FOOD HEALTH AND INCOME

Report on

A Survey of Adequacy of Diet in Relation to Income

by

JOHN BOYD ORR

SECOND EDITION

MACMILLAN AND CO., LIMITED
ST. MARTIN'S STREET, LONDON
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NOTE OF ACKNOWLEDGMENT.

THIS investigation was made by the staff of the Rowett Institute in co-operation with the staff of the Market Supply Committee. Valuable assistance was obtained from a number of individuals interested in the different aspects of the problem. Special mention should be made of the assistance obtained from Dr. Leitch, of the Imperial Bureau of Animal Nutrition, on the health aspect of the investigation, from Mr. Colin Clark, University Lecturer in Statistics at Cambridge, and Mr. H. W. Macrosty, an Hon. Secretary of the Royal Statistical Society, on the statistical work involved; and from Mr. David Lubbock, who assisted in all stages of the work and also in seeing this Report through the press.

The present Report gives a general account of the investigation. Papers dealing at greater length with various parts of the enquiry are being prepared for publication in the appropriate technical journals. The first of these, "Food Supplies and Consumption at Different Income Levels," by Mr. E. M. H. Lloyd, was published in the Journal of Proceedings of the Agricultural Economics Society, Vol. IV, No. 2, April, 1936.

FIRST EDITION, 1936. SECOND EDITION, 1937

PRINTED IN GREAT BRITAIN

FOREWORD TO SECOND EDITION.

"Food, Health and Income" gives results of the first attempt to estimate the diets of different classes, including the whole population, according to family income. The standard of dietary requirements with which the diets of the different classes are compared is new for this country. The method of grouping the whole population according to income and also much of the other technique has not been used before. It was hoped that the publication would be subjected to close scrutiny and constructive criticism which would be of value in further investigations of this nature. Although the publication did receive a good deal of attention, nothing has been forthcoming so far to necessitate making any alteration in this edition. Some of the authoritative comments and criticisms are, however, of interest.

GENERAL PICTURE OF FOOD CONSUMPTION IN DIFFERENT CLASSES.

The Minister of Health remitted the publication to the Advisory Committee on Nutrition for consideration. The Committee appointed a Statistical Sub-Committee to report on the adequacy of the data and the degree of probability attached to the estimates of food consumption of the different groups of the population. After examining the data and the methods employed the Sub-Committee, while pointing out that it is possible that there may be a considerable margin of error in the estimate of the average level of consumption of any particular income group, did not discover any reason to suggest that the results were seriously misleading, or more likely to err in one direction than another. They reported that *: "The conclusions as to the broad trend of consumption of the different articles of food over the income groups appear to us likely to be in accordance with the facts," and "In general we are satisfied that no better estimates of variations in food consumption could have been made from the available data."

INADEQUACY OF DATA.

The Sub-Committee referred to the inadequacy of the data; 1,152 family budgets are indeed a slender foundation for far-reaching

* Ministry of Health. Advisory Committee on Nutrition. First Rep. H.M.S.O. 1937.

conclusions. The inadequacy of the data is emphasised both in the Foreword to the First Edition and in the text. It is probably over-emphasised, for, while the graphs and tables are based only on the 1,152 budgets spread over the six groups into which the population was divided, they were checked by comparing them with the data from all the dietary surveys which had been published, and also by comparison with the total national food consumption calculated from different data, viz. agricultural and trade statistics. The data of the 1,152 budgets collected between 1932 and 1935 give a picture which is truer for the present time than if all the earlier data had been included, because, as is clearly brought out in Chapter IV, the national dietary has been steadily improving. If all the dietary surveys which have been made since the beginning of the present century had been included, the figures for the consumption of the protective foods would have been lower than those given in the text. The earliest ones were, therefore, discarded and 2,640 family budgets compiled in the last ten years were taken and analysed. But to ensure that the results would be applicable to present-day conditions, those prior to 1932 were omitted in the final calculations. If they had all been included, the general trend of the results would have been the same, except that the consumption of the protective foods would have been rather lower. The picture based on 1,152 budgets has thus a background of data which gives confidence that it is a close approximation to the facts.

Calculations based on the statistics for 1935 are so similar to those for 1934 that no alteration of the tables has been made to include figures for 1935.

GROUPING OF POPULATION ACCORDING TO FAMILY INCOME.

The Sub-Committee referred to above considered that the weakest point in the calculations is the uncertainty with regard to the distribution of working-class incomes as to which no statistical returns are at present available. Professor Bowley,* however, while criticising the estimate of food consumption in different classes on the grounds of inadequacy of data and rightly pointing out that there must be wide variations in consumption between families classed together in the same group, says: "The best statistical work in the book is in the estimates of the numbers within these limits. It is based on a special examination of a sample of the 1931 Population

* Bowley, A. L., "Poverty and Nutrition," *The Nineteenth Century*, Dec., 1936, p. 725.

Census, together with fairly well established estimates of wages, and is probably sufficient for the very guarded result to which it leads—namely, that the percentages in the grades in round numbers are 10 each for the lowest and highest, and 20 for each of the four intermediate grades. Thus, very roughly, half the population falls into the grades where the income per head is less than 20s., and the budgets considered to be relevant show deficiency of vitamins and minerals."

In his "National Income and Outlay" (1937), Mr. Colin Clark finds that 47·1 per cent. of the population fall into the three lower groups, i.e., those with less than 20s. per week. A table showing the numbers found by him in the six groups used in this report has been added to Appendix V.

STANDARD OF DIETARY REQUIREMENTS.

The standard of requirement for the various dietary constituents has been criticised on the ground that it is too high. People have become accustomed to the use of a minimum diet for maintenance of life in calculating the cost of living, and it is well known that people can keep alive for varying periods on diets with varying degrees of deficiency. The level of the standard adopted here—the optimum—is not just to provide a diet which will keep people alive, but a diet which will keep people in health; and the standard of health adopted is a state of well-being such that no improvement could be effected by a change in the diet. The standard may be regarded, therefore, as the minimum for maximum health.

Since the report was issued a technical commission of the League of Nations, consisting of fifteen leading authorities on nutrition from different countries in Europe and America, has made a statement on the basic requirements for maximum health. This can now be accepted as the international standard.

A comparison of the standard adopted in this report with the international standard given in Appendix VIII of this edition shows a close degree of agreement even in detail. In the case of no single constituent considered is the figure for the requirement higher than that of the international standard.

It has been suggested that the standard adopted, viz. what is needed to enable people to attain their maximum inherited capacity for health and physical fitness, is so high that it is impracticable.

One writer terms it " utopian." In animal husbandry, an optimum standard, far from being utopian, is regarded as good practice. Every intelligent stock farmer in rearing animals tries to get a minimum diet for maximum health and physical fitness. A suggestion that he should use a lower standard would be regarded as absurd. If children of the three lower groups were reared for profit like young farm stock, giving them a diet below the requirements for health would be financially unsound. Unfortunately, the health and physical fitness of the rising generation are not marketable commodities which can be assessed in terms of money.

