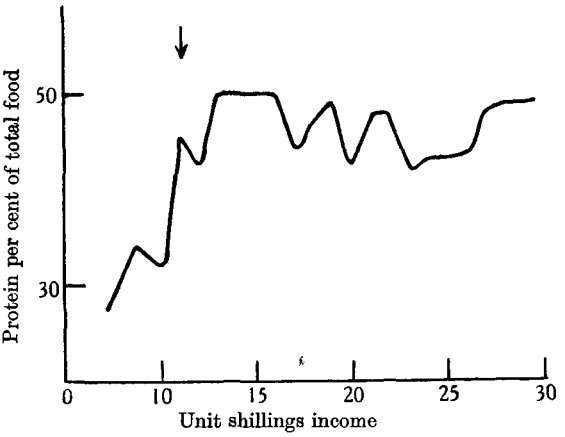
It is apparent that balance in this respect becomes altered at seventeen unit shillings at which point the expenditure upon butcher's meat falls off.

The second test of balance is provided by examination of expenditure upon meat, milk, fish, cheese and eggs, the first-class proteins which satisfy the growth impulse. These should constitute (according to different standards) from 0·37 to 0·44 of the total cost of a man's diet and proportionately more in the case of young children.

Graph 3 shows the average for each income group of the proportion of expenditure upon first-class proteins to the total expenditure upon food, similarly plotted against unit incomes.

It is apparent that the balance is maintained until the neighbourhood of eleven unit shillings of income, from which point the protein ratio is seen to decline. This is in accordance with expectations, since first-class proteins provide only about 6% of the energy in a balanced diet, and inevitably yield to the purchase of energy foods when incomes become inadequate and the demands of hunger must be satisfied.

The third test of sufficiency is based upon the postulate that priority will always be given to expenditure upon food when the gross income is low. If the point at which essential household expenditure begins to be satisfied in favour of food can be determined, this should offer some indication of the lowest level of diet which the housewife looks upon as adequate. This postulate will not be more than generally true; many families will sacrifice even necessities of



Graph 3

nutrition (in any proper physiological sense) before giving up standards of, say clothing and housing, which are essential to their self-respect. In fact, of the items of necessary household expenditure, rent and rates, insurance and fuel and light do not permit of much saving. Where saving has been effected, in the families in this investigation, it has been by sacrifice of the remaining items, household-cleaning sundries, replacements, clothing and the services of a private doctor.

The following arbitrary scale has been adopted as representing a minimum expenditure upon these last four items: doctor's services 1½*d.* per week for non-insured persons, replacements 1*s.* per week, clothing 1*s.* 3*d.* per unit per week, household sundries 1*s.* 6*d.* per family per week. After making an adjustment of the essential household expenditure in each budget to come up to this scale, and in addition allowing 1*s.* per week for each adult for private use, the remainder of the gross income is the sum which is available when the household expenditure is not sacrificed.

In Graph 4 "actual" and the above "possible" expenditure per unit upon food are shown together.

A study of the graph brings out the following points:

(1) There is an instinct to provide food which very largely overrides other calls upon money (as shown by the steady increase in food provision and the close approximation between "actual" and "possible" provision until a unit income of 19 shillings is reached).

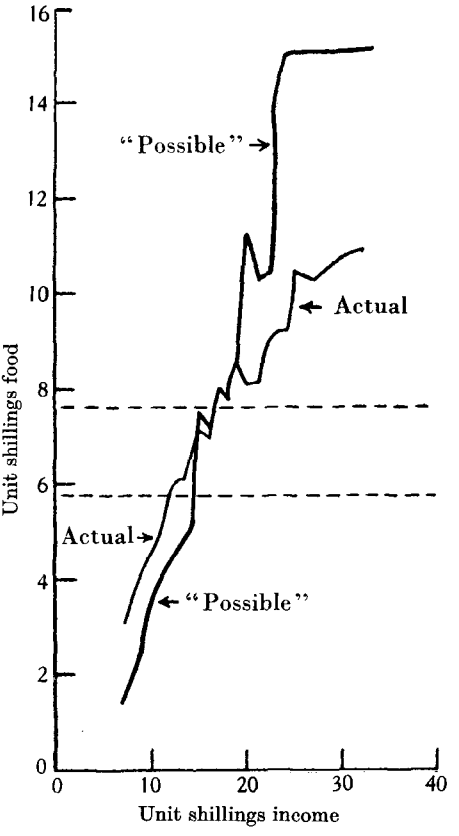
https://doi.org/10.1017/S0022172400032630 Published online by Cambridge University Press

(2) Below 15 unit shillings the "actual" provision exceeds the "possible", which is evidence that in the lower incomes many other necessary household expenses take second place.

(3) Above 19 unit shillings the "possible" exceeds the "actual" and indicates that the instinctive needs in food are now completely satisfied.

(4) "Sufficiency" lies somewhere between unit incomes of 15 and 19 unit shillings.

It is, therefore, evident that the housewife maintains a physiological balance between first-class protein and energy foods until the unit income reaches a very low level (11 unit shillings representing an expenditure upon food of 5*s.* 3*d.*); that she begins to abandon butcher's meat in favour of some more economical protein at 17 unit shillings of income (representing an expenditure of 7*s.* 7*d.* on food); and that she shows a desire to spend her housekeeping allowance upon food at the expense of certain other necessary items of household expenditure below a unit income somewhere between 15 and 19 shillings (representing an expenditure upon food of between 7*s.* and 8*s.* 4*d.*).



Graph 4

Now from 9*s.* to 11*s.* per man per week is the amount which housewives of these families spend upon food wherever the unit income is sufficient to allow it. In Tables II and III this point is emphasized by showing the families forming the group of 25 unit shillings compared with the 12 unit shilling group.

