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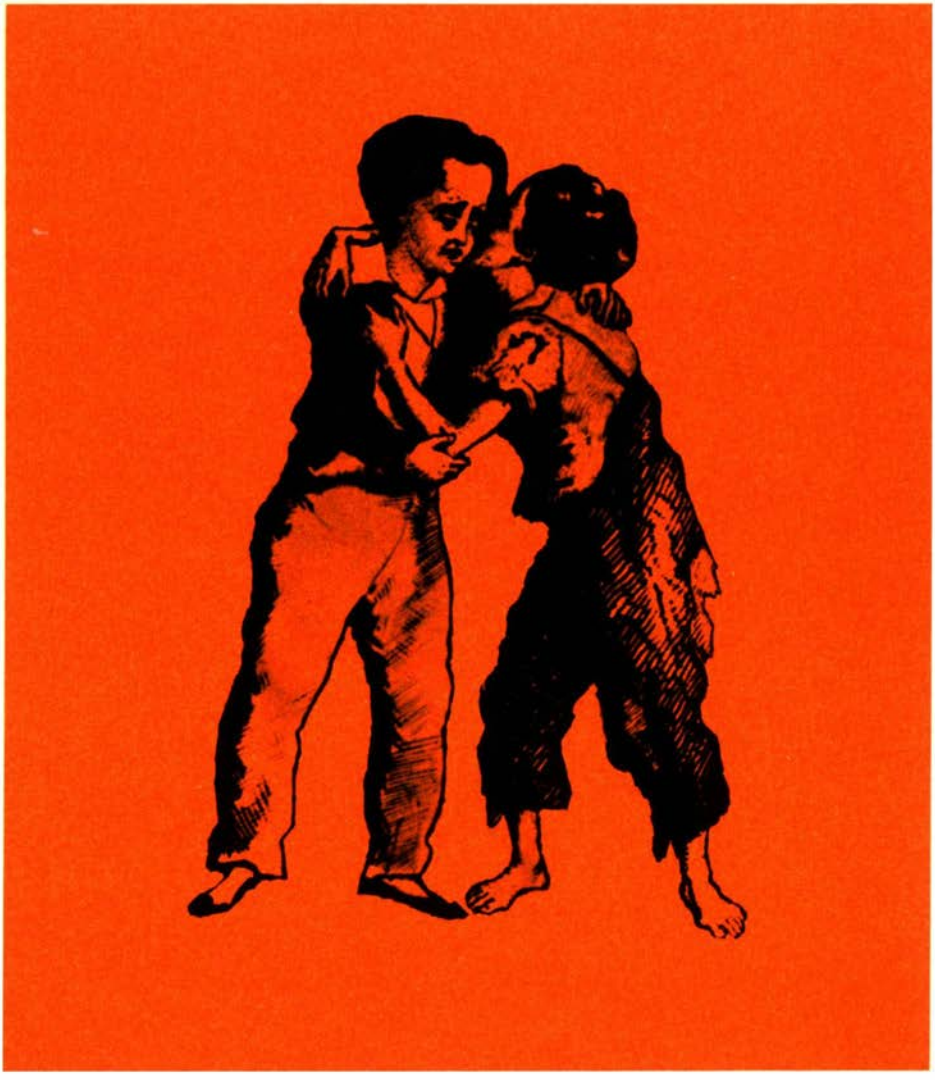

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Malnutrition in the 1960s?

THE economic and social history of the twentieth century paints a picture of substantial improvement for the community as a whole. Poverty and hardship for large sections of the population in the 1920s and 1930s was replaced in the 1950s and 1960s by full employment and all the attractions of a 'boom' economy. The purpose of this paper is to assess the extent to which these improvements are reflected in the state of nutrition of the public and the consequent reduction in the prevalence of malnutrition*. Such an investigation requires the collection and assessment of several types of evidence and this paper will examine each in turn. Information is required on the food consumption and nutrient intake of the population. Details of clinical examinations are needed to indicate the extent to which health has been affected by differing diets. The results of biochemical tests may be used to indicate the level of nutrient reserves within the body. The study of vital statistics and anthropometric data demonstrate the impact of dietary variations. Too often in the past attempts have been made to investigate the nutritional status of a community using only one of these methods and unjustified deductions based on these findings have been published. Only after an examination of all these areas and their inter-relationship can an adequate assessment of nutritional status be made.

Food, Nutrition and Prosperity

Consumption of food by the individual is confined within narrow physiological limits. Thus increased prosperity is reflected as much in movements between food groups as in overall increases in consumption and one cannot therefore look for simple increases in consumption of all foods. Estimates of food supplies show a marked increase in dairy products, poultry, eggs and sugar since before the War and a decline in

* The term malnutrition is now commonly used to mean simply bad nutrition; for an individual this might mean either a deficiency or an excess of calories or the various nutrients. For the purpose of this paper the term has been used primarily to refer to nutrient deficiencies.

A

Trends in United Kingdom Food Supplies from 1880 to 1965 (lb. per head per year)

Source: Greaves & Hollingsworth, 1966.

	1880	1909 1913	1924 1928	1934 1938	1941	1944	1947	1950	1953	1956	1959	1962	1965*
Total as milk solids	n.a.	33	35	38	41	49	49	54	53	54	54	56	56
Liquid milk	213	219	217	217	265	308	303	345	330	323	319	325	325
Cheese	8	7	9	9	8	10	9	10	9	9	9	10	10
Meat (carcase wt., incl. bacon and ham)	91	131	129	129	99	110	96	112	111	134	132	142	135
Poultry and game	n.a.	5	6	9	6	4	7	7	7	8	12	15	17
Fish	18	41	41	26	16	20	32	22	20	22	22	21	21
Eggs	11	16	15	28	25	27	25	31	28	29	33	34	34
Butter	12	16	16	25	10	8	11	17	13	16	19	20	20
Margarine	0	6	12	9	18	18	15	17	18	17	14	11	10
Other fats	n.a.	4	6	19	19	19	14	19	20	21	22	24	25
Sugar	64	79	87	96	67	71	82	84	98	109	111	111	110
Potatoes	296	243	230	190	188	275	286	242	245	225	211	214	213
Other vegetables (incl. pulses) and tomatoes	n.a.	78	105	127	123	140	142	122	133	127	130	127	136
Fruits (incl. nuts)	n.a.	68	97	104	30	52	89	84	92	95	110	108	109
Wheat flour	280	211	198	195	237	234	225	206	193	179	168	161	155
Other cereals	n.a.	26	16	16	20	19	17	17	16	14	15	16	16

n.a. figures not available.