From the point of view of the State, the adoption of a standard of diet lower than the optimum is uneconomic. It leads to a great amount of preventable disease and ill-health which lay a heavy financial burden on the State, and on the public-spirited citizens who support hospitals and other charitable organisations. It is probable that an inquiry would show that the cost of bringing a diet adequate for health within the purchasing power of the poorest would be less than the cost of treating the disease and ill-health which would thereby be prevented. A few years hence when the connection between the poor feeding of mothers and children and subsequent poor physique and ill-health is as clearly recognised as the connection between a contaminated water supply and cholera, the suggestion that a diet fully adequate for health should be available for everyone will be regarded as reasonable and in accordance with common sense, as is the preservation of our domestic water supply from pollution.

CONFIRMATION OF THE PICTURE.

According to the estimate given here the diet of nearly one-half of the population, though sufficient to satisfy hunger, is deficient for health. This seemed to come as a shock to people who had previously given no thought to the subject. It appeared startling because it was the first time that a survey covering the whole population had been done. The picture, however, is not out of keeping with that given by previous surveys covering small areas. The general picture is confirmed by Mr. Seebohm Rowntree's recent publication. Mr. Rowntree in his " Study of Human Needs " adopts a standard of diet lower than that adopted here. His standard is below the requirements for health. To reduce the cost of the diet he cuts out fresh liquid milk and substitutes dried

separated milk from which the valuable butter-fat rich in vitamins has been removed. Then he allows only the equivalent of 2 pints a day for a family of father, mother and three children. The Government Advisory Committee on Nutrition recommends 4½ pints for the three children alone. Even to attain this level of nutrition, on which it is impossible to rear healthy children, he estimates that the family must have an income of 53s. per week in the town and 41s. in the country for 52 weeks in the year. He finds that millions of our fellow citizens cannot attain even this low standard. Further, he estimates that even if every family were up to this very inadequate level of nutrition, there would still be a third of the children in the country (those in families of over three children) who for five years of their lives would not be able to obtain even this minimum diet. There have been a number of investigations of this kind. Every inquiry which covers a large representative section of the whole population shows the same general picture.

THE FUTURE.

Many regard this as a gloomy picture and a cause for alarm. Bad as the picture is, however, it is better than any picture which could have been drawn in the past—much brighter than the picture of pre-war days. Since then, as is pointed out in Chapter IV, the national dietary has improved. The consumption of most of the protective foods has increased—about 75 per cent. in the case of fruit and vegetables, and about 50 per cent. in the case of eggs and dairy products. Accompanying that improvement in diet, there has been a corresponding improvement in national health. Infant mortality rate in England has fallen from over 100 to 57. Gross diseases due to deficient diets have decreased. Children are taller and healthier and about seven years have been added to the expectation of life. All this shows how easily health and physique can be improved.

An important feature of the situation is that we are now in a much better position to accelerate the rate of improvement than we were in pre-war days. We have a yard-stick with which we can measure the problem. We have the international standard showing the kind of diet needed for health. That standard has been approved by the Advisory Committee on Nutrition set up by the Government, and it may be assumed that it will be accepted by the Government as a guide to the level of consumption to be aimed at in all further

legislation dealing with the national food supply. On the other hand, owing to technical improvements in agriculture, our power to produce the more expensive foods which have a high health value is increased. It remains, however, to adjust our food policy so that the great wealth of food which we have or can produce will be brought within the purchasing power of the poorest. This is no easy task. It will require economic statesmanship of the highest order.

But in a democratic country the necessary legislation must be preceded by an intelligent demand on the part of the people. At the present stage, what is most urgently needed is that the general public should realise the extent to which health and physique can be improved by better feeding. An increasing public interest in nutrition is the first step towards an improvement in national health and physique. That step has been taken, and the indications are that progress will continue at an ever-increasing rate towards the ideal state of affairs when every person, including the 25 per cent. of the country's children who are in the lowest income group, will, through better feeding, reach the high standard of health and physical fitness which is adopted in this book.

J. B. ORR.

Aberdeen, June 1937.

FOREWORD.

The state of nutrition of the people of this country is surveyed here on a broad scale and from a new angle. Instead of discussing minumum requirements, about which there has been so much controversy, this survey considers optimum requirements. Optimum requirements are based on the physiological ideal, which we define as " a state of well-being such that no improvement can be effected by a change in the diet." The standard of adequacy of diet adopted is one which is designed to maintain this standard of perfect nutrition.

The average diet of each of six groups into which the population has been divided according to income are compared with these requirements for perfect nutrition. The health of the population is reviewed to see to what extent inadequacy of diet is reflected in ill-health and poor physique.

It is difficult in the present state of knowledge to lay down precise and detailed criteria of perfect nutrition. The basis of comparison taken for health is, therefore, the state of health and physique of those groups of the population who can choose their diets freely, without any economic consideration seriously affecting their choice. For the purposes of this large scale survey individual errors of diet can be ignored. These errors are undoubtedly common. The diets, even of those who are able to purchase unlimited amounts of any foodstuff available, will improve as the knowledge of dietetics extends. Meantime, however, the state of nutrition of the higher income groups, whose diet is not limited by income, can be taken as a standard which can be attained with the present dietary habits of the people of this country.

The tentative conclusion reached, is that a diet completely adequate for health, according to modern standards, is reached at an income level above that of 50 per cent. of the population. This means that 50 per cent. of the population are living at a level of nutrition so high that, on the average, no improvement can be effected by increased consumption.

The important aspect of the survey, however, is the inadequacy of the diets of the lower income groups, and the markedly lower

standard of health of the people, and especially of the children in these groups, compared with that of the higher income groups.

The method of grouping the population according to income is new and may be open to the criticism, among others, that it over-emphasises the importance of children as an economic factor affecting standard of living. The basis of the grouping is the total family income divided by the number of persons, including children, supported by it. Thus an average income of 30s. per head per week is reached by a man earning £550 a year, with a wife, four children, and one domestic servant. It is also reached by a manual worker earning £3 a week with only a wife to support. The "higher income" and "lower income" groups cannot be simply identified with "rich" and "poor" in the generally accepted sense of these terms.

The lowest of the six income groups contains a disproportionately high number of children—rather more than a fifth of all the children in the country. This is the group whose diet falls furthest below the standard of adequacy for health. Great improvements in health have been and are being effected in these children by improved nutrition. The picture presented in the survey justifies all and more than all the efforts which have already been made, but opens up a prospect of still further improvement.

As is noted in the report, the data are too scanty to yield a picture fully accurate in detail. Moreover, both the technique of the investigation and the standard of dietary requirements adopted are new and must be regarded as still on trial. There is need for further investigation and further discussion of the whole question in all its complicated relationships, in order that the measures taken to deal with the situation may be based on generally accepted facts and well-informed public opinion.

J. B. ORR.

Aberdeen, February 1936.

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APPENDIX I.

THE BASIS OF CALCULATION: PER "HEAD" AND PER "MAN VALUE" UNITS.

The data on consumption and requirements were arranged on a per head instead of a per " man value " basis. The man value of any individual is the ratio of that individual's normal calorie requirement to the calorie requirement of the average moderately active man taken as unity. Thus the man value of the average moderately active woman, whose calorie requirement is commonly estimated as four-fifths that of the average moderately active man, may be taken as 0·8. The man values of children are smaller or larger than unity according to age and according to the particular scale of man value adopted. There are at least thirty-eight such scales.