Table II

Unit income group	Total income in shillings per week	Cost coefficients	Unit expenditure upon food in shillings per week
25	60	2·4	11·0
	60	2·4	11·3
	105	4·3	10·7
	120	4·84	10·0
	128	5·2	9·2
12	47	3·96	4·4
	54	4·62	6·8
	57·5	4·11	6·3
	60·8	5·2	6·0
	62·3	5·3	6·6

https://doi.org/10.1017/S0022172400032630 Published online by Cambridge University Press

This can again be seen in Table III, showing in broad gross income groups the expenditure upon food per unit according to the size of the family.

Table III. *Shillings spent on food per unit*

Family size in cost units	Income group 40	50	60	80	100	150	200
2 –2·5	—	7·4	10·4	11·1	—	—	—
2·5–3	4·9	8·33	8·9	11·05	—	—	—
3 –3·5	4·0	6·05	8·3	7·65	12·0	—	—
3·5–4	—	5·05	6·8	8·3	—	8·3	—
4 –4·5	3·2	4·9	6·3	7·0	8·4	9·5	10·5
4·5–5	3·0	4·4	6·8	9·9	8·9	8·95	—
5 –5·5	—	—	4·7	6·1	7·8	8·4	—
5·5–6	—	—	4·4	7·0	—	11·0	—
6 –6·5	—	—	—	—	7·0	6·9	7·6
6·5–7	—	—	—	5·55	7·5	7·2	—

It will be seen that, for example, in the family group 4–4·5 units (i.e. where there are three children or occasionally four) the amount spent at a level of 200*s*. of gross income is 10·5*s*. per unit, and that this declines uniformly until in the families with a weekly wage of 40*s*. the amount spent is 3·2*s*. It is, in fact, evident that in the course of years many families pass through the whole range of expenditure represented on Graph 1 from the highest to the lowest. A family having a wage, for example, of 50*s*. prior to the birth of children will be spending (according to Graph 1) 10*s*. 4*d*. per unit in accordance with their unit income at this stage; at a later date when with six non-earning children their unit total is 7, they will have reached the lowest limit of the scale and, with an income of 7 unit shillings, will now provide no more than 3*s*. worth of food per unit per week. If this is a true interpretation of the analysis of these family budgets, it would be very surprising if the expenditure which a housewife makes in the early years of married life greatly exceeds the adequacy. We should expect that relative affluence would allow some luxury spending, and to what extent cannot be gauged. We cannot, however, escape the implication that the highest of the above three estimates is not too high. In short, if we accept the housewife's instinct in providing food as representative of the body needs, we must suppose that a sum of about 8*s*. per man per week is in the neighbourhood of adequacy.

Adequacy by physiological standards

We may compare this with the adequacy which has been suggested by various authorities. For the British Medical Association Nutrition Report diet (1933), which is reproduced in Table IV, with the prices ruling during the winter months of 1936/37 in this district, the cost is 7*s*. $2\frac{3}{4}$*d*.

It has been criticized as overgenerous mainly (1) as giving, at 3400, a too liberal allowance of calories and (2) as containing 50 g. of first-class protein. Cathcart & Murray (1936), summing up the evidence of many critics, are inclined to the view that the figure of 2400 represents more nearly the needs in

calories, and those in first-class protein have been given by Hutchison & Mottram (1933) and the Ministry of Health (1932) as 37 g. These modifications probably represent the minimum diet which any authority would recommend. At this computation the minimum balanced diet would cost 5*s.* 4¾*d.* (a reduction of 1*s.* for the lower calorie needs, assuming that this comes entirely from the energy foods in the diet, and of 10*d.* for the reduction in amount of first-class protein). On the weight of evidence it seems certain that 2400 cal.

Table IV

Item	Quantity	Present price winter 1936–7 *d.*	Price in 1933 *d.*
Beef	1 lb.	8	6
Minced meat	½ lb.	4	2½
Bacon	½ lb.	4	3
Corned beef	½ lb.	3½	3
Liver (ox)	¼ lb.	2½	1¾
Eggs	2 oz.	1½	1
Cheese	½ lb.	4½	3¼
Milk	1¾ pt.	6½	5
Fish (cod)	¼ lb.	2	1¼
Butter	¼ lb.	3	2½
Suet	1 oz.	¼	¼
Lard	¼ lb.	2½	1½
Bread	7¼ lb.	16¼	12½
Sugar	1 lb.	2½	2¼
Jam	¾ lb.	3¼	3¼
Potatoes	5 lb.	6	3¾
Peas (dried)	¼ lb.	¾	1
Tea	¼ lb.	4	3
Oatmeal	½ lb.	1¼	1¼
Rice	¼ lb.	¾	¾
Syrup (treacle)	½ lb.	2	2
Cabbage	1 lb.	1	1
Beans (butter)	¼ lb.	¾	¾
Barley	½ lb.	1	1
Fresh fruit and green vegetables	—	7	7

represents the lowest level of energy requirements. In the League of Nations' Report (1936) this amount has been given as the needs of a man not engaged in manual work with a varying addition for work of varying grades of severity. It may also be mentioned that the first-class protein needs, particularly in respect of children, in the League of Nations' Report are more liberal (66 g. for a child aged 12–14 compared with 50 g. in the B.M.A. Report).