* Provisional figures from Board of Trade Journal.

grain products and fish[1] (Table A). Other foods such as meat and fruit have shown little increase. However, calculations have been made to show that these totals mask substantial increases in consumption among the poorer socio-economic groups and a decline in the highest. Thus in 1960 the richest 10 per cent of the community was eating 22 per cent less meat than in 1936[2]. As might be expected, the whole pattern of change was influenced by rationing during the War and early post-War period, when potatoes and cereals were consumed in much greater quantities to make up for the curtailment of supplies of other foods.

But the study of food intake is not simply a question of seeing how many of us are eating large quantities of meat or dairy products. We eat food, but our bodies absorb nutrients. If nutrient requirements are not satisfied, specific deficiency diseases may develop, or there may be a general reduction in resistance to infectious diseases. It is equally important, therefore, not only to assess trends in the intake of foods but also of the various vitamins and other nutrients. In Table B the estimates for food supplies have been converted into caloric and nutrient equivalents and point to an increase since the 1930s in most nutrients[1]. It is also possible to demonstrate that an attractive diet is not necessarily the most desirable nutritionally. A maximum intake of many nutrients occurred during the period of rationing, when choice was limited and food habits were generally regarded as frugal.

It is also important to go beyond the national average figures and make some assessment of nutritional status based upon class, income, region and size of family. In 1934, Sir John Boyd Orr made a study of diet related to size of income and found that some 50 per cent of the population was below what he defined as the required standard for one or more nutrients; the average diet of 10 per cent of the community was inadequate for health in all constituents considered[3].

Government studies during the Second World War demonstrated that an overall food policy of which rationing formed a significant part had produced a marked improvement. The variation in diet between various social groups had been much reduced, and the diet of nearly all population groups was on average either very close to or above recommended nutrient requirements.

The Food Survey begun on a national basis in 1950 and continued annually has shown this position to have been broadly maintained. The figures suggest a generally satisfactory intake of nutrients whether examined by region or

B

Nutritional Value of United Kingdom Food Supplies from 1909 to 1965 (per person per day)

Source: Greaves & Hollingsworth, 1966.

		1909 1913	1924 1928	1934 1938	1941	1944	1947	1950	1953	1956	1959	1962	1965*
Protein:													
Animal	g.			43·1	36·7	41·9	43·6	45·9	43·4	48·1	49·2	52·3	51·3
Vegetable	g.			36·0	46·7	43·9	45·4	41·3	38·7	35·3	34·8	34·9	35·4
Total	g.	81	79	79	83	86	89	87	82	83	84	87	87
Fats—all sources	g.	98	107	131	115	124	107	133	130	140	140	144	142
Carbohydrate	g.	415	408	414	409	429	433	419	425	422	417	411	408
Calcium	mg.	608	646	696	707	1040	1140	1152	1090	1116	1118	1120	1130
Iron	mg.	12·6	12·6	13·0	13·1	15·9	16·5	15·2	13·5	14·7	15·4	16·1	15·4
Vitamin A	i.u.	2560	2950	3690	3500	3670	3640	3880	3840	4380	4420	4640	4750
Thiamine	mg.	1·3	1·3	1·3	1·3	2·0	1·8	1·7	1·7	1·6	1·8	1·8	1·8
Riboflavin	mg.	1·5	1·5	1·6	1·5	1·8	1·8	1·8	1·8	1·8	1·8	1·9	1·9
Nicotinic acid	mg.	14·0	13·8	13·2	11·8	16·2	16·3	15·2	14·3	15·6	16·2	16·7	16·7
Vitamin C	mg.	81	93	96	77	102	111	95	104	95	98	97	106
Energy value	kcal.	2760	2810	3050	2900	3060	2940	3120	3100	3180	3150	3190	3150

* Provisional figures from Board of Trade Journal.

income. At the same time the caloric intake for many of the community is probably too high and obesity is becoming an ever increasing problem. It seems for some at least the removal of rationing led to a diet unsatisfactory because of an excessive intake of calories. Thus in nutritional terms the period during and just following World War II may have been a high water mark, although in terms of variety it was a low water mark.

Certainly there is increasing evidence of obesity. Thus the Department of Education and Science has commented on the increasing incidence of overweight in school children[4]. For the adult community slimming is becoming an important activity. A study in 1967 has indicated that 35 per cent of women and 15 per cent of men in the United Kingdom have tried to lose weight during the past year. Most of them (78 per cent) had attempted to do this by modifying food intake.[5]

Consequently, the nutritional problems of the 1960s are generally seen as those related more to excess than deficiency. However, recently there have been persistent reports in the national press of the re-emergence of deficiency diseases, not only amongst immigrants but also in sections of the indigenous population. The medical literature also occasionally brings to light cases presenting classical clinical symptoms of deficiency. Further examination of the position is therefore justified.

Dietary Intake and Nutrient Requirements

EVIDENCE on the dietary intake of the population of the United Kingdom has rested mainly with the National Food Survey. This is a continuous sampling enquiry into the domestic food purchases of private households in Great Britain. A sample is selected by means of a three-stage stratified random sampling scheme. In 1964 the effective response rate was only 52 per cent[6]. The housewife is asked to keep a record of the description, quantity and cost of food which enters the household during one week. Items such as soft drinks, ice cream, alcohol and other items likely to be purchased by the other members of the family are not included.

The energy value and nutrient content of the recorded quantities of food are evaluated using tables of food composition which make allowance for inedible material*. The calculated nutrient intake is then compared with the allowances based on British Medical Association recommendations of what is believed to be the quantity of each nutrient required to maintain health†[7]. In making this comparison allowances are made for the presence of visitors and for meals eaten outside the home and in addition a general reduction of 10 per cent in the total intake figure for each nutrient is made to allow for wastage.