The object of this investigation is to present an economic survey of the food habits of the country, and consequently the cost of supplying fully health-maintaining diets to individuals of both sexes and all ages is necessarily one of the most important bases of the investigation. The use of any man value scale based on calorie requirements would have led to an underestimation of the cost of feeding children, since foods rich in first-class protein, vitamins or minerals, of which the requirements are greater for growing children than for adults, are the more expensive. Stiebeling (44) has drawn up tables showing the relative cost of food for different individuals in terms of the cost of the diet of the moderately active man. Thus the cost of feeding a boy 11–12 years old is only 11 per cent. less than the cost of feeding a moderately active man an adequate diet, while for an active boy over 15 years old it is 17 per cent. more. The cost of feeding an infant alone is clearly less than that of an adult, but on the other hand the nutritional requirements of the nursing mother are much greater. The difference between the cost of feeding an infant compared with an adult is partly counterbalanced by the extra cost of giving the mother a fully adequate diet, which would enable her to breast-feed her infant.

APPENDIX II.

FAMILY BUDGETS EXAMINED.

Twelve surveys comprising 2,640 family budgets were examined, ranging from very poor families spending less than 2s. per head weekly on food, up to families with an income of £2,000 per annum spending 15s. or more per head weekly on food. Rather more than half of these budgets had to be rejected when compiling Table I, Appendix VI. They were used, however, to a more limited extent as an indication of the food habits of the country. None of those rejected differed materially from the budgets used in the information they supplied, the rejection being solely on the grounds either of insufficiency of data on family income, or total food expenditure, or of relating to years prior to 1932. In all 1,152 budgets were used. The total number examined in each survey, the final number used, the areas covered by the surveys and the years in which the enquiries were made :—

NUMBER OF FAMILY BUDGETS EXAMINED AND AREA COVERED BY ENQUIRIES.

Total Number of Budgets.	*Number Used.*	*Area to which Budgets refer.*	*Year.*
700	538	England and Wales (Women's Co-operative Guild).	1935
105	102	Newcastle	1933–34
50	49	Manchester and District	1933
85	82	Stockton-on-Tees	1932
300	243	Merseyside	1932
200	138	Great Britain (Middle-class) ..	1932
100	—	Peterhead and Aberdeen	1932
60	—	London	1931
100	—	Reading and Cardiff	1928
180	—	St. Andrews	1927
600	—	Scotland (larger eastern towns) ..	1926–27
160	—	England and Wales (Middle-class)	1926
2,640	1,152		

Grateful acknowledgment is due to those responsible for collecting the budgets; for their kindness in permitting the original data to be used, and particularly to the Women's Co-operative Guild for carrying out a special enquiry on our behalf.

APPENDIX III.

QUANTITIES OF FOOD SUPPLIES, HOME PRODUCED AND IMPORTED, OF THE UNITED KINGDOM, 1909–13, 1924–28 AND 1934.

	Average of 1909–13.			Average of 1924–28.			1934.		
	Home Produced.	Imported.	Total.	Home Produced.	Imported.	Total.	Home Produced.	Imported.	Total.
	Th. met. tons.	Th. met. tons.	Th. met. tons.	Th. met. tons.	Th. met. tons.	Th. met. tons.	Th. met. tons.	Th. met. tons.	Th. met. tons.
Beef and veal	820	491	1,311	579	683	1,262	614	646	1,260
Mutton and lamb	331	266	597	205	273	478	255	338	593
Bacon and ham	100	272	372	75	447	522	104	438	542
Other pigmeat	304	41	345	234	51	285	271	66	337
Meat offals	60	—	60	94	8	102	107	68	175
Poultry and game	41	14	55	47	27	74	78	2	102
Rabbits	—	18	18	—	9	9	16	26	42
Total Meat	1,656	1,102	2,758	1,234	1,498	2,732	1,445	1,606	3,051
Eggs	129	129	258	156	156	312	279	170	449
Fish	715	133	848	638	214	852	742	173	915
Milk, fresh*	4,500	—	4,500	4,465	—	4,465	3,930	8	3,938
,, condensed	—	55	55	32	121	153	137	107	244
Butter	114	207	321	44	282	326	57	485	542
Cheese	30	117	147	42	149	191	75	150	225
Lard	—†	90	90	—†	120	120	48†	142	190
Margarine	60	59	119	184	64	248	166	—	166
Wheat flour	840	3,485	4,325	711	3,348	4,059	660	3,560	4,220
Other cereals	170	370	540	92	238	330	93	196	289
Apples	127	163	290	194	323	517	400	267	667
Bananas	—	150	150	—	309	309	—	256	256
Other fruit and nuts	214	617	831	198	840	1,038	300	1,246	1,546
Potatoes	3,988	262	4,250	3,563	415	3,978	4,600‡	108	4,708
Other vegetables	800	432	1,232	1,123	474	1,597	1,540	580	2,120
Sugar	—	1,621	1,621	106	1,671	1,777	490	1,505	1,995
Cocoa	—	36	36	—	54	54	—	72	72

* Including cream.

† Vegetable lard only. Animal lard included in Other Pigmeat.

‡ Includes cottage produce.

APPENDIX IV.

FOOD SUPPLIES OF THE UNITED KINGDOM CONVERTED INTO PROTEIN, FAT, CARBOHYDRATE, AND CALORIES.

	Average 1909–1913				Average 1924–1928				1934			
	Protein	Fat	Carbo-hydrate	Calories	Protein	Fat	Carbo-hydrate	Calories	Protein	Fat	Carbo-hydrate	Calories
	Th. met. tons	Th. met. tons	Th. met. tons	Thousand million	Th. met. tons	Th. met. tons	Th. met. tons	Thousand million	Th. met. tons	Th. met. tons	Th. met. tons	Thousand million
Meat	356	799	—	8,890	341	793	—	8,774	397	886	—	9,867
Poultry and eggs	49	37	—	547	51	39	—	571	69	53	—	775
Fish	91	17	—	531	90	18	—	536	98	18	—	569
Dairy produce	198	588	258	7,338	217	641	289	8,036	216	884	279	10,251
Cottage produce from animal sources	14	5	—	103	4	3	—	44	*	*	—	*
Total from animal sources	708	1,446	258	17,409	703	1,494	289	17,961	780	1,841	279	21,462
Cereals	531	53	3,557	17,254	497	51	3,281	15,964	514	50	3,374	16,404
Fruit	9	14	222	1,077	15	19	302	1,476	19	25	383	1,876
Vegetables	120	10	1,031	4,812	125	11	1,008	4,751	139	12	1,208	5,633
Sugar	—	—	1,562	6,404	—	—	1,724	7,068	—	—	1,941	7,958
Cocoa	5	18	10	229	8	27	14	341	10	36	18	450
Margarine	1	98	—	915	3	209	—	1,956	2	140	—	1,310
Cottage produce from vegetable sources	46	2	551	2,466	52	7	510	2,370	*	*	*	*
Total from vegetable sources	712	195	6,933	33,157	700	324	6,839	33,926	684	263	6,924	33,631
Grand total	1,420	1,641	7,191	50,566	1,403	1,818	7,128	51,887	1,464	2,104	7,203	55,093

* Included under individual commodities.

