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A STUDY OF ENGLISH DIETS BY THE INDIVIDUAL METHOD

PART I. MEN

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(With 1 Figure)

INTRODUCTION

THE quantitative assessment of diets is a problem which has attracted many workers in different parts of the world, and a considerable amount of data has been accumulated as to the food intakes of human beings. Some of these data are reasonably reliable; some are not. The food actually eaten by healthy individuals living at various levels of income in different parts of the world, and performing various kinds of work, has often been accepted as a measure of the requirement of these individuals. Studies such as this certainly provide information as to the diets upon which individuals are maintaining average health and strength, but they do not necessarily indicate what the optimum intakes of the various food constituents should be. This point will be discussed in detail in a later paper.

There are three different methods which have been used hitherto for the determination of the amount of food consumed. The first is the *account-book method.* The housewife keeps account of all the food purchased over some definite period, usually a year. Thus the total food entering the house during that period is known and its chemical composition can be calculated. No check is kept upon the amount of waste, and an average of 10 per cent. of the purchased food is usually allowed for this. Further, some of the food may have been fed to animals, but no record is kept thereof. This method is extremely approximate, but it has been employed by some workers, notably by McKay (1929) in her study of the food consumption of farm families in Ohio, by Enghoff and Wastl (1933) in an investigation on the diet of 100 families in Vienna, and by Escudero (1933) in a study of the average food intake in Buenos Aires.

The second and most usual method of finding out what people eat is the *family method.* All the food entering the house during a shorter period, usually one week, is carefully checked by trained workers, the food already in the house at the beginning of the week and also at the end of the week is noted, and the amount of waste is usually determined. This method is described in greater detail, and some of the difficulties to be overcome if reliable results are obtained, by Cathcart (1931).

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This method was employed by Paton *et al.* (1900) who investigated the diets of working classes in Edinburgh. A similar study was carried out by Rowntree (1902) on the diet of the labouring classes in York, and in 1921 and 1924 by Tully on the nutrition of working class families in Glasgow. During 1922–3 the Medical Research Council Committee upon Human Nutrition undertook a study of the diet of miners and their families in five mining districts. Hill (1925) investigated the diets of families of agricultural workers living in Essex. More recently, Cathcart and Murray (1931 *b*) have studied the food intake of people of various classes, both rich and poor, living in St Andrews, a relatively well-to-do community. A later study (Cathcart and Murray, 1932) was carried out on the diets of working class families in Cardiff and Reading. Orr and Clark (1930) carried out an extensive study of the diets of 607 families in seven Scottish towns, and Davidson, Fullerton *et al.* (1933) collected information concerning the food consumption of forty-nine families in Aberdeen and sixty-six families from the poorest classes in Peterhead. Similar studies have been carried out in America by Sherman, Mettler and Sinclair (1910) and Hawley (1929), in Germany by Hornemann (1913) and v. Tyszka (1932), Belgium by Bigwood and Roost (1934), Holland by Banning (1931 *a*, *b*), and Italy (see Bottazzi, 1935). A summary of results obtained from a study of family budgets in this country has recently been published (Orr, 1936). The population has been divided into six income groups, and the average chemical composition of the diets of each group has been calculated and compared with Stiebeling and Ward's (1933) standards.

One of the chief difficulties in studying food intakes by either of the above methods is the fact that the families consuming the food consist of men, women and children of various ages. How are the results to be expressed? Orr's (1936) results are expressed "per head", but the conventional method is to assume that women and children eat definite fractions of the amount of food eaten by men, and calculations are usually made on the basis of some scale of family coefficients, and the results are expressed in terms of the adult male. Since about thirty-eight different scales have been proposed by various authors at different times and these scales differ widely from one another, it is obvious that the results obtained will depend to a large extent upon the particular scale of man values chosen for the calculations. In fact, as v. Tyszka (1935) has pointed out, the particular scale used may determine whether a diet appears to be completely adequate or grossly inadequate. Scales proposed by Cathcart and Murray (1931 *a*, *b*) and by the League of Nations (1932) are probably the most widely used at the present time, though Hawley's (1927) scale has been used to some extent in America.