A number of issues emerge from the figures. The first is that the recommended allowances for protein and calcium are not on average reached by certain sub-groups namely: households with a man and woman and three or more children, or adolescents and children. Similarly, the standard is not reached for protein in other households with adolescents but no children or for protein and calcium in other households with one or more children. The types of household in which

* In addition, to allow for loss in cooking and storage, the figure for thiamine is reduced by 15 per cent and for vitamin C by 75 per cent for green vegetables and by 50 per cent for other vegetables.

† It should be noted that these allowances are not minimum requirements to keep a particular individual alive. They are allowances 'believed to be sufficient to establish and maintain a good nutritional state in representative individuals in the groups concerned'. Adjustments are made for age, sex and activity.

Energy Value and Nutrient Content of Food Consumption of Certain United Kingdom Households in 1950 and 1964 expressed as a percentage of their Recommended Allowances.

Source: Domestic Food Consumption and Expenditure Survey 1950, 1964.

	Families with 1 child			Families with 4 or more children		
	1950	1964	Change	1950	1964	Change
Energy value	109	114	+ 5	101	101	—
Total protein	117	112	− 5	94	90	− 4
Calcium	120	118	− 2	92	87	− 5
Iron	123	126	+ 3	107*	110	+ 3
Vitamins†:						
Vitamin A	167*	211	+ 44	145*	176	+ 31
Thiamine	140*	141	+ 1	131*	122	− 9
Riboflavin	126	130	+ 4	109	108	− 1
Nicotinic acid	146	154	+ 8	123	128	+ 5
Vitamin C	283*	272	− 11	213*	187	− 26

* 1952 figures.

† No details are given for vitamin D as there are no BMA recommended allowances for this nutrient.

Range in Nutrient Consumption for Different Social Classes in the United Kingdom—1950 to 1964

Source: Greaves & Hollingsworth, 1966.

Note: Difference in percentage points between highest (A1) and lowest (D1) social classes, when the intake of each is expressed as a percentage of the average intake.

	1950	1954	1958	1960	1962
Nutrient Intake					
Calories	6	−0·5*	6	5	3
Protein	8	5	12	13	9
Fat	12	9	20	20	13
Calcium	16	11	14	19	16
Iron	10	7	9	7	9
Vitamin A	30	18	32	30	18
Thiamine	4	6	12	7	9
Riboflavin	20	17	21	23	19
Nicotinic acid	7	8	15	14	17
Vitamin C	27	50	45	36	44
Vitamin D	22	10	11	4	2

* Negative figures indicate higher consumption for social class D1

the standards for protein or calcium are not on average reached constitute 48 per cent of the families with children in the sample.

The trend over time also demonstrates a slight decline in standards compared with the period of austerity in 1950. Thus today families with only one child have a lower nutrient intake of protein, calcium, and vitamin C than in 1950. For families with four or more children the intake is lower for protein, calcium and the vitamins thiamine, riboflavin and vitamin C (Table C). Additionally, variations between classes are also still substantial and in some nutrients growing (Table D).

However, the situation may be more serious than these figures suggest. One of the features of any average is that people divide into two groups—some are above it and some below it.

This fact becomes particularly significant if the average intake comes close to the recommended allowance (Table E). Thus families with a dietary intake 10 per cent less than the average would be below the recommended allowance for calories, protein and calcium. This problem has long been appreciated by the Ministry of Agriculture.

'The reports of the National Food Survey and the Report of the committee on Nutrition of the British Medical Association express their findings in statistical terms. They deal with average households, average families and average allowances. Those who are concerned with the standard of nutrition for the whole community will not be satisfied merely because average people are adequately fed, but will wish to ensure that, provided a surplus does no harm, the average intake will be so much greater than the average requirements that even the individuals whose intakes are most below average still receive enough'[8].

Doubts also exist regarding the accuracy of the estimates of vitamins and other nutrients available from various foods. For example, the National Food Survey indicates that potatoes provide one-third of the vitamin C in our diet. However, recent studies have shown that the vitamin C content of potatoes fluctuates very substantially between samples. Storage may also reduce vitamin value considerably and cooking is always a source of great uncertainty[9]. Thus the quantity of water used in the cooking of vegetables and the length of time they are allowed to cook will have a substantial influence. In the event a potato nine months old will only have a content of vitamin C a quarter that of a new potato and

E

Energy Value and Nutrient Content of Household Food Consumption of Households of Different Social Class in the United Kingdom in 1964 (expressed as a percentage of Recommended Allowances).

Source: Domestic Food Consumption and Expenditure Survey 1964.

	Class								
	A			B	C	D			All households
	A1	A2	all			With earners (D1)	Without earners (D2)	OAP	
Energy value	113	110	111	108	105	107	115	114	108
Total protein	118	107	110	104	100	103	113	115	104
Calcium	123	114	116	109	104	102	110	115	108
Iron	128	118	120	118	116	114	110	101	118
Vitamin A	223	210	213	198	168	180	170	156	193
Thiamine	144	138	139	131	126	130	141	133	131
Riboflavin	138	128	130	118	110	112	123	120	116
Nicotinic acid	175	148	154	144	137	144	152	144	143
Vitamin C	329	278	291	239	219	204	237	207	236
Percentage of energy value derived from:									
Protein	12·5	11·8	11·9	11·6	11·4	11·6	11·3	11·2	11·6
Fat	43·7	42·1	42·5	40·4	39·4	38·9	39·7	40·5	40·3
Carbohydrate	43·7	46·0	45·5	47·9	49·0	49·3	48·8	48·2	48·0
Animal protein as percentage of total protein	67·5	63·7	64·6	60·5	57·8	57·4	59·7	60·7	60·1

much of the vitamin C that remains may be lost in cooking. The National Food Survey figure for the vitamin C content of potatoes cannot therefore hope to be very precise.

Not only the estimates of intake are difficult to ascertain accurately. Estimates of requirements vary according to sex, age, degree of activity and other factors[7] (Table F).* Some account can be taken of these influences in estimating average requirements for the family. However, since the recommended intake of calories, protein, niacin, thiamine and riboflavin can change by several hundred per cent according to degree of activity the question of assessing leisure activity arises. Clearly, the keen athlete's requirements will differ from the man whose most active leisure time pursuit is to change the channel of the TV set he is watching, but the problem is how to record this in a national study. Moreover, there is no way of assessing whether the food consumed and therefore the nutrients available for absorption are distributed by the family according to the needs of the various members.