APPENDIX V.

DISTRIBUTION OF THE POPULATION BY INCOME GROUPS.

The analysis of the family budget data was carried out on the basis of per head consumption, in groups of families which were defined by the average income per head in the family, i.e., the total family income from all sources divided by the number of persons, irrespective of age and sex, supported by that income. It was then necessary to make some estimate of the proportions of the population falling into these several income groups. The earnings of the head of the family are no sure guide; the earnings of other members, together with supplementary income—unemployment benefit, pensions of various kinds, public assistance, investments—have to be brought into the account, and the total related to the number of persons to be maintained. An average per head income of say, 60s. per week may be reached in many ways—by a skilled worker at £6 per week with only a wife to support; or by a worker and his wife both in employment with earnings of 75s. and 45s. per week respectively; or by a man earning £1,100 a year with a wife and four children and a domestic servant; or by a variety of other combinations of earners and non-earners.

The method adopted in estimating the approximate proportions in the different income groups may be very briefly described as follows:—

(i) Tables were constructed separating married men, single men and women, and male and female juveniles into groups according to their estimated weekly incomes on the following basis:—

35s. and under per week.
35s. to 45s. per week.
45s. to 55s. „ „
55s. to 65s. „ „
65s. to 75s. „ „
75s. to 85s. „ „
Over 85s. „ „

For this purpose the occupation tables in the 1931 Census Report were used, together with such published information as could be traced regarding wages and earnings in different occupations and different areas. Those returned as out of work in the 1931 Census were classified separately. A number of independent estimates of this nature were made by different authorities, and as the results showed a satisfactory degree of agreement it was felt that any of them might be accepted as a reasonable approximation to the facts.

(ii) Tables were constructed showing the estimated proportionate distribution of families according to the numbers in the family, and the numbers of earners or recipients of income from other sources. In addition to one table covering all "private families," separate distribution tables were made for those families which included a married couple, and those in which no married couple occurred. "One-person" families, and families of which the head was "retired" were excluded from these subsidiary tables.

These tables were derived from figures given in the Report on Housing and from the General Tables in the 1931 Census. The former volume includes tables showing the numbers of private families of different sizes; and an analysis of private families according to constitution of family (married couples, adult males, adult females and children) for families of each size from 1 to 15 persons in two boroughs (Camberwell and Sheffield). The General Tables give, in addition to population by ages and marital condition, information regarding the number and (partially) the sexes, ages and marital condition of persons living in hotels, boarding houses, schools and institutions of various kinds; and a comparison of the Census and resident populations.

(iii) By courtesy of the Registrar General a random sample of 23,000 returns of private families was taken from the original records of the 1931 Census and frequency distribution tables, by size of family and numbers of earners, were constructed for seven different groups—those in which the head of the family fell into the following classes:—

(*a*) agricultural workers.
(*b*) unskilled labourers.
(*c*) other manual workers.
(*d*) unemployed.
(*e*) no earner.
(*f*) remainder.
(*g*) all families.

These figures included as earners only the occupied, retired and out of work, whereas the tables referred to under (ii) above included as " earners " all persons dependent upon social and investment income. Allowing for this difference, the table showing distribution of all families was found to be in sufficient agreement with the similar table constructed from the Census publications to warrant acceptance of the latter. Moreover, the Census sample revealed differences between the various occupations in such matters as average size of family and proportion of non-earners to earners, small enough to justify the application of the frequency distribution tables to all families, irrespective of the income or occupation of the head of the family.

(iv) The estimated number of "private families" including a married couple (roughly 8,000,000) agreed fairly closely with the number of married men in the country (8,500,000), the disparity being accounted for by families including more than one married couple, and by married occupants of hotels, boarding houses and institutions. The married men in the various income groups were consequently allotted families of earners and dependants in accordance with the frequency distribution tables for " married couple " families. Subsidiary earners (varying from an old age pensioner at 10s. and a juvenile at perhaps less, to an adult male earning many times that sum) were distributed among the families upon a simple mathematical basis in accordance with the estimated numbers in the various income groups, after deducting married men. Aggregating the incomes and dividing by the numbers in family give the numbers both of families and of persons in the following " per head " income groups :—

Up to 10s. per head per week.
10s. to 15s. „ „ „
15s. to 20s. „ „ „
Over 20s. „ „ „

(v) Similar tables were constructed for families without a married couple, the appropriate frequency distribution table being used, and the earners again being distributed proportionately throughout all families. A rough estimate was made of the probable distribution among the income groups of persons living alone, and separate estimates were also made for married couple families in which the head was " retired "—on the ground that such families have fewer dependants than married couples still in occupations.

(vi) The addition of the numbers in the different per head income

groups (up to 20s.) accounted for practically one-half of the population in private families. The provisional figures arrived at were as follows :—

TABLE I.

	No. of Families.	*No. of Persons.*	*Proportion per cent.*
Up to 10s. per head per week	701,000	2,935,000	7·7
10s. to 15s. „ „ „	1,649,000	6,826,000	18·0
15s. to 20s. „ „ „	2,026,000	8,356,000	21·9
Over 20s. „ „ „	5,854,000	19,923,000	52·4
Total	10,230,000	38,040,000	100·0

Beyond 20s. per head per week the first analysis did not go, but income tax statistics indicate that roughly 10 per cent. of the incomes in the country are in excess of £250 per annum, and if the ratio of dependants to earners in that group is taken at about 1·1 (as compared with rather less than 1·0 for the country as a whole) then 10 per cent. of the population may be taken as having a per head income of 45s. per week and upwards. The 42 per cent. of the population between 20s. and 45s. per head per week were then divided into two equal groups, at 20s. to 30s. and at 30s. to 45s. Further analysis of the available material suggests that the two 5s. ranges between 20s. and 30s. may, however, embrace as much as 27 per cent. of the total population (17 per cent. between 20s. and 25s., and 10 per cent. between 25s. and 30s.) while the next three sub-divisions, from 30s. to 45s., may comprise only 15 per cent.

Estimates were also made on the same bases of the numbers of children of and below school age falling into the respective groups. From these estimates it appears that children comprise 49 per cent. of the persons in group I, 35 per cent. of those in group II, 25 per cent. of those in group III, 14 per cent. of those in group IV, and about 12½ per cent. of those in groups V and VI.

(vii) The analysis described above related only to private families in England and Wales. The figures are very rough, and, moreover, take no account of reduced incomes owing to sickness and short-time employment, nor, on the other hand, of casual earnings, overtime and soldiers' disability pensions and allowances. In view of these factors, and in view also of the probability that the proportions in the lower groups in Scotland are larger than those in England and Wales, it was considered reasonable to round up the proportions in

the two lowest groups to 10 and 20 per cent. respectively and to apply them to the whole of Great Britain. Finally, the results were assumed to apply to the inhabitants (staff, residents and inmates) of hotels, boarding houses and institutions as well as private families.

The figures finally adopted for the purposes of this report are as follows :—

TABLE II.