Lastly, we must bear in mind that the buying prices of diets are not always adhered to. The prices given in the B.M.A. diet are an average of cheaper brands, e.g. that of a pound of beef is 8*d.* and that of ½lb. of minced meat 4*d.* The average housewife in country districts of Sussex does not maintain this standard of buying. In this investigation it was found that the price of protein food bought on the average exceeded those of the above diet by 4*d.* a week per man (mainly in respect of meat) and of calorie foods 2*d.* The B.M.A. diet would, therefore, cost on the average of families investigated 7*s.* 8¾*d.*

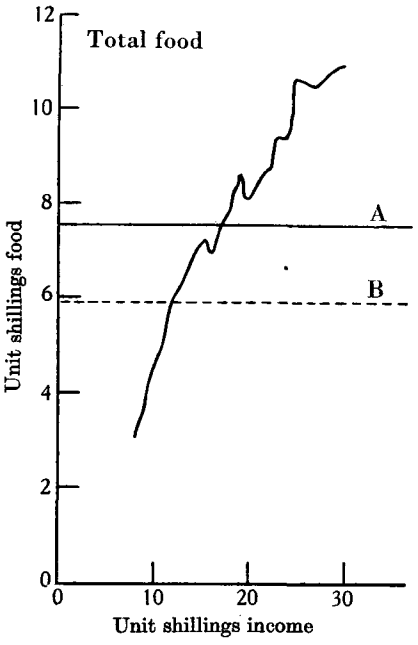
Since this figure does correspond closely with the estimate of 8*s.* suggested by the instincts of the housewife, I am inclined to the view that it represents,

at the present winter prices and in the existing circumstances of uneconomical buying, the average needs in food expenditure per adult per week. Alternatively, this may be considered as a high level of adequacy which we will term A, an expenditure of 5*s.* 10¾*d.* constituting a low level standard B. Upon these standards the figures for the families will be further analysed in respect of the influence of the growing family upon adequacy of food provision.

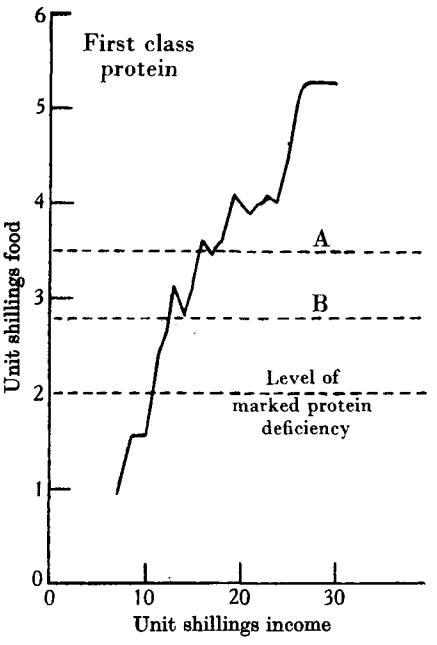
Part II. An analysis of ninety-seven urban families attending one elementary school

The ninety-seven families chosen at random from an elementary school represent half the total families in the school and half (183) the total children. The picture obtained by an analysis of these families is probably closely related to that of the whole school and the school to the area, namely, an urban district, population 16,000, with little unemployment. The incomes of families appeared to be good, the average for the ninety-seven families being £3. 12*s.* 9*d.*

Graphs 5 and 5*a* show unit expenditure upon food and first-class protein in relation to unit income:



Graph 5



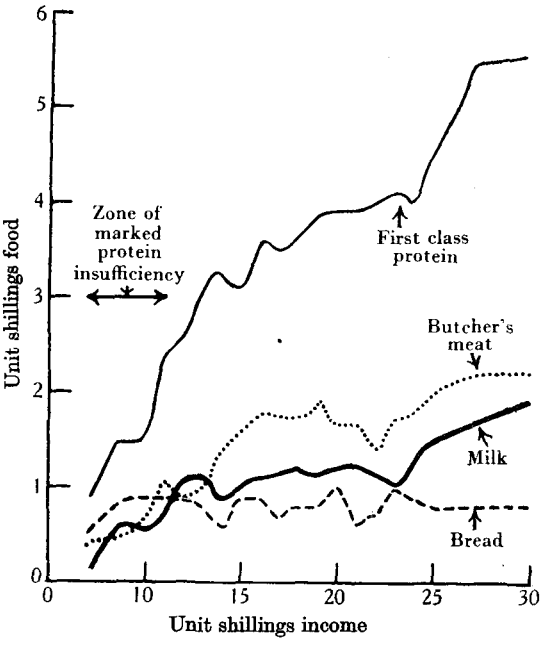
Graph 5*a*

Upon standard A 51·4% of children fall below sufficiency in respect of total food, and 45·4% for first-class protein; upon standard B 20·2% for total food and 21·3% for protein.

https://doi.org/10.1017/S0022172400032630 Published online by Cambridge University Press

Marked protein deficiency

It has been shown that below eleven unit shillings the balance between first-class protein and energy foods is no longer maintained (Graph 3). It is, therefore, apparent that below this level of income, insufficiency is complicated by improper balance. Graph 6 shows the profound change which takes place in the diet at these low levels of unit income. Expenditure upon first-class protein is less than two unit shillings, and butcher's meat and milk are reduced to less than 6*d.* per unit per week, while expenditure upon bread has not appreciably declined. This has, therefore, been termed the zone of "marked protein deficiency". Within this zone were twenty-five children, amounting to 13·7% of the children.



Graph 6

Analysis of figures in relation to the period school life

If expenditure upon food diminishes proportionately with unit income, as is suggested by the main food graphs, it seems probable that food provision per unit will fall in families in proportion as they become larger by additions and growth, as, in fact, can be seen in Table III. Since first-class protein also appears to decline proportionately with unit income, it is again probable that protein will diminish in the diet as the family grows. This would appear to be opposed to the recognized needs of a growing family, for most authorities (B.M.A. Nutrition Report, 1933; League of Nations' Report, 1936) are agreed that protein requirements are greater in childhood. Children of 3 years are

recommended 38 g. of first-class protein by the League of Nations' Report and 28·2 g. by the B.M.A. (1933), and at the age of 6 the amounts are 44 and 28·8 g. respectively; these are a high proportion of the requirements of the adult, and exceed, in the case of the League figures, the minimum of 37 g., which some authorities (Hutchison & Mottram, 1933; Ministry of Health, 1932) recommend for the adult.