Even given the same stature and activity, individual requirements will differ considerably. A number of studies have demonstrated that given a number of individuals the levels at which apparently adequate nutrition can be maintained varies very substantially. The FAO committee on Protein Requirements defined average minimum requirements as 'the smallest amount of protein which will maintain nitrogen balance when the diet is adequate in other respects'[10]. However, as long ago as 1920 Sherman reviewing 109 balance experiments showed that the mean intake required was 44·4 grams per 70 kilograms bodyweight, but that individual requirements varied between 21 and 65 grams[11]. A study just reported by Garrow and Pike has suggested that the child whose genetic make-up is such that he would grow very rapidly if well fed will suffer more on a restricted diet than one with more modest demands. This could explain both the fact that in a given family on a restricted diet some children suffer much less harm than others, and also the tendency of the child who has been successfully treated for malnutrition to outgrow his siblings[12].

In the light of such opinions, it is not surprising that there is no concensus of opinion even at official levels as to the quantity of nutrients various individuals require. Thus the United States National Research Council (1963) recommended allowance of vitamin C for adults is 70 milligrams per day

* See pages 16–17.

G

Variations in Recommended Daily Dietary Allowances for Certain Nutrients during Pregnancy and Lactation for different countries.

Source: Marks, 1967

Vitamin		USA	GB	W. Germany	USSR
A (i.u.)	normal	5000	5000	5000	4500
	pregnancy	6000	6000	6000	6600
	lactation	8000	8000	8000	6600
Thiamine (mg.)	normal*	0·8	1·1	1·7	3·0
	pregnancy	1·0	1·1	2·1	2·5
	lactation	1·2	1·4	2·3	3·0
Riboflavin (mg.)	normal*	1·3	1·4	1·8	3·0
	pregnancy	1·6	1·6	2·0	3·0
	lactation	1·9	2·1	2·5	3·0
C (mg.)	normal	70	20	75	100
	pregnancy	100	40	100	100
	lactation	100	50	120	120

* GB rates are those for women occupied in light work.

whilst the British Medical Association (1950) recommends 20 milligrams per day[13]. This is by far the greatest variation between recommendations, but there are many smaller variations between other items on these two lists. There are also variations on lists produced in other countries. In each case they occur not only for the normal adult, but also for special groups at risk such as the pregnant women or lactating mothers[14] (Table G). Clearly, there are differences in definition. Thus the US allowances are 'those which will maintain good nutrition in essentially all healthy persons under current conditions of living'. The BMA figures 'are believed to be sufficient to establish and maintain a good nutritional state in representative individuals in the groups concerned. It is recognised that in every group there must be cases where the need for one or other nutrients is greater than that of the average'. In part the variations may also reflect differences in views as to requirements.

Any assessment of the nutritional adequacy of a diet will depend upon the series of recommendations against which it is rated. Thus if vitamin C intake in the United Kingdom is expressed as a percentage of US standards it would indicate that the average for all households was 27 per cent *below* recommended allowances instead of 136 per cent *above* when rated against the BMA figures.

All of this means that only a limited and general impression can be obtained from figures of average dietary intake. Such a view has long been held by nutritionists[15]. 'If the results of a dietary survey show that the diet has a very low calorie content, the conclusion that the group in question is suffering from under-nutrition is perhaps a legitimate one. But the fact that intake of certain nutrients falls below some recommended allowance does not justify the conclusion that a proportion of any group surveyed is suffering from malnutrition. In such circumstances the possible presence of malnutrition may be inferred, but the dietary survey *per se* provides no evidence of its existence'[16].

For this and other reasons the members of the National Food Survey Committee have also always stressed the limitations of the Survey as an assessment of nutritional status. 'Since the Survey is concerned primarily with food purchases by family units it cannot at the same time provide detailed information on diet and nutrition of individuals. Moreover, with the derationing of food, emphasis has shifted from the nutritional to the economic aspects of the Survey. Thus the results are used for the analysis of demand for food

Summary of daily allowances as recommended by the Nutrition Committee of the

	Requirement Class*	Calories	Protein	Calcium	Iron
			g.	g.	mg.
BOTH SEXES					
0–1 year	—	1000	37	1·0	6·5
2–6 years	—	1500	56	1·0	7·5
7–10 years	—	2000	74	1·0	10·5
11–14 years	—	2750	102	1·3	13·5
MALES					
15–19 years	—	3500	130	1·4	15·0
20 years and over	0	1750	51	0·8	12·0
	1	2250	66	0·8	12·0
	2	2750	80	0·8	12·0
	3	3000	87	0·8	12·0
	4	3500	102	0·8	12·0
	5	4250	124	0·8	12·0
	6	5000	146	0·8	12·0
FEMALES					
15–19 years	—	2500	93	1·1	15·0
20 years and over	0	1500	44	0·8	12·0
	1	2000	58	0·8	12·0
	2	2250	66	0·8	12·0
	3	2500	73	0·8	12·0
	4	3000	87	0·8	12·0
	5	3750	109	0·8	12·0
Pregnancy					
First half	—	2500	93	0·8	12·0
Second half	—	2750	102	1·5	15·0
Lactation	—	3000	111	2·0	15·0

* Requirement Classes
[0] No work, lying in bed.
[1] Sedentary work
[2] Light work
[3] Medium work
[4] Heavy work
[5] Very heavy work
[6] Extremely heavy work

British Medical Association (1950) (All values per day)

Vitamin A and Carotene i.u.	Vitamin D i.u.	Thiamine mg.	Niacin mg.	Riboflavin mg.	Ascorbic Acid mg.	Iodine μg.
3000	800	0·4	4	0·6	10	—
3000	400	0·6	6	0·9	15	150
3000	400	0·8	8	1·2	20	150
3000	400	1·1	11	1·6	30	150
5000	400	1·4	14	2·1	30	150
5000	—	0·7	7	1·0	20	100
5000	—	0·9	9	1·4	20	100
5000	—	1·1	11	1·6	20	100
5000	—	1·2	12	1·8	20	100
5000	—	1·4	14	2·1	20	100
5000	—	1·7	17	2·6	20	100
5000	—	2·0	20	3·0	20	100
5000	400	1·0	10	1·5	30	150
5000	—	0·6	6	0·9	20	100
5000	—	0·8	8	1·2	20	100
5000	—	0·9	9	1·4	20	100
5000	—	1·0	10	1·5	20	100
5000	—	1·2	12	1·8	20	100
5000	—	1·5	15	2·2	20	100
6000	400	1·0	10	1·5	40	150
6000	600	1·1	11	1·6	40	150
8000	800	1·4	14	2·1	50	150

and for making demand projections for administrative purposes. On the nutritional side less interest attaches to the relatively minor changes in the estimates that occur from year to year, than to the study of long term trends. The results are of importance in enabling, for example, calculations to be made of the probable consequences of a change in Government policy concerning the fortification of foods with certain nutrients. *With regard to the assessment of nutritional status the Survey has always been recognised as an imprecise instrument, but it is nevertheless of value in indicating sections of the community which might merit closer investigation by more appropriate methods*'[17]. (Italic added).