A study of the average food consumption in the training camps of the United States Army was made by Murlin and Hildebrandt (1919). This investigation, although carried out by a "group" method, was independent of scales of family coefficients, since only men were included in the survey.

No attempt is made by either of the methods of dietary study already

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described to determine the actual food consumptions of the various individuals which make up the families under consideration, though Clark (1933) carried out an approximate study on these lines.

The third method of assessing the intake of various food constituents is the *individual method*. Dietary studies on individuals, however, whether men, women or children, are relatively few. Tigerstedt (1910) estimated the daily food intakes of 64 individuals including men, women and children in Finland with special reference to calcium, phosphorus and magnesium. Moss (1923) investigated the individual calorie intakes of sixty colliers in different parts of the country. All food was weighed for 7–10-day periods, and the calorie values calculated. Browning (1935) has published figures for the calorie consumption of six individual men, but since her results are little more than pure guesswork they are not worth considering. Mitchell (1935) has described individual dietary studies made by forty-one American students on themselves. All the food eaten over the period of one week was weighed and the chemical composition of the diets was calculated. This method has obvious advantages over the first two, for it gives information, not only as to the average intake, but the maximum and minimum, and the deviation from the mean. This applies to every single constituent of the diet. It is with the individual that physicians are mainly concerned, and it is most important to know what departures from the mean are compatible with average normal health. It is something to know that the average intake of iron is 17 mg. per day, but it is still more important to realise that an intake of 8 mg. per day is not necessarily any cause for alarm.

Sherman (1933) has pointed out another fallacy in drawing conclusions from average values, for the high intakes of some individuals raise the average, but do not confer any benefit on individuals whose intake is low. An individual method, moreover, is independent of any scales of "family coefficients".

A further important point to be considered in dietary investigations carried out by any of these methods is the accuracy of the tables of composition of foods employed for the calculation of the results. Food tables are almost as plentiful as scales of family coefficients, and the variation from one to another is considerable. This is especially true for the inorganic constituents. Further, most of these tables give the composition of raw foods only, and although it may be the raw food that is weighed in the first instance, it is well known that losses occur on cooking, and it is obviously the composition of the food after it has been cooked that is required.

FOOD REQUIREMENTS FOR MAINTENANCE

The *calorie* requirement is a subject upon which a great deal has been published. The pioneers in this field were Voit (1881), Atwater (1902) and Rubner (1913), who considered the daily energy requirements of a man doing "moderate" work to be 3055, 3400 and 3093 calories (as eaten) respectively. In 1919 the Food (War) Committee of the Royal Society published a report giving the energy requirements of different classes of workers, and a table of

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family coefficients suggested by Lusk (1917) for women and children of different ages was adopted. The figure of 3000 calories per day as eaten has been put forward by the Ministry of Health Advisory Committee on Nutrition (1934), and at the conference between this committee and the Nutrition Committee of the British Medical Association (1934). The British Medical Association (1933) assessed the value at 3400 calories per day as purchased. Stiebeling and Ward (1933) and v. Tyszka (1934) also advocate 3000 calories per day for the average man. More recently a committee appointed by the League of Nations (1935) has suggested 2400 calories per day for an adult, male or female, "living an ordinary, everyday life in a temperate climate and not engaged in manual work". To this basic requirement are added supplements for muscular activity, varying from 50 to 200 calories per hour of work according to its nature.

The *protein* requirements have formed the subject of much discussion, and there is much divergence of opinion among different workers as to the most satisfactory amount of protein in the diet. Atwater's (1902) standard was 125 g. per day, while Chittenden (1905) advocated about 60 g.