The significance of this decline may be further emphasized by computing from the above graphs the figures for two imaginary families. In this manner we shall be able to follow their fortunes through the years of childhood (assuming a continuance of present income of 50*s.* a week and similar living conditions).

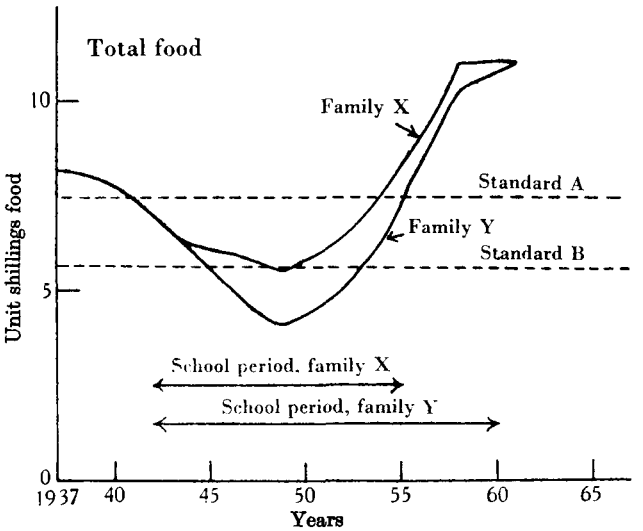
Table V and Graphs 7 and 7*a* show unit expenditure upon food from the anniversary of the birth of the first child in 1937, through the pre-school and school periods, until the last child leaves school. Family X has two further children born, and family Y four.

Table V

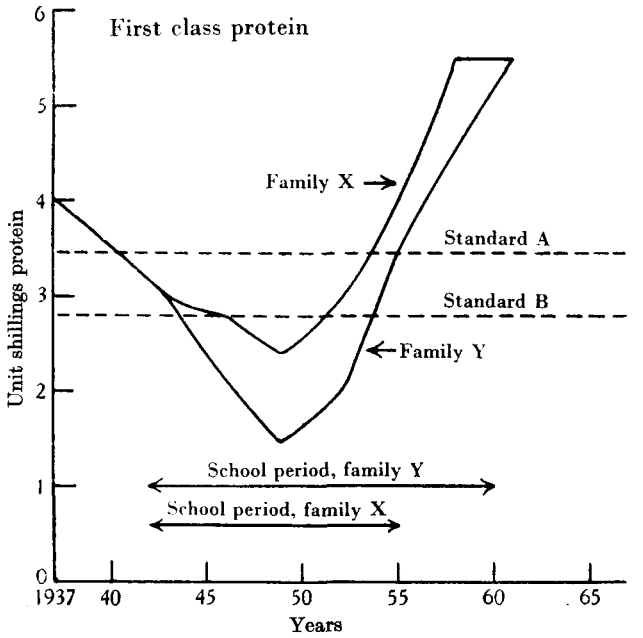
Family ages and composition	Cost coefficients X	Cost coefficients Y	Income	Unit Income X	Unit Income Y	Expenditure: Per unit on food X	Expenditure: Per unit on food Y	Expenditure: On protein X	Expenditure: On protein Y
						s. d.	*s. d.*	*s.*	*d.*
1937 F.M. C 1	2·3	2·3	50	21·7	21·7	8 2	8 2	4·0	4·0
1940 F.M. C 2, 4	2·85	2·85	50	17·6	17·6	8 0	8 0	3·5	3·5
1943 F.M. C 2, 5, 7	3·46	3·46	50	14·4	14·4	6 7	6 7	3·0	3·0
1946 F.M. C (3), 5, 8, 10	3·91	4·49	50	12·9	11·1	6 2	5 3	2·8	2·2
1949 F.M. C (3) (6) 8, 11, 13	4·23	5·51	50	11·8	9·1	5 8	4 3	2·4	1·5
1952 F.M. C (6) (9) 11, 14, 16	4·63	5·94	65	14·0	10·9	6 6	5 2	3·0	2·0
1955 F.M. C (9) (12) 14, 17, 19	4·83	6·53	97·5	20·2	15·0	8 8	7 0	4·0	3·5
1958 F.M. C (12) (15) 17, 20, 22	4·83	6·63	167·5	34·7	24·9	11 0	10 4	5·5	4·5
1961 F.M. C (15) (18) 20, 23, 25	4·83	6·83	200·0	41·7	30·0	11 0	11 0	5·5	5·5

The progress of these imaginary families, based upon the average accomplishment of families attending this one school, suggest that there is adequacy of food and protein before and after the school period, with a considerable reduction at the time when all the children are fully embarked upon it. The extent and degree to which this reduction constitutes inadequacy must depend upon the standard adopted. Upon the highest standard, provision both of food and protein becomes deficient just before the school period, and does not again become adequate until shortly before the last child leaves. If the lowest standard is adopted, provision is only markedly defective in the family with five children. It will be observed that the family with five children lies within the zone of "marked protein deficiency" from 1947 to 1952.