EACH year there are references in the medical literature to cases of vitamin and other nutrient deficiencies in the United Kingdom. Such reports are usually limited to fairly clearcut groups. These are the elderly, often incapacitated or living alone, without the means or incentive to provide a diet of any real value, and the poverty stricken large families. Both groups find it very difficult not only to make ends meet but also to make the maximum use in a nutritional sense of available income; the latter group may even fail to collect subsidised supplements. In a different way, the immigrant who is short of money but has set food habits based on his indigenous diet which is both expensive and relatively difficult to provide for in this country may also be vulnerable. Nutritional deficiencies may also emerge as a secondary response to serious illness, either physical or psychological which diminish the individual's appetite. In such circumstances the need for certain vitamins may also be increasing.

Nevertheless it seems that general practitioners believe that nutrient supplements are required by a much greater section of the population than those just mentioned. A study of the morbidity statistics from general practice for 1955/56 indicated that just under one person per thousand was being diagnosed by doctors as suffering from avitaminosis of one type or another. The figure is highest for the young and the old. 5·7 persons per thousand were diagnosed as suffering from iron deficiency anaemia and as might be expected the figure was much greater for women than men, reaching nearly 13 per thousand for women between 15 and 45[18].

Estimates of prescriptions indicate that 16·75 million prescriptions were issued in the United Kingdom in 1965 for vitamins and other nutrients including iron. Over half of the 16 million is for iron preparations with another 4 million going on tonics which include nutrient supplements and another million going both to multivitamin and vitamin B tablets. Again the pattern indicates a substantially larger number of prescriptions going to women especially of child bearing age. In both sexes a relatively high percentage goes

to the over 65s[19]. Some of these prescriptions may have been used as little more than placebos. But this number compares with only 3 million prescriptions for anti-obesity preparations.

As is indicated by the morbidity statistics perhaps the most widespread deficiency state in this country is iron deficiency anaemia. If this is so it clearly indicates the limitation of the current statistics on consumption. According to the National Food Survey every group of the population is receiving an adequate intake of iron. Yet mal-absorption or excessive loss, especially in menstruation, appears to have led to many individuals having anaemia*. Indeed, where deficiencies do occur, they may be due just as frequently to the phenomenon of malabsorption as to inadequate intake. Certainly the whole issue of malabsorption places a limit on the value of relating nutrient requirements to intake and from this making some pronouncement about nutritional status.

Another problem is to assess how far clinical reports of nutritional deficiencies in the literature represent the only cases within the country. If this is so, they indicate that the problem is very small. On the other hand many other doctors may not write up reports of similar cases. It is possible that the published reports represent only a small minority of the cases.

Many studies are based simply upon biochemical tests. Andrews, Brook and Allen (1965) examined 136 subjects aged 59 to 98 years living either at home or in different types of residential care. They showed that there was a significant fall in the leucocyte vitamin C content of these subjects during the winter and that the majority of the subjects were likely to be receiving less than 30 milligrams a day of vitamin C in their diet. Vitamin C status was significantly inferior in those resident in two hospitals and a large welfare home[20]. In March 1966, Griffiths, Brocklehurst, Maclean and Fry reported on an investigation of ascorbic acid and thiamine blood levels in the elderly. They showed that in Farnborough in Kent, 41 per cent of elderly people were deficient in ascorbic acid and 59 per cent deficient in thiamine on admission to hospital. Of people living at home and not ill, or not sufficiently ill for admission to hospital 27 per cent were deficient in ascorbic acid and 22 per cent in thiamine[21]. This particular study is now being extended to assess the impact upon health of improving these nutritional levels.

Studies of this sort have been used to imply directly that

* It is interesting that the BMA recommended allowance for iron is the same for both men and women.

many individuals are suffering from malnutrition and consequently facing ill health. This may not be the case. Biochemical tests are important in that they provide a clearcut scientific measurement for use as a yardstick. But the significance of borderline deficiencies as indicated by such tests needs to be established. Thus women with evidence of marginal iron anaemia present no clinical symptoms and are not demonstrably fitter when their haemoglobin levels are improved.

At this stage much research is needed to assess whether or not a biochemical test indicating a low nutrient level is of itself sufficient to justify the term malnutrition; whether such non-specific symptoms as loss of appetite, general malaise, insomnia, increased irritability can be and on occasions are the result of nutritional problems; whether 'sub-optimum' nutrition leads to lowered resistance to infectious disease or to a health problem at a later period of one's life. For example it is now agreed that 'the nutritional status of a pregnant woman depends more upon her life experience of diet than upon the nature of the diet she happens to take during pregnancy[22].

One of the remarkable things about nutrition is that in the area between chronic deficiency and optimum health, more is known about animals than about man. Thus in animal nutrition a clear distinction is drawn between minimum requirements for health, above which no specific symptoms of deficiency occur, and 'optimum-nutrition' where maximum growth occurs. No study designed to examine whether a similar concept is valid for humans has been undertaken. Indeed it is difficult to assess whether such a study would be realistic because one of the major difficulties is to decide what we mean by 'optimum' health for humans. Does it mean maximum growth, maximum resistance to disease, long life, or what? For animals the issue is usually more clear-cut—they are fed for maximum growth, maximum milk yield, or some other specific criterion.