The Royal Society Committee (1919) suggested 70–80 g. per day, Stiebeling and Ward (1933) 67 g., and the Ministry of Health (1934) 80–100 g. Burnet and Aykroyd (1935) say that for practical public health work a standard of from 70 to 100 g. of protein may be employed. Sherman (1933), from an extensive study of the literature, proposed 1 g. of protein per kg. body weight, and the League of Nations Committee (1935) adopted a similar figure. Heupke (1934), in a review of studies on the amount of protein eaten by various races, concludes that large numbers of people maintain health on an intake of 50–70 g. per day. Hindhede (1934) says that nitrogen equilibrium can be maintained in the human subject on as little as 22 g. of protein per day, while Süsskind (1934) states that the presence of 1 g. of protein per kg. body weight is not sufficient for the maintenance of normal condition, even when 70 per cent. of the protein is of high biological value.

It is usually accepted that a proportion of the protein should be of animal origin. The Ministry of Health suggests 37 g., the British Medical Association 50 g., while v. Tyszka proposes as a standard 40 g. Corry Mann (1935) claimed on the basis of his own personal experience that on an intake of 61 g. of total protein and 42 g. of animal protein general health could be maintained if the diet included about 21 oz. of milk per day. If, however, only 11 oz. of milk were included in the diet, there was a deterioration of health even if the total protein intake was increased to 64 g., and the animal protein to 44 g. per day.

The *mineral* requirements of man have only been comparatively recently investigated, and attention has mainly been confined to calcium, phosphorus and iron. Sherman (1920 *a*) collected together the results of ninety-seven calcium balance experiments from various sources, and found that the mean calcium intake in the balanced experiments was 0·45 g. of calcium per day for a 70-kg. man. In a similar way he found the average phosphorus intake to be 0·88 g. per day (Sherman, 1920 *b*). Sherman considered that the results

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obtained from these balance experiments represented minimum requirements, and to allow for a margin of safety this author suggested that the average calcium and phosphorus intakes should be 50 per cent. higher than the figures quoted above, and he proposed that the average adult should have 0·68 g. of calcium and 1·32 g. of phosphorus daily.

Sherman (1907), from a study of iron balance experiments on healthy men, found that 6–12 mg. per day were sufficient for equilibrium. This is a minimum rather than a normal amount. Assuming that an average of 10 mg. per day is required to maintain iron equilibrium, and assessing the actual requirement 50 per cent. above this, Sherman concluded that the daily iron requirement is about 15 mg. per day. These figures for calcium, phosphorus and iron requirements have been adopted by Stiebeling and Ward (1933). Sherman's recommendations, which are based on balance experiments of short duration, cannot be regarded as more than tentative standards, though these figures for calcium, phosphorus and iron are quoted in every text-book on nutrition, usually with a considerable amount of authority.

Calculations of the protein, fat, carbohydrate and calorie intakes were made in most of the dietary surveys to which reference has already been made. Some studies of calcium, phosphorus and iron intakes have also been carried out. These will be discussed as they bear upon the results obtained in the present investigation.

PRESENT INVESTIGATION

Method

The subjects of this investigation were sixty-three healthy men of the English middle class, and all lived at their homes. Their ages ranged from 18 to 89 years. Sixty of the subjects were in regular employment, the remaining three had retired. The occupations, which were very varied and were detailed by Widdowson and McCance (1936), were mainly of a moderately active kind, though about eight might be classed as sedentary and three as very active. None of the subjects was judged to earn an income which was too low to provide him with the food he required, so the dietaries could be considered to be "freely chosen" so far as money was concerned. They would all probably fall into Orr's (1936) three highest income groups.

Each subject was provided with a spring balance weighing by ¼ oz. up to 1 lb., a plate on which to weigh the food and a form on which to enter the results. The subjects were interviewed personally in almost every case, and the exact procedure to be adopted was explained to them individually. A record was taken of their heights and weights.

All food eaten during the period of 1 week was weighed. The weighings were carried out on the edible portion of the foods, and where bones, skins of fruit, etc., were included, this was stated so that allowance could be made in calculating the results. Eggs were not weighed, but the number was given, and a mean weight of 50 g. was assumed.