If this reconstruction is correct we must expect to find confirmation in an analysis of families in relation to the school period. Families have therefore been classified as entrant, leaving and middle. "Entrant" have a child not older than 7 years at school, "leaving" one or more children earning in excess of 10*s.* weekly; these groups should show relatively little deficiency. The



Graph 7



Graph 7*a*

https://doi.org/10.1017/S0022172400032630 Published online by Cambridge University Press

remaining families are fully embarked upon the school period; these will be expected to show a greater percentage and degree of deficiency, and greater in proportion as the number of children in the family. Tables VI–VIII show the figures for these three types:

Table VI

(Excluding families of income over £4)

	No. families	Average provision per family in unit shillings	
		Food	Protein
Entrant	19	9·5	4·4
Leaving	29	7·8	3·5
Middle	42	6·5	3·2

Table VI shows average provision to be greatest in entrant families, less in leaving and least in middle type.

Table VII

		Entrant families 19 22 Standard		Leaving families 29 53 Standard		Middle families 49 108 Standard	
		A	B	A	B	A	B
No. of families							
No. of school children in families ...							
No. of families below sufficiency:	Food	1	Nil	13	2	25	13
	Protein	2	Nil	13	2	24	13
Average per family below in unit shillings:	Food	0·8	Nil	1·5	1·15	2·17	1·26
	Protein	0·5	Nil	0·63	0·5	1·18	0·86
No. of children below sufficiency:	Food	1	Nil	32	5	61	32
	Protein	2	Nil	24	5	58	34
No. of children below level of marked protein deficiency		Nil	Nil	Nil	Nil	25	25
Percentage of children deficient in protein		10·5	Nil	45·3	9·4	53·7	31·5
Percentage of children below level of marked protein deficiency		Nil	Nil		Nil	24	24

Table VII shows that, upon standard A, one of nineteen entrant families (5%), thirteen of twenty-nine leavers (45%), and twenty-five of forty-nine "middle" type (51%) show deficiency in respect of total food, and upon standard B the percentages are 0, 6·9, and 26·5% respectively. It is, therefore, clear that the families fully embarked on the school period fall to a greater extent and degree below "sufficiency" than either entrant families or leaving families, the difference being more marked in the case of entrants.

In Table VIII "middle" type families are classified according to the number of children (again showing separately those with incomes over £4 as not being representative of working classes).

It is again apparent that deficiency increases markedly with the growth of the family. Of the middle type families with more than one child 60% under standard A lie below sufficiency and 47·6 according to standard B. In the families with more than two children the percentages below sufficiency are

Table VIII. *Middle type families subdivided*

		Income exceeding £4		1 child		2 children		3 children		4 children		5 children		6 children	
No. of families		7		8		13		8		9		1		3	
No. of school children in families		18		8		23		16		27		4		12	
		Standard		Standard		Standard		Standard		Standard		Standard		Standard	
		A	B	A	B	A	B	A	B	A	B	A	B	A	B
No. of families below sufficiency:	Food	Nil	Nil	2	2	5	2	7	4	6	2	1	1	2	2
	Protein			2	1	6	2	6	4	7	3	1	1	2	2
Average below in unit shillings:	Food	Nil	Nil	2·75	0·75	1·6	0·85	1·7	1·4	1·01	1·55	2·1	0·5	3·5	1·9
	Protein			0·7	0·4	0·73	0·55	1·3	1·2	1·03	1·07	1·5	0·8	2·65	1·85
No. of children below sufficiency:	Food	Nil	Nil	2	2	8	3	14	8	18	16	4	4	8	8
	Protein			2	1	10	3	12	8	22	19	4	4	8	8
No. of children below level of marked protein deficiency F		Nil	Nil	Nil		Nil		6		7		4		8	
Percentage of children deficient in protein		Nil	Nil	25		25		75		81·4		100		66	
Percentage of children below level of marked protein deficiency		Nil	Nil	Nil		Nil		37·5		26		100		66	

77·8 and 60·1. The extent of insufficiency also increases with the number of children. It is further significant that all the children in the zone of "marked protein deficiency" occur in middle type families with more than two children; 42% of the children of such families fall into this zone.

These figures correspond very closely with the facts observed from the reconstructed graph of the imaginary families. Deficiency even on the standard A would not appear likely before the school period, and it diminishes rapidly with the additional earnings of the eldest children after leaving school. During the intermediate period, when the family is fully embarked on school life, the above evidence suggests that the needs of growth, particularly in respect of first-class protein foods, are unsatisfied, and markedly so when the family consists of more than two children. The deficiency is considerable upon the highest standard but still appreciable upon the lowest standard of expenditure, at present prices and by the average housewife.

Part III. An analysis of eighty rural families attending four elementary schools

Eighty out of ninety-nine families in the four schools have been completed. Of these, fifty-four were workers on the land and road and the remaining twenty-six were as follows: farmers (2), timber thrower working for himself with his many sons (1), pipe layer (1), bus driver (1), lorry drivers (2), carpenter (1), bricklayers (6), brickyard workers (2), builder (1), washer at creamery (1), widow (1), blacksmith (1), gardeners (6).

In every family the amount of food obtained without payment, either from the garden or elsewhere, has been estimated at current prices, and the access to rabbits has, so far as is possible, been discovered by careful inquiry through the district nurse.

The range of income (32–55*s.*) was found to contain all the families of rural workers on a simple wage (i.e. before the income becomes multiple in the sense of being augmented by the earnings of children on an adult wage). These fifty-four families have been dealt with separately under the groups 32–35*s.* (7), 35–45*s.* (33), 45–55*s.* (14). The income groups up to 45*s.* were almost all farm and road workers with a simple wage augmented in a few cases by small earnings of a child, of mother, or from a pension. The group 45–55*s.* contained six farm workers—two with substantial assistance from a grown-up child, one woodman also with material assistance from the earnings of a child, three bricklayers, two gardeners, one lorry driver, and a widow with a pension of 21*s.*

In forty-three of the fifty-four families the rent paid was the 3*s.* of a "tied" cottage; in the remaining eleven instances five were at the rent of untied cottages, about 5*s.*, three were in council houses at 7*s.*, one at 10*s.*, and one family was in a bungalow estate at 13*s.* 8*d.* In all instances where the cottage was rent free, 3*s.* has been added to the income.