The issue may also be so imprecise that it defies quantification. 'It is relatively simple to establish minimum levels just sufficient to prevent the development of specific overt signs of deficiency, exceedingly difficult to ascertain at what point additional supplies cease to confer additional advantage'[23]. Thus the recent Ministry of Health report on protein requirements commented, 'we have attempted to delineate as closely as possible a gap in our knowledge concerning protein requirements. This gap is bounded at the

H

Incidence of Obstetric Abnormalities in Aberdeen Primigravidae by Maternal Health and Physique as assessed at the first Antenatal Examination. (Twin pregnancies have been excluded).

Source: Thomson and Billewicz (1963).

	Health and Physique			
	Very Good	Good	Fair	Poor; Very Poor
Prematurity* (%)	5·1	6·4	10·4	12·1
Caesarean section (%)	2·7	3·5	4·2	5·4
Perinatal deaths per 1000 births	26·9	29·2	44·8	62·8

* Birth weight of baby 2500 g. or less.

I

Mean Height (in.) of Boys of School or Pre-school Age in England with no Siblings or with three or more Siblings.

Source: Berry and Hollingsworth (1963).

Mean Age	Place	No Siblings	Three or more Siblings
5 years 6·1 months	Croydon	43·8	43·1
	Salford	43·9	42·1
	Exeter	43·6	42·3
	York	43·4	42·7
	Sheffield	43·8	42·1
	Southampton	43·7	42·6
	Lancashire	44·4	42·7
	Nottinghamshire	44·3	43·6
	Northumberland	43·6	43·4
	Gloucester	44·0	43·3
14 years 6·0 months	Croydon	64·9	63·5
	Salford	62·8	59·8
	Exeter	65·4	62·7
	York	64·3	62·7
	Sheffield	64·1	61·7
	Southampton	63·9	62·1
	Lancashire	65·0	63·0
	Nottinghamshire	64·1	62·9
	Northumberland	65·1	62·8
	Gloucester	64·5	63·9
	Cumberland	63·6	61·2

lower level by what can be derived (albeit with much uncertainty) from the result of balance studies and similar information, and at the upper level by information about the average dietary intake of protein in Britain. Somewhere between these limits which themselves are not precise, lie physiological requirements'[24]. In fact it may not have been correct to accept that the present average intake exceeds the optimum physiological level.

To some extent the problem also involves the subjective nature of clinical assessment. 'The state of nutrition of the population of this country is such that it is rare to see people with classical signs and symptoms of deficiency diseases. . . . The clinical examination therefore raises not only the problems of the comparability of assessments by different observers and the consistency of assessment by the same observer, but also doubts of the ability of clinicians to detect relatively small changes in the state of nutrition which would not be reflected in specific diagnostic features, but in unspecific elusive and subtle changes'[7].

However, there is no doubt that anthropometric evidence of optimum growth and fitness does demonstrate that health is related to social factors. Health and physique is directly related to social class[25]. As health and physique deteriorates, the percentage of still births and neo-natal death rate increases[26] (Table H). There is also a good deal of evidence to show that in large families the height of children is less than that for the average, or for 'only children'[27] (Table I).

Methods of Improving Nutritional Status

ADEQUATE nutritional status is achieved by consuming foods containing the appropriate quantity of required nutrients. However, if the individual's food habits do not satisfy these requirements, the situation may be improved in several ways.

Firstly, attempts may be made to influence the type and quantity of foods which people eat. There is a growing public interest in nutrition and this is reflected in newspaper articles and books on the subject, as well as in indications of the nutrient content of foods in advertisements. But nutritional knowledge is still fairly limited, especially amongst the more vulnerable lower social classes, and as in so many cases increased knowledge does not of itself necessarily lead to the modifications of behaviour. Food habits are slow to change when the only incentive is the improvement of health.

A second method of improving upon nutrient intake is to ensure that certain foods have a nutrient content above a minimum level. Legal control is now placed on the nutrient content of flour and margarine. Thus flour must contain not less than 0·24 milligrams of thiamine, 1·6 milligrams of nicotinic acid, and 1·65 milligrams of iron per 100 grams. Vitamins are added to margarine to the order of 2500–3200 international units of vitamin A and 270–340 international units of vitamin D per 100 grams[28]. In the same way in view of the widespread incidence of dental caries throughout the United Kingdom the addition of fluorine up to 1 part per million to the water supplies of those areas where it is lacking is being encouraged.

Another government activity is the encouragement of pregnant and lactating mothers and of young children to consume certain foods rich in specified nutrients which are heavily subsidised. The current welfare foods are listed in Table J.

Total annual consumption of welfare milk is 198 million gallons of which nearly six million gallons is of national dried milk. One and a half million bottles of concentrated orange juice, and nearly a million bottles of cod liver oil and vitamin A and D tablets are also distributed. The total expenditure by

Amount and Kind of Welfare Foods and Scale of Entitlement.

Welfare Food and Beneficiary	Entitlement	Present Vitamin Content
Orange Juice		
Expectant mother	One 6 oz. bottle every 9 days at 1s. 6d.	
Child under 6 months	One 6 oz. bottle every 4 weeks at 1s. 6d.	60 mg. of Vitamin C per fluid oz.
Child 6 months to 2 years	One 6 oz bottle every 2 weeks at 1s. 6d.	
Cod Liver Oil		
Expectant mother*	One 6 oz. bottle every 6 weeks at 1s. 0d.	Vitamin A 26,000 i.u.
Child 0–5 years	One 6 oz. bottle every 6 weeks at 1s. 0d.	Vitamin D 2600 i.u. per fluid oz.
Vitamin A & D Tablets		
Expectant mother*	One packet of 45 tablets every 6 weeks at 6d.	Vitamin A 4000 i.u.
Mother of newly-born child	5 packets of 45 tablets at 6d. per packet	Vitamin D 400 i.u. per tablet
Milk† (*a*) *Liquid*		
Expectant mother	One pint per day at 4d.	
Child 0–5	One pint per day at 4d.	
(*b*) *National Dried Milk*		
Expectant mother	One 20 oz. tin per week at 2s. 4d.	
Child up to 1 year	Up to 83 20 oz. tins at 2s. 4d.	
Child 1 to 5 years	One 20 oz. tin per week at 2s. 4d.	