Group.	*Income per head per week.*	*Estimated average expenditure on food per week.*	*Estimated population.*	
			Numbers.	*Percentage.*
I	Up to 10s.	4s.	4,500,000	10
II	10s. to 15s.	6s.	9,000,000	20
III	15s. to 20s.	8s.	9,000,000	20
IV	20s. to 30s. (*a*)	10s.	9,000,000	20
V	30s. to 45s. (*a*)	12s.	9,000,000	20
VI	Over 45s.	14s.	4,500,000	10
Average	30s.	9s.	—	—

(*a*) Further analysis suggests that the upper limit of group IV and the lower limit of group V should be somewhat below 30s., but the average expenditure upon food and the consumption of individual foods in these two groups would not be materially affected by this alteration.

Included in the table is a column showing average food expenditure per head per week. This has been computed from the analysis of family budgets, and represents an average outlay on food amounting to rather over 45 per cent. of income for the lower three groups, the proportion falling sharply above the third group. Expenditure upon food includes the value, at retail prices, of meals taken at restaurants, etc., but excludes the cost of service of such meals.

The foregoing description of the various steps taken in arriving at a rough estimate of the proportions of the population falling within certain per head income groups gives a very summary and imperfect indication of the mass of calculations involved and the many considerations which had to be taken into account. Comparison with particulars of persons below the poverty line given in recent social surveys in London, Merseyside and Southampton and with data regarding the dispersion of family incomes in these surveys, suggests that, at any rate as regards the two lowest groups, the results are probably not seriously in error. But more information is needed in respect of earnings and the constitution of families before the population can be divided into per head income groups with a satisfactory degree of precision.

For comparison, an independent estimate of the income distribution of the population made by Mr. Colin Clark and published in his book "National Income and Outlay" (Macmillan, 1937) is appended.

Group.	*Income per head per week.*	*Percentage distribution.*
I	Up to 10s.	13·7
II	10s. to 15s.	16·9
III	15s. to 20s.	16·5
IV	20s. to 30s.	25·3
V	30s. to 45s.	19·4
VI	Over 45s.	8·1

As stated, no allowance is made for incomes from property, nor for incomes from war pensions, widows' and orphans' pensions, compensation payments or public assistance. The effect is to magnify the proportion in the lowest group and to minimize that in the top group. On the other hand, no allowance is made for sickness and short time.

These results, therefore, are in general agreement with the estimate adopted.

APPENDIX VI.

COMPARISON OF ESTIMATED FOOD CONSUMPTION IN INCOME GROUPS WITH FIGURES OBTAINED FROM FAMILY BUDGETS.

If all the statistics were perfect, the average consumption of each food found by calculating an average of the consumption per head in the various income groups, weighted by the proportions of the population within those groups, should agree with the national average consumption figure obtained by dividing total supply by total population. Such precise agreement cannot, of course, be expected, partly because of the margin of error inherent in the estimates themselves, partly because the two sets of figures—the aggregate national supply, and the consumption in households as derived from family budgets—relate to somewhat different totals.

At all stages it has been necessary to make estimates from insufficient or barely sufficient data, and the figures used have throughout been approximations, sometimes reasonably close, sometimes subject to a fairly wide margin of error. The figures of total supplies, which are the most satisfactory of the data, are themselves merely estimates which, though believed to be reasonably accurate, cannot be accepted as precise beyond dispute. An indication of the error which may be involved is given by the impossibility of reconciling the official estimates of milk consumed in liquid form with corresponding figures derived from the published statements of the Milk Marketing Boards.

What applies to the estimates of total quantities applies with even more force to the two separate factors which should, theoretically, also give us figures of total supplies. As we have seen, the number of family budgets used was something less than 1,200. They included an undue proportion of families in the industrial north, of families with small incomes and relatively large numbers of dependants. Moreover they were not distributed seasonally throughout the year, but tended to be concentrated in

the spring and early summer months. Family budgets for "black-coated" workers were few; those for the middle classes were poorly represented and for the rich completely lacking. There is good reason to believe that the average proportion of the income spent in providing food is fairly accurately shown by the family budget figures for the various income groups—at any rate by those in the lower income groups—but the actual quantities and values of the different items in the family dietary would no doubt be somewhat altered if a collection of family budgets thoroughly representative of the whole country were available.

The estimates of the proportions of the population falling within each income group on a per head basis are similarly the result of work done with inadequate material, and a margin of error of as much as 10 or 15 per cent. in any one group would not be surprising.

Apart from these possibilities of error, however, there are a number of points of difference between the estimated national supply and the quantities consumed in family households. In the first place, the national supply figures are "gross"; they cover the total quantity of each food available at the first point of sale—the farm, factory or port. Between that point and the purchase by the housewife there is a considerable loss of weight. The total supply of fish and meat includes a large proportion which is not passed on to the consumer, but is wasted or is sold for industrial purposes. Other commodities also are subject to a similar, although smaller, degree of wastage, e.g., milk, eggs, fruit and vegetables. Secondly, not all the food consumed in the country is included in the "family food bill"; some part of it is eaten in institutions, residential hotels, and other "non-family" establishments, while a considerable proportion is served in restaurants, eating-houses and canteens. It has been assumed that the average consumption per head in institutions and hotels is the same as the average for the whole country.

Consumption of food in restaurants, etc., is additional to the food provided by the housewife, and yet must be included in the average per head consumption of the families concerned. It is assumed that food bought and eaten away from the home constitutes a very small addition to the food consumption of the poorest groups, is unimportant for most foods even in the fourth group, but increases rapidly in the fifth and sixth groups. Mr. Feavearyear, in his estimates of national expenditure, assumed that 10 per cent. of the

nation's food is sold through hotels, restaurants and eating-houses. It is probable that this is an over-estimate; but even if the proportion be taken at only 5 per cent., and this be divided equally between the fifth and sixth groups, it means an addition of 12½ per cent. and 25 per cent. respectively to the per head consumption in these groups. For some foods of course, the increase will be much larger than for others.

Since it is the upper groups (V and VI) which are mainly affected by the "meals out" problem, and since in any case the family budget data for these groups were scanty, it is the average consumption in the upper groups that has needed most adjustment to secure agreement between the national average and the weighted average of the groups. The proportion of the income spent on food in the lower groups being fairly well established, no material alteration in the average consumption of any one food can be made in these groups without a corresponding alteration in the opposite direction in some other food: otherwise the food expenditure of the groups would be altered.

One further preliminary point should be made clear. Since the income groups are on a per head basis, any one group will contain a heterogeneous collection of occupations, wages, earners and non-earners. Even in the wealthier groups there will be a small proportion of working-class families—skilled workers with only one dependant, or families with several earners each in receipt of good wages. Of no group can it be said that its needs or tastes are noticeably different from those of the groups immediately above and below it. This would be equally true if the income groups were to be made much narrower—with one or two shilling ranges instead of the wider ranges selected. Hence it follows that any curve showing variation in average consumption per head at different income levels should be a smooth curve.

The procedure adopted was as follows:—The family budget figures were first entered on a diagram and a smooth curve drawn as closely as possible to the points plotted. The curve was continued in groups V and VI, its course being determined by the trend of consumption as shown by the middle-class budgets. The group averages were then read off from the diagrams, and the weighted average of all groups compared with the national averages. Reasonable approximation was regarded as satisfactory, but if a serious disparity appeared, which could not be explained by a

necessary difference between the national and the weighted budget averages, the disparity was removed either by slight amendments throughout the groups, or by further adjustment in the two upper groups; for the lower groups could not be substantially altered without affecting the proportion of income spent on food. The result is a compromise, but one which is believed to be not far from the truth. Such errors as are contained in the picture are likely to be mainly in groups V and VI, and would merely involve transfers between these two groups.