The remaining twenty-five families have been dealt with in income ranges 55–60*s*. (7), 60–70*s*. (7), 70–100*s*. (5), and 100–200*s*. (6). These consist of farm and road workers with "multiple" incomes (one or more children earning an adult wage, or with a lodger) (13), bricklayers (3), lorry driver (1), bus driver (1), pipe layer (1), carpenter (1), builder (1), timber thrower (1), washer at creamery (1), and farmers (2).

The circumstances of these higher income groups were in many respects quite different from those of the lower range. The rentals paid were on the whole higher (sixteen out of twenty-five were at 3*s*.), and in some instances very high. The pipe layer and lorry driver in the range 55–60*s*. were paying 14*s*. a week rent in a bungalow estate; it is of no small interest that this income range falls below the group preceding it in respect of food provision. The two farmers, the builder and the timber thrower were running successful businesses with incomes computed at between 100*s*. and 200*s*. per week. It will be realized that the numbers in these higher groups are much smaller than in the lower range.

The total number of children in the four schools was 189 and in the eighty families analysed 165. 107 were in the fifty-five families in the lower range up to 55*s*., and fifty-seven in the twenty-five families in the higher range. It is believed that the families are representative of the complete schools; two schools were completed with the exception of one family each, a third school with the exception of three families, and in the fourth school (the largest) twenty-two out of thirty-five families were completed.

In order to show the influence of the growing family in each income group, an average has been taken of food provision per unit for the following sizes of family: 2–2·5, 2·5–3, 3–3·5, 3·5–4, 4–4·5, 4·5–5, 5–5·5, 5·5–6, 6–6·5, 6·5–7, 7–7·5, 7·5–8, and 8–8·5. The smallest possible unit total was 2·41 (father 1·0, mother 0·83, and child entering school 0·58).

Graph 8 shows the average provision of food per unit plotted against the average of these family totals in each income group in the lower range:

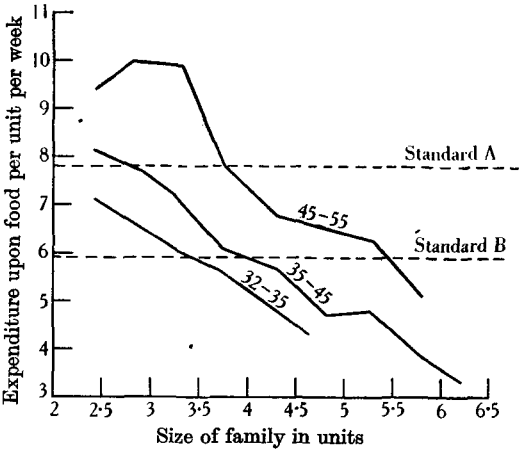
Table IX

Family size in cost units	Shillings spent on food per unit in income groups		
	32–35	35–45	45–55
2 –2·5	7·1	8·15	9·4
2·5–3	—	7·7	10·4
3 –3·5	6·15	7·25	9·9
3·5–4	5·7	6·04	7·8
4 –4·5	—	5·66	6·8
4·5–5	4·35	4·74	—
5 –5·5	—	4·8	6·3
5·5–6	—	3·88	5·1
6 –6·5	—	3·3	—

An examination of Graph 8 shows a considerable degree of uniformity of response by successive income groups to the increasing size of the family. There is, in fact, a steady decline in food provision as the family grows. Each incre-

ment of 5*s*. in the gross income results in an improved expenditure which continues from the smallest family total through successive stages of the growth of the family.

The income group 32–35*s*. falls entirely below standard A diet, group 35–45*s*. falls below after reaching 2·8 units, group 45–55*s*. after 3·8. In respect of standard B, the successive income groups fall below on reaching 3·4, 4·0 and 5·5.



Graph 8. Showing expenditure upon food in relation to the growing family in income groups from 32*s*. to 55*s*.

Of the 107 children in these families 78% lie below standard A and 52·4% below standard B. The figures for the groups were as follows:

	32–35*s*.	35–45*s*.	45–55*s*.
Percentage below standard A	91·7	82·6	57·7
Percentage below standard B	75	58	27

In families with an income less than 40*s*. and with more than two children 100% fall below standard B.

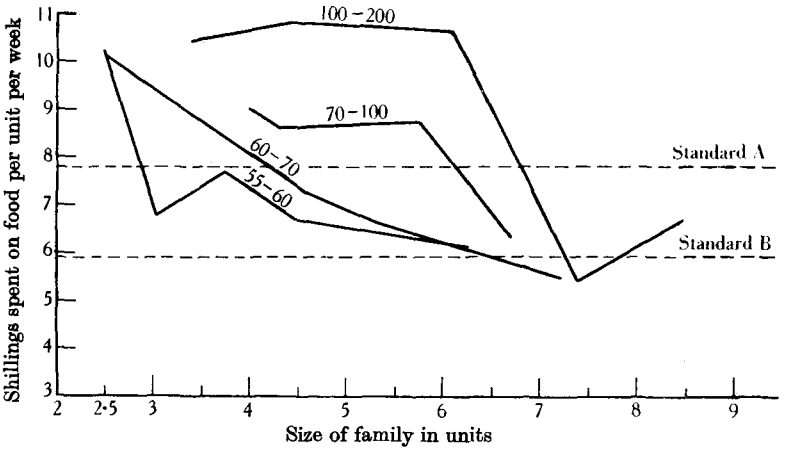
Graph 9 shows the results with the families with higher incomes:

Table X

Family size in cost units	Shillings spent on food per unit in income groups			
	55–60	60–70	70–100	100–200
2 –2·5	10·4	—	—	—
2·5–3	—	10·0	—	—
3 –3·5	6·85	—	—	10·4
3·5–4	7·7	—	—	8·4
4 –4·5	—	9·0	8·6	10·8
4·5–5	6·6	7·2	—	—
5 –5·5	—	6·6	—	—
5·5–6	—	5·8	8·7	—
6 –6·5	6·24	—	—	9·9
6·5–7	—	—	5·95	—
7 –7·5	—	5·5	—	5·4
7·5–8	—	—	—	—
8 –8·5	—	—	—	6·7

https://doi.org/10.1017/S0022172400032630 Published online by Cambridge University Press

In view of the small numbers too much emphasis should not be laid on these figures. It is, however, clear that the weight of the growing family continues to be felt, and that the food provision declines with growth of family until a high level of income is reached. It is of interest that the onset of the decline in the two highest groups is postponed to a later date. Above 100*s.* of income a maximum of a little over 10*s.* per unit per week appears to be maintained until the family has reached a very large size.



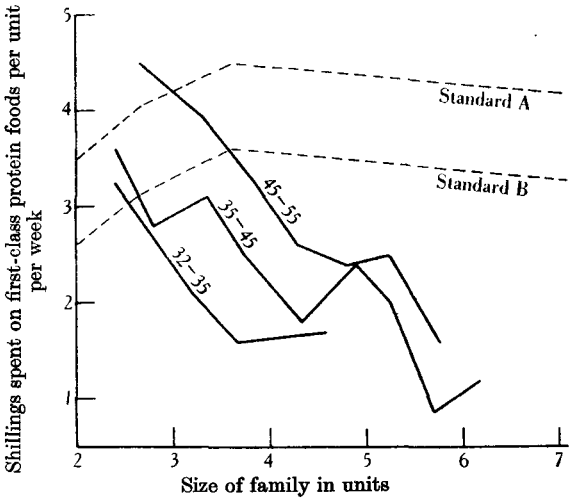
Graph 9. Showing expenditure upon food in relation to the growing family in upper range of income.

The question of adequacy as suggested by the instinctive provision of food by the housewife has been discussed previously in the analysis of urban school families. The same observation is again presented here. There appears to be a striving by every housewife in every group to achieve a provision of food per unit equal to an expenditure at current prices of 10*s.* a week. An examination of Graphs 8 and 9 will show that at the outset of family life in all incomes, with the exception of the two below 40*s.*, the provision approximates to this figure. If the interpretation of the above graph is correct this effort by the housewife is not abandoned until the demands of an increasing number of mouths renders it no longer possible to accomplish. This effort so constantly and persistently made by housewives of different degrees of affluence cannot fail to be of significance in the problem of determining sufficiency. The instinct of housewives to balance the food has been more than once recorded; it is probable that the same instinct will guide her to provide as far as possible the amount normally sufficient for the development of optimum nutrition.

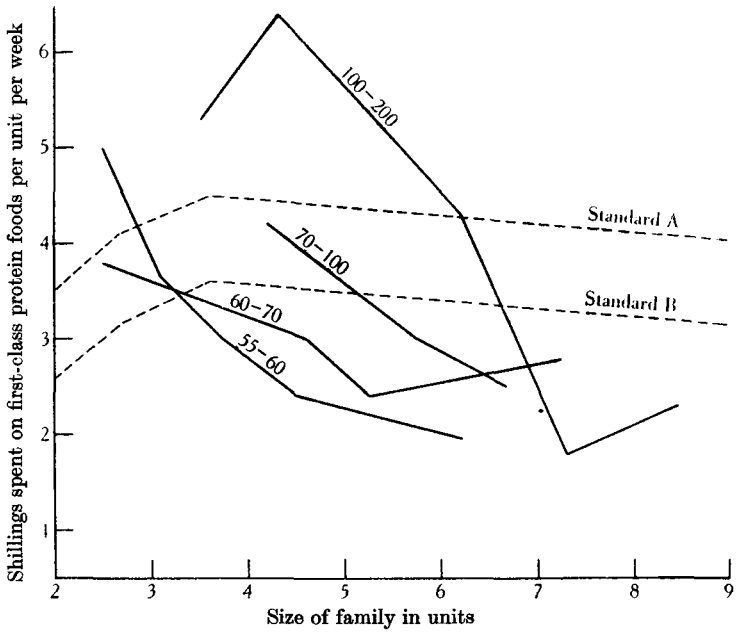
The percentage of children in the whole of the eighty families may now be given; below standard A 72·2 and below B 40·6.

Provision of first-class protein

Graph 10 shows the provision of first-class protein in the families of the lower range. Graph 11 shows this for the upper range of families.



Graph 10. Showing expenditure upon first-class protein foods in relation to the growing family in income groups from 32*s*. to 55*s*.