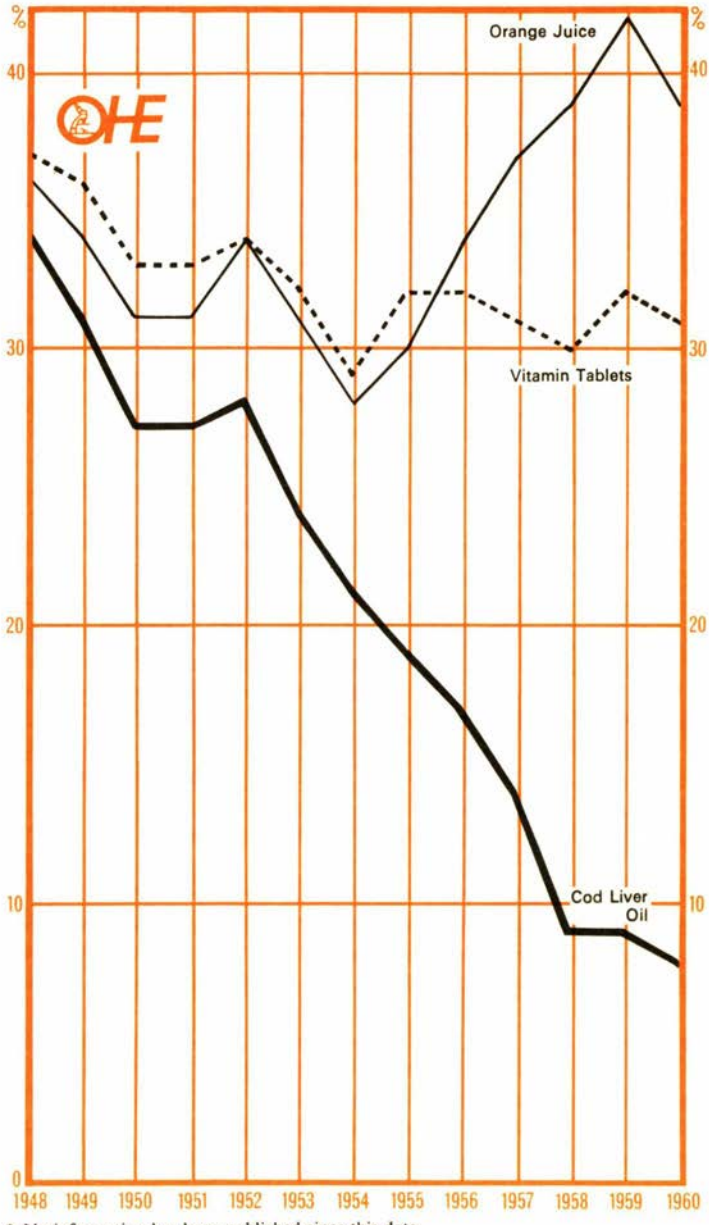
* An expectant mother may be supplied with *either* cod liver oil *or* vitamin A and D tablets

† Either liquid *or* dried milk may be claimed

1

Uptake of Welfare Food as a percentage of Entitlement 1948 to 1960*, England & Wales.

Source: Ministry of Health Annual Report, various years.



* No information has been published since this date.

the Ministry of Health in 1964/65 on welfare foods in Table J was over £33 million of which over £32 million went on the subsidy for welfare milk. The figure does not include the expenses of the local authorities in distributing welfare foods[25].

Nearly everyone entitled (95 per cent) makes use of the cheap milk, though how far this is reflected in an increase of total milk consumed within the family rather than simply obtaining the same quantity for less money is uncertain. However, only 8 per cent of the cod liver oil, 31 per cent of the vitamin tablets and 39 per cent of the orange juice to which people were entitled was taken up in 1960. The uptake of vitamin tablets and cod liver oil has been declining since the start of the National Health Service whereas uptake of orange juice has increased (Fig. 1).

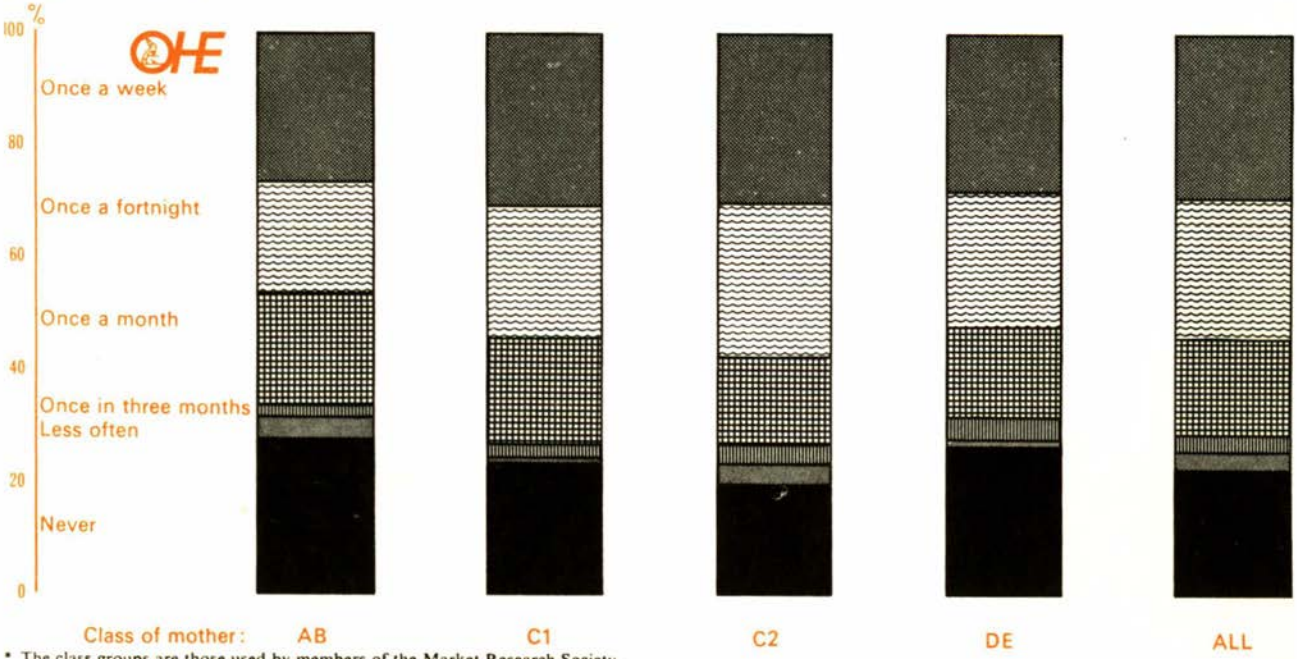
It is clear that many mothers do not take their children to a welfare clinic where these supplements may be obtained. A recent survey has shown that only just over half of mothers visit the clinic each fortnight and that more than one-quarter do not take their children at all[29]. The figures are worse for the richest and poorest sections of the community, the latter of which are likely to be the most vulnerable (Fig. 2). The Ministry of Health has also pointed out that those sections of the community whose diets are least likely to be adequate make least use of the service[30].