In the following tables (p. 72 *et seq.*) are shown the actual budget data and the figures finally adopted.

Most of the differences between the figures in Tables I and II are due to the smoothing of the curves described above. In a few cases, however, more important alterations have been made. These are described below.

(i) *Meat.*—The national supply figures for meat include the whole of the dressed carcase weight. While the butcher manages to pass on to the consumer considerable quantities of bone and surplus fat, there is a proportion varying between 5 per cent. for mutton and 15 or 20 per cent. for beef, which is not sold to the consumer. Moreover some edible fat (lard, dripping, suet) is included in the carcase weight, but may be bought separately by the consumer. But even allowing for these factors and for meals in restaurants, etc., the family budget averages were quite inadequate to account for the whole of the meat supply, and it was found necessary to raise consumption throughout the groups, the increases ranging from 6 ounces per head per week in group I to 20 ounces in group VI—the latter, of course, including the allowance for meals out.

(ii) *Eggs.*—The national supply of eggs was insufficient to provide the quantities shown in family budgets. As the latter were obtained mainly in the season when eggs are plentiful, a reduction throughout the groups was necessary.

(iii) *Cheese, Sugar.*—Here the converse occurred, and it was found necessary to raise all figures slightly.

(iv) *Condensed Milk.*—The budget figures were increased throughout by an allowance to represent the condensed milk used in confectionery.

(v) *Fish.*—Much the same considerations apply here as to meat.

TABLE I. (Appendix VI.)

QUANTITIES OF FOOD CONSUMED PER HEAD PER WEEK AT DIFFERENT INCOME LEVELS IN 1,152 FAMILY BUDGETS.

	Group I.	Group II.	Group III.	Group IV.	Group V.*	Group VI.*	Weighted Average of Groups
Proportion of the population	10%	20%	20%	20%	20%	10%	
Number of budgets	411	152	233	156	136	64	—
Beef and veal ozs.	9.5	11.5	11.7	11.3	10.2	9.5	10.8
Mutton and lamb ,,	2.1	3.1	4.3	6.2	6.8	9.7	5.3
Bacon and ham ,,	2.6	4.1	4.6	5.7	5.7	6.6	4.9
Other meat (*a*) ,,	2.8	2.9	4.2	5.4	3.6	3.5	3.8
Total meat (*b*) ,,	17.0	21.6	24.8	28.6	26.3	29.3	24.8
Bread and flour (excl. biscuits and cakes) (*g*) ,,	64.5	62.0	63.3	64.7	54.6	47.7	60.1
Milk—fresh pints	1.1	2.1	2.6	2.9	4.5	5.4	3.1
,, condensed (*c*) ,,	0.6	0.4	0.4	0.3	0.2	0.1	0.3
Eggs No.	1.9	2.8	3.7	4.8	4.7	5.2	3.9
Butter ozs.	2.7	5.7	7.4	8.8	8.9	9.7	7.4
Cheese ,,	1.5	2.1	2.8	3.2	2.9	2.5	2.6
Margarine ,,	4.9	2.9	2.2	1.9	2.5	1.4	2.5
Tea ,,	2.2	2.5	2.5	2.8	2.5	2.1	2.5
Potatoes (*f*) ,,	51.2	50.8	55.5	57.4	42.8	39.4	50.4
Lard, suet and dripping ,,	2.5	3.4	4.5	4.7	3.5(*e*)	3.2(*e*)	3.8
Fish (*d*) ,,	2.4	2.6	3.9	5.4	5.9	8.1	4.6
Sugar purchased as such ,,	13.5	15.9	18.1	20.1	19.0	18.1	17.8
Jams, jellies and syrups	4.3	5.5	5.7	5.8	6.5	5.6	5.7

(*a*) Sausage, corned beef and pork only.
(*b*) i.e., the total of the four items above.
(*c*) In terms of liquid milk equivalent.
(*d*) Excludes fried and tinned.
(*e*) For the two middle class groups, lard only.
(*f*) Excludes purchased "chipped" potatoes.
(*g*) In terms of flour.

* Group V has been calculated as a straight average of one working class group with income of 30s. to 40s. per head, and two middle class groups with family incomes of £200–£300 and £300–£400 (30s. and 40s. per head per week respectively).

Group VI has been calculated as a straight average of four middle class groups with family incomes of £400–£500, £500–£600, £600–£700, £700–£800 per annum.

TABLE II. (Appendix VI.)

ESTIMATED QUANTITIES OF FOOD CONSUMED PER HEAD PER WEEK AT DIFFERENT INCOME LEVELS IN THE UNITED KINGDOM.

	Group I.	Group II.	Group III.	Group IV.	Group V.	Group VI.	Weighted Average of Groups.	National Average.
Proportion of the population	10%	20%	20%	20%	20%	10%	—	—
Average food expenditure per week	4s.	6s.	8s.	10s.	12s.	14s.	9s.	—
Beef and veal ozs.	10.5	14.5	17.2	18.9	19.5	18.9	17.0	20.0 (*a*)
Mutton and lamb „	3.1	5.6	7.2	9.4	11.6	13.9	8.4	9.0 (*a*)
Bacon and ham „	4.3	6.3	6.8	7.3	7.8	9.4	7.0	7.8 (*a*)
Other meat „	5.2	5.2	5.9	5.9	5.9	7.2	5.8	7.2 (*a*)
Total meat „	23.1	31.6	37.1	41.5	44.8	49.4	38.2	44.3 (*a*)
Bread and flour (including biscuits and cakes) (*b*) „	66.0	68.0	68.0	67.0	65.0	60.0	66.0	61.0
Milk, fresh pints.	1.1	2.1	2.6	3.1	4.2	5.5	3.1	2.8
„ condensed (*c*) „	0.7	0.6	0.55	0.5	0.4	0.3	0.5	0.5
Eggs No.	1.5	2.1	2.6	3.2	3.6	4.5	2.9	2.9
Butter ozs.	3.0	6.5	7.5	8.5	9.5	11.0	7.8	7.8
Cheese „	1.8	2.5	3.1	3.6	3.6	2.6	3.0	3.2
Margarine „	4.5	3.5	2.5	2.0	1.6	1.3	2.5	2.4
Tea „	2.2	2.7	2.9	3.0	2.9	2.7	2.8	2.8
Potatoes „	53.0	56.0	57.0	57.0	57.0	54.0	56.0	64.0 (*d*)
Lard, suet and dripping „	2.7	3.6	4.2	4.4	4.3	3.5	3.9	2.7 (*e*)
Fish „	2.7	5.5	8.2	10.4	12.2	13.5	8.9	13.2 (*a*)
Sugar purchased as such „	13.5	16.0	18.0	19.0	19.5	19.5	17.8	27.7 (*g*)
Jams, jellies, syrup, etc.	4.3	5.3	5.2	5.4	5.8	5.5	5.2	(*h*)
Sugar consumed in other forms	6.5	7.5	8.5	9.5	10.5	11.5	9.0	(*i*)
Fruit (*k*)	14.0	21.7	25.8	27.9	30.5	39.3	26.5	35.1 (*j*)
Vegetables (excluding potatoes) (*k*)	16.0	20.0	27.2	30.6	32.3	34.0	27.0	30.2 (*f*)

(*a*) Includes wastage in distribution.