Graph 11. Showing expenditure upon first-class protein foods in relation to the growing family in the upper range of income

https://doi.org/10.1017/S0022172400032630 Published online by Cambridge University Press

Table XI. *Table of figures for income groups* 32–55*s.*

Family size in cost units	Shillings spent on first-class protein per unit in income groups		
	32–35	35–45	45–55
2 –2·5	3·25	3·6	2·8
2·5–3	—	2·8	5·0
3 –3·5	2·1	3·1	3·95
3·5–4	1·6	2·5	3·3
4 –4·5	—	1·8	2·6
4·5–5	1·7	2·43	—
5 –5·5	—	2·0	2·5
5·5–6	—	0·87	1·6
6 –6·5	—	1·2	—

Table XII. *Table of figures for income groups* 55–200*s.*

Family size in cost units	Shillings spent on first-class protein per unit in income groups			
	55–60	60–70	70–100	100–200
2 –2·5	5·0	—	—	—
2·5–3	—	3·8	—	—
3 –3·5	3·65	—	—	4·8
3·5–4	3·0	—	—	5·7
4 –4·5	—	3·5	4·9	6·4
4·5–5	2·9	3·3	—	—
5 –5·5	—	2·2	—	—
5·5–6	—	2·1	2·8	—
6 –6·5	2·2	—	—	3·9
6·5–7	—	—	2·45	—
7 –7·5	—	2·8	—	1·8
7·5–8	—	—	—	—
8 –8·5	—	—	—	2·4

It will be seen that the same general principles apply again as were shown for total food. Provision of protein declines in all families with increasing size. This again cannot fail to be of the greatest significance since all authorities are agreed that protein requirements for growth are proportionately greater in childhood. Upon Graphs 10 and 11 the level of expenditure marked standard A has been computed from the allowances given in the balanced dietaries of the B.M.A. Nutrition Report (1933) for a family increasing by one child every other year. It will be seen that the allowance increases somewhat up to a unit total of 3·5. These diets which give a higher allowance of first-class protein up to the age of eight years and subsequently the same proportion as an adult, are appreciably lower in this respect than the diets recommended in the League of Nations' Report (1936). The amounts recommended in grams per day in the two reports are compared in Table XIII.

Upon the standard of the League of Nations' recommendations it is clear that the level of standard A in respect of first class protein would continue to increase as the family grows beyond the unit total of 3·5, and would apparently reach considerably higher levels.

However, it will be seen that even on the standard of the B.M.A. diets every family with the exception of one in the lower range lies below standard A,

https://doi.org/10.1017/S0022172400032630 Published online by Cambridge University Press

and a very high proportion are below standard B. In the high range only the highest income group lies materially above standard A, and this falls below when the family total reaches the high level of 6·5 units.

Table XIII

Age	B.M.A. (1933)	League of Nations (1936)
1–2	28·2	30
2–3	25	38
3–5 / 3–6	24·7	38
5–7 / 6–8	28	44
12–14	45 (*circa*)	56

We are therefore left with the conclusion that rural workers are able in only a small number of instances to provide an adequacy of diet for their growing families. Where the wage is below 40*s*. this would appear to be impossible after the birth of the first child. As the wage rises the date at which insufficiency must occur will be progressively postponed, but it would appear to be inevitable in the largest families of which country dwellers are capable.

Most significant is the decline in provision of first-class protein through the years when the needs of growth are greatest. In many families where the unit total is reaching a high level and the wage is low (e.g. group 35–40*s*., Graph 10) the discrepancy between the requirements of protein (4*s*. per unit) and the provision (1*s*. per unit) would appear to be considerable. Accepting 2*s*. per unit per week as a conservative estimate of the lowest expenditure upon first-class proteins (5*s*. would appear to be nearer the physiological needs), 32·7% of children in the rural schools were subsisting on amounts suggesting protein starvation.

Summary

1. The weekly budgets of eighty out of ninety-nine families in four rural schools (containing 165 school children) and ninety-seven out of 200 families in one urban school (containing 183 school children) have been analysed.

2. Evidence is given that housewives, despite varying social status, spend between 9 and 11*s*. per man per week on food when the income is sufficient to allow this.

3. The lowest level of sufficiency in diet according to the instincts of the housewife is seen to correspond, at prices ruling in this district in the winter of 1936–7, with the cost of the diet of the British Medical Association Nutrition Report (1933) (7*s*. $8\frac{3}{4}d$.). This has been called standard A and compared with standard B costing 5*s*. $10\frac{3}{4}d$. which contains 1000 cal. and 13 g. of first-class protein a day less. Standard B is probably the lowest standard of diet which any authority would be prepared to recommend.

4. In the school in a prosperous urban district, in working class families (income not exceeding £4) where the children were fully embarked on the school period (i.e. the eldest child over 7 years but no child yet earning more

than 10*s*. weekly), and which contained more than one child, 60% of children fell below standard A and 47·6% below standard B.

5. In the rural schools taking all the children, 72·2% were below standard A; where there was an income below 55*s*., 78% fell below standard A; below 40*s*. 85%; and below 35*s*. 91·7%. The figures below standard B were 40·6, 52·4, 60, and 75% respectively.

6. Both in urban and rural families, with the exception of high income groups (e.g. farmers), increase in the size of the family steadily lowers the allowance of food per unit. In medium wage earners the allowance of 9–11*s*. per unit per week when the family is small, is reduced to about 3*s*. when the family grows to a large size and before the first children begin to earn.

7. Most significant is the decline in the provision of first-class protein foods both in town and country in proportion as the family grows. Evidence is given that this contrasts markedly with the recognized needs of growth in childhood, and it is clear that in both town and country the large family in low wage groups produces a condition of extreme protein deficiency. Accepting 2*s*. per unit per week as a conservative estimate of the minimum expenditure upon first-class proteins, 13·2% of the school children in the urban school and 32·7% in the rural schools were subsisting on amounts suggesting protein starvation.

REFERENCES

CATHCART, E. P. & MURRAY, A. H. T. (1936). *Spec. Rep. Ser. Med. Res. Coun.* No. 218.
British Medical Association (1933). Rep. of Comm. on Nutrition.
League of Nations (1936). *The Problem of Nutrition*, pp. 11, 19.
HUTCHISON, R. & MOTTRAM, V. H. (1933). *Food and the Principles of Dietetics*, 7th ed. London.

(*MS. received for publication* 16. VII. 37—Ed.)