A more successful attempt has been made to influence nutrient intake by providing at reduced cost a meal of a specified nutritional value at school. 'The school dinner should have an energy value of between 650 and 1000 calories depending on the age and sex of the children. It should supply an average of 20 grams of protein of animal origin and 25–30 grams of fat in all forms.' Menus are planned in such a way so that they 'will contain suitable amounts of the principal food factors including vitamins and mineral salts'[31].

Another major way of improving the nutrient intake of an individual's diet is by means of nutrient supplements. It has already been indicated that a substantial quantity of nutrient supplements are prescribed by the doctor. To this must be added products purchased over-the-counter by the public. In the United Kingdom in 1965 the cost of ethical and generic (roughly equivalent to prescription medicines) vitamin and nutrient preparations was almost £4 million, while an additional £5 million was spent on household medicines[19].

2

Frequency of visits to Welfare Clinic, by Socio-economic class of mother*, 1965, England & Wales.
Source: Interscan Limited.



* The class groups are those used by members of the Market Research Society.

Conclusion

IN 1950 the British Medical Association's Report on Nutrition ended in the following way. 'The final assessments of the states of nutrition of the various groups of the population came from a synthesis of the mortality and morbidity, clinical, anthropometric and biochemical data which the committee has considered. Perhaps the first feature of importance which emerges from that synthesis is the patchy nature of the data available, especially in regard to certain population groups, so that it is difficult to speak with certainty concerning them. But this is not surprising since the methods of assessing nutrition in the main are new and still relatively undeveloped; they deserve to be the subject of more investigation and research.' Such a summary would still be a fair one seventeen years later in 1967.

The evidence deduced both from a study of the National Food Survey and from the clinical material shows how insufficient is the evidence available on which to assess the nutritional status of the community. There is need to consider whether the National Food Survey should be developed in order to assess more realistically individual intake of nutrients. There is also need to examine the position of groups such as students in hostels, those in prison and others who are not living in households. If such developments are not possible within the existing framework then further dietary studies as well as detailed morbidity surveys should be undertaken. Only then will we be able to isolate the percentage of the community suffering from symptoms of deficiency. Above all there is a need for substantial research into the level of nutrient intake required for the maintenance of health and an assessment of how far this differs from the level required for optimum well being. Such research must be concerned not only with the average position but also with individual variations. Until such studies are undertaken uncertainty as to the precise nature of the position will remain and with it not only the inability adequately to isolate and deal with potentially vulnerable groups but also perhaps an over-readiness to discount any suggestion of malnutrition.

References

1 GREAVES, J. P. and HOLLINGSWORTH, D. F. (1966). *World Review of Nutrition and Dietetics, VI.*

2 BARKER, T. C., MCKENZIE, J. C. and YUDKIN, J. (1966). *Our Changing Fare*, MacGibbon & Kee.

3 BOYD-ORR, J. (1936), *Food Health and Income*, Macmillan.

4 *The Health of the School Child* 1964 and 1965 (1966). HMSO.

5 *Private Communication from Mass Observation Ltd.*

6 *Domestic Food Consumption & Expenditure*, 1964 (1966). HMSO.

7 *Nutrition Committee Report* (1950). British Medical Association.

8 *Report of the Panel on Composition and Nutritive Value of Flour* (1956). HMSO.

9 *Vitamin Contents of Modern Dietaries: Losses due to Various Procedures* (1967). Roche.

10 *Protein Requirements: Report of the FAO. Committee* (1957). Food and Agricultural Organisation.

11 SHERMAN, H. C. (1920). *J. Biol. Chem.*, **41**, 97-109.

12 GARROW, J. S. and PIKE, M. C. (1967). *The Lancet*, **1**, 1-4.

13 *National Research Council* (1963). Food and Nutrition Board, National Academy of Sciences, United States of America.

14 MARKS, J. (1967). *The Vitamins in Health and Disease*, Churchill (in press).

15 HOLLINGSWORTH, D. F. (1961). *Federation Proceedings*, 20.

16 NORRIS, T. (1949). *FAO. Nutritional Studies No.* 4.

17 *Private Communication from the Secretariat of the National Food Survey Committee.*

18 LOGAN, W. P. D. and CUSHION, A. A. (1958). *Morbidity Statistics from General Practice*, HMSO.

19 *Private Communication from Intercontinental Medical Statistics.*

20 ANDREWS, J., BROOK, M. and ALLEN, M. (1966). *Geront. Clin.*, 8.

21 GRIFFITHS, L. L., BROCKLEHURST, J. C., MACLEAN, R., and FRY, J. (1966). *Brit. med. J.*, **1**, 739.

22 THOMSON, A. M. (1957). *Proc. Nutr. Soc.*, 16.

23 GREAVES, J. P. (1965). *Nutrition Reviews*, 23.

24 *Requirements of Man for Protein* (1964). HMSO.

25 *Report of the Ministry of Health for the year* 1965 (1966). HMSO.

26 THOMSON, A. M. and BILLEWICZ, W. Z. (1963). *Proc. Nutr. Soc.*, 22.

27 BERRY, W. T. C. and HOLLINGSWORTH, D. F. (1963). *Proc. Nutr. Soc.*, 22.

28 *Bread & Flour Regulations* (1963). Statutory Instrument No. 1435. *Margarine Regulations* (1954 and 1955). Statutory Instrument Nos. 613 & 1899.

29 *Private Communication from Interscan Ltd.*

30 *Report of the Joint Sub-Committee on Welfare Foods* (1957). HMSO.

31 *The Nutritional Standard of the School Meal* (1965). HMSO.

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