(*b*) In terms of flour: 130 bread = 100 flour.

(*c*) In terms of liquid milk equivalent. Allowance has been made for consumption of condensed milk in complex foodstuffs.

(*d*) Includes allotment production.

(*e*) Lard only.

(*f*) Includes shop wastage estimated at 10 per cent.

(*g*) Includes industrial consumption estimated at 40 per cent.

(*h*) Included in fruit and sugar.

(*i*) Included in sugar above.

(*j*) Includes fruit used industrially estimated at 25 per cent.

(*k*) Group quantities for fruit and vegetables have been estimated from expenditure after allowing for quality variations, but the figures are subject to a wide margin of error.

TABLE III. (Appendix VI)

ESTIMATED EXPENDITURE PER HEAD PER WEEK ON FOOD AT DIFFERENT INCOME LEVELS IN THE UNITED KINGDOM.

—	Group I.	Group II.	Group III.	Group IV.	Group V.	Group VI.	Weighted Average of Groups.	National Average
Proportion of population	10%	20%	20%	20%	20%	10%	—	—
Average food expenditure per week	4s.	6s.	8s.	10s.	12s.	14s.	9s.	—
Expenditure on—	pence	pence	pence	pence	pence	pence	pence	pence
Beef and veal	4.7	7.1	9.8	12.0	14.5	15.4	10.7	10.4
Mutton and lamb	1.7	3.1	5.0	7.1	9.2	11.0	6.1	5.9
Bacon and ham	2.9	4.4	5.1	5.9	6.7	8.0	5.5	7.3
Other meat	4.1	5.1	6.0	6.8	8.0	10.0	6.6	5.5
Total meat	13.4	19.7	25.9	31.8	38.4	44.4	28.9	29.1
Bread and Flour (including cakes and biscuits)	9.0	11.0	12.4	13.8	15.3	17.5	13.2	8.1 (*a*)
Milk, fresh	3.4	6.4	8.5	10.2	13.2	17.8	9.8	8.7
,, condensed	1.4	1.2	1.1	1.0	0.8	0.6	1.0	1.0
Eggs	1.7	2.3	3.1	4.0	4.9	7.6	3.8	4.3
Butter	2.1	4.7	5.6	6.8	8.0	10.1	6.2	5.4
Cheese	1.0	1.4	1.7	2.0	2.4	2.1	1.8	2.3
Margarine	1.6	1.3	1.0	0.8	0.7	0.6	1.0	0.8
Tea	2.5	3.6	4.1	4.6	5.0	4.8	4.2	3.8
Potatoes	2.5	2.9	3.0	3.0	3.1	3.0	3.0	3.6 (*b*)
Lard, suet and dripping	1.2	1.7	2.0	2.2	2.2	1.9	1.9	1.1 (*c*)
All fish	1.0	2.4	4.1	5.8	7.6	9.3	5.0	5.1
Sugar purchased as such	1.9	2.4	2.7	2.8	3.1	3.2	2.7	4.8 (*d*)
Jams, jellies and syrups	1.3	1.5	1.7	1.9	2.2	2.4	1.8	—
Vegetables (excluding potatoes)	1.5	2.6	3.9	5.2	6.5	8.5	4.6	3.9
Fruit	2.4	4.6	6.6	9.5	13.0	20.0	9.0	11.7 (*e*)
Miscellaneous (*f*)	0.1	2.3	8.6	14.6	17.6	14.2	10.1	12.0
Total	48.0	72.0	96.0	120.0	144.0	168.0	108.0	105.7

(*a*) Excludes cakes and biscuits.
(*b*) Includes estimate for allotment output.
(*c*) Lard only.
(*d*) Includes sugar used for manufacture.
(*e*) Includes fruit used for manufacture.
(*f*) Miscellaneous, includes such items as coffee, cocoa, condiments, sauces, etc., and, for the groups, is the difference between the enumerated items and the total group food expenditure.

The budget figures show little consumption of fried fish, and it would seem probable that fried fish purchases may sometimes be regarded by the housewife as falling outside normal household expenditure.

All groups have been raised in the same proportion and sufficiently to give an average approximating to the national average, less an allowance for wastage.

Other differences are accounted for by the necessity of obtaining a smooth curve. The figures shown in the budget data for the poorest groups have seldom been reduced and have more often been increased. Apart from eggs, only margarine has been given a lower figure than that indicated by the budgets in group I, and this slight decrease has been balanced by an increase in butter. Only jams are reduced in group II; and only jams and lard in group III. On the other hand, in each of the groups there are several increases.

The adjustments, however, are not such as to alter materially the average composition of the diets of the different income groups, as calculated from the budgets and dietary surveys. In general the changes made to bring the results into harmony with the estimates of total food supplies have tended to raise the level of consumption throughout.

In Table III corresponding figures are given for expenditure per head per week in each income group. This provides a useful check on the figures of quantities in Table II. The price per unit in each group can be roughly estimated. The figures in each group added together must then correspond with the total expenditure on food in the group and the weighted averages of expenditure on each food in all groups must add up to the average expenditure on all food for the whole population. The chief causes of discrepancy between the national and weighted averages, which is not serious, are referred to in the footnotes to Table III.

APPENDIX VII.

AVERAGE HEIGHTS OF MALES AT DIFFERENT AGES TABULATED ACCORDING TO THE SOURCES FROM WHICH THEY HAVE BEEN TAKEN.

Age.	Public School.*	Cathcart (9).			Christ's Hospital School (17).	Council School, Boys, 1927 (4).	Age.	Council School, Boys, 1932–34.†	B.A. Anthropometric Committee, 1883 (6).				
		Students.	Employed.	Unemployed.					All Classes.	Professional.	Commercial.	Labouring.	Artisan.
5	—	—	—	—	—	41.4	5½	41.8	41.0	—	—	42.4	39.7
6	—	—	—	—	—	43.0	6½	—	44.0	—	46.5	44.6	41.9
7	—	—	—	—	—	45.4	7½	—	46.0	—	47.5	45.8	44.6
8	—	—	—	—	—	47.8	8½	48.1	47.1	—	47.6	47.1	46.5
9	—	—	—	—	52.2	49.2	9½	—	49.7	50.8	50.0	49.1	48.9
10	—	—	—	—	53.7	51.3	10½	—	51.8	53.7	52.0	50.9	50.7
11	—	—	—	—	55.2	52.7	11½	—	53.5	55.2	53.8	52.3	52.7
12	—	—	—	—	56.7	55.0	12½	55.4	55.0	57.3	55.3	53.7	53.7
13	61.9	—	—	—	58.6	56.2	13½	—	56.9	59.1	57.4	55.3	55.8
14	63.7	—	—	—	61.1	58.0	14½	—	59.3	61.3	59.5	57.9	58.6
15	65.3	—	60.4	59.6	63.7	—	15½	—	62.2	63.6	62.2	61.8	61.4
16	68.1	—	62.9	64.3	66.0	—	16½		64.3	66.2	64.6	63.6	62.9
17	69.8	68.5	64.9	62.8	67.7	—	17½	—	66.2	67.8	66.6	65.9	64.7
18	70.8	68.1	66.1	64.4	68.7	—	18½	—	67.0	68.3	67.4	66.5	65.6
19	—	68.4	66.3	65.8	69.4	—	19½	—	67.3	68.6	67.6	66.9	66.2
20	—	68.6	66.7	65.9	—	—	20½	—	67.5	69.1	67.6	66.9	66.5
21	—	68.6	66.8	66.2	—	—	21½	—	67.6	68.2	67.8	67.2	66.6

* Grateful acknowledgement is due to the headmaster of the Public School for allowing measurements to be made, and especially to one of his science masters, who carried out the work on our behalf.

† Data collected from School Medical Officers' Reports, 1932-34, and averaged at the Rowett Research Institute.

APPENDIX VIII.

COMPARISON OF THE LEAGUE OF NATIONS TECHNICAL COMMISSION'S * STANDARDS OF REQUIREMENTS WITH THOSE ADOPTED IN THIS REPORT.

It is difficult to make direct comparisons between the standards since the Technical Commission's report does not state figures for the requirements of every age group of the population. For example, no standards for mineral requirements of adults are given. A table has therefore been compiled which gives the calorie, protein and mineral requirements for every age group from one year upwards as specified in the League's report, and where no precise figures are given by the Technical Commission, figures have been computed on indications given or implied in the text of the report. The assumptions which have had to be made are specified in notes below the table.

The requirements of these constituents for each age group have been weighted according to their distribution in the population, and the averages per head of the population calculated on this basis are compared with those of Dr. Stiebeling and those adopted in this report which are based on her figures.

It will be seen that in every constituent considered according to this calculation the League of Nations standard is higher than that which has been adopted in this report. Judged by the international standards, therefore, the country appears to be worse fed than is suggested by this report.

* League of Nations Technical Commission, Report on the Physiological Basis of Nutrition, 1936.

ESTIMATE OF REQUIREMENTS PER HEAD OF THE POPULATION OF ENGLAND AND WALES ACCORDING TO THE REQUIREMENTS FOR INDIVIDUALS GIVEN BY THE LEAGUE OF NATIONS TECHNICAL COMMISSION AND A COMPARISON WITH THE FIGURES USED IN "FOOD, HEALTH AND INCOME."

	Energy value. Calories.	Protein. Grams.		Calcium. Grams.	Phosphorus. Grams.	Iron. Mgms.	No. in thousands (R.G.1934).
		(*a*)	(*b*)				
Pregnant and nursing woman	3,000	91	91	1·72	2·25	16	519
Child 1–2 years	840	38	38	1·00	0·90	5	558
„ 2–3 „	1,000		46·5	1·30	1·14	5·7	577
„ 3–5 „	1,250	46	53	1·34	1·24	7	1,184
„ 5–7 „		66	64	1·45	1·38	8·6	1,219
„ 7–12 „			66·5	1·67	1·94	16	3,270
„ 12–15 „	3,000	107	69	1·89	2·50	23	2,162
„ 15–17 „		109	69	1·89	2·50	23	1,188
„ 17–21 „		96	69	1·28	1·91	19	2,470
„ 21 and upwards		85	69	0·68	1·32	15	26,765
Average per head of population	2,889	83	68	1·00	1·51	15·3	39,912
Stiebeling standards	2,810	68		0·9	1·23	13·5	
"Food, Health and Income" standards	2,810	68		0·6—0·9	1·23	11·5	
Difference, per cent. of "Food, Health and Income" standards	+2·8	+22		+67—+11	+22·8	+33	

1. The mean of the figures for highly milled and whole grain cereals has been taken throughout.

2. Calories.—A global figure of 3,000 calories (basal 2,400+600 for activity) has been taken for all ages, sex and activities over 5 years.

3. Protein.—(*a*) The protein requirements (*a*) are based on the table of grammes per kilogramme of body weight at different ages given in the text.

(*b*) Baldwin's * scale of weights has been applied from ages 3 to 17 and the estimated weights of 10·8 and 64 kgms. for age groups 1–3 and 17–21 are made on an extrapolation of the weight–age curve.

(*c*) The adult weight is taken to be 68 kgms. and the requirement 1·25 gm. per kgm.

(*d*) The subsidiary column (*b*) is compiled from the figures in the examples at the end of the report.

* Baldwin, B. T., Univ. Iowa, Studies in Child Welfare, 1920–21, 1, 1.

(*e*) To supply the extra protein requirements in age groups 12–15 and 15–17 (not allowed for in the examples), 108·5 gms. legumes and 333 gms. bread have been added.

4. Minerals.—(*a*) The figures for age groups 7–12 and 17–21 are the averages of those for the adjacent groups. It has been assumed that the mineral requirements at ages 15 and 16 are the same as those at ages 12 to 15.

(*b*) No information is given as to the mineral requirements of the adult, and therefore the Stiebeling figures of 0·68 gm. Ca, 1·32 gm. P and 15 mgms. Fe have been used. It is assumed that had figures been given they would not have been lower than these.

(*c*) 0·075 gm. Ca, 0·1 gm. P and 1·57 mgm. Fe per 30 gms. of meat, fish, liver or cheese are included from ages 3 to 17 years, on the basis of $\frac{3}{4}$ meat, $\frac{1}{4}$ cheese.

(*d*) 0·04 gm. Ca per egg has been included instead of nil as in the report.

0·03 gm. Ca per 250 gms. potatoes has been included instead of nil as in the report.

0·046 gm. P per 100 gms. green and leafy vegetables has been included instead of nil as in the report.

(*e*) The extra quantities of minerals supplied by legumes and bread, 3 (*e*), have been included.

APPENDIX IX.

CALCIUM REQUIREMENTS.

Since the first publication of this report the League of Nations Technical Commission has published the "Physiological Bases of Nutrition," which can now be adopted as the international standard. If the requirements for the individuals specified in that report be weighted according to their age distribution in the population the average per head on this basis is 1·0 gm. (See Appendix VIII.)

The alarming extent of calcium deficiency in this country if the requirement is as high as 0·9 gm. per head per day necessitated investigation of the original data on which the standard is based. Dr. Leitch * of the Imperial Bureau of Animal Nutrition therefore made a survey of the literature, and by a new method of determination estimated the minimum to be as high as 0·765 gm. Since publication of this estimate further data on weights of public schoolboys have been received and a revised estimate prepared which gives an average minimum requirement of 0·754 gm. There is no evidence to show what margin above this minimum is required for perfect health. If Sherman's estimate of 50 per cent. for adults be accepted, the total requirement would be 0·95 gm. per head per day. The L.o.N.T.C. allowance of 1 gm. per head amply covers this requirement.

It is therefore certain that the extent of calcium deficiency in this county is very widespread, and if the larger numbers of children in the lower groups be taken into account, the degree of deficiency in those groups is even worse than here portrayed.

* Leitch, I., "Nutrit. Abst. Rev.," 1936–37, 6, 553.

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