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In most cases the subject weighed out for himself ¼ or ½ lb. butter at the beginning of the week and used this portion until it was done. Any remaining at the end of the week was weighed. All sweets, chocolates, drinks, etc., were entered under "Extras". In practically every case, every item of food was actually weighed. Where meals were taken away from home, the balance was carried to the restaurant and the food weighed as usual. Occasionally it was impossible to weigh the food at some meal during the week of investigation. In this case the day was usually omitted altogether from the records, and the corresponding day the following week substituted.

The chemical composition of the diets was calculated from figures given by McCance and Shipp (1933) for meat and fish, by McCance, Widdowson and Shackleton (1936) for fruit and vegetables, and from other figures, not yet published, for common foods such as flour, bread, milk, etc. Available iron was calculated from the figures of Shackleton and McCance (1936) and available phosphorus from McCance and Widdowson (1935). The total and available iron in the diets has been made the subject of a separate paper (Widdowson and McCance, 1936). In many cases foods eaten were specially cooked and analysed for the survey. The chemical composition of other cooked dishes, cakes, puddings and so on, were obtained from a calculation of the composition of the ingredients and from the average loss in weight on cooking of that particular dish.

A summary of the results is shown in Table I, while in Table II detailed information as to the composition of each individual diet is given.

Table I. *Daily food intake of sixty-three men of the middle class. Summary of results*

	Average	Maximum	Minimum	Standard deviation
Total calories per day	3067	4955	1772	714
Calories per kg. body weight (normal weight for height and age)	43·8	74·6	25·2	11·3
Total protein (g. per day)	97·6	167	53	23·8
Animal protein (g. per day)	66·6	121	30	19·2
Total fat (g. per day)	129·4	215	69	35·0
Total carbohydrate (g. per day)	348	589	171	86·0
% of calories from protein	13·1	19·3	8·3	1·9
% of calories from fat	39·1	50·8	29·0	4·9
% of calories from carbohydrate	46·7	59·8	33·5	5·4
Calcium (g. per day)	0·87	1·96	0·36	0·36
Total phosphorus (g. per day)	1·61	2·79	0·87	0·44
"Available" (non-phytin) phosphorus (g. per day)	1·57	2·73	0·86	0·42
Total iron (mg. per day)	16·8	28·5	7·8	4·64
"Available" (inorganic) iron (mg. per day)	10·8	18·7	5·3	2·80
Intake of milk (pints per day)	0·58	1·46	0	0·32
Intake of meat (oz. per day)	5·2	11·1	1·4	2·0
Intake of bread (oz. per day)	7·6	16·2	0·6	3·4
Calories per penny	117	165	53	23·6

N.B. The sum of the percentages of calories derived from protein, fat and carbohydrate is less than 100 because a small percentage of the calories is derived from alcohol (see p. 284).

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RESULTS

Calories

It will be observed that the mean daily calorie intake (3067) lies very close to the orthodox figure of 3000 calories recommended by Stiebeling and Ward (1933), the Ministry of Health (1934), the joint conference between the Ministry of Health and the British Medical Association (1934) and by v. Tyszka (1934).

The actual average calorie intakes determined in the more important dietary studies in different parts of the world are summarised in Table III. All these studies were carried out either by the account book or family method, and all are calculated on a "man value" basis. Different scales have, however, been used for the computation of the results. Orr's (1936) results have not been included as they have been calculated "per head", and are therefore not directly comparable with those calculated on the "man value" basis. One of the most interesting conclusions to be drawn from the present investigation is the corroboration of the figure 3000 calories as the amount eaten by the "average" man.

The individual variation found in the present study is, however, enormous, even among a group of men whose lives are mainly of a similar activity. It will be seen from Table II that the highest calorie intakes are not necessarily those of the most strenuous workers, and that the widest variation occurs among men of similar occupations. Subject No. 28, a university teacher of 28 years, is slightly overweight on an intake of 1772 calories per day, while subject 34, an electrician one year older, is obtaining 4955 calories per day from his food and is not overweight.

Wide variations such as this have been found in previous investigations by the "family" method (see Table III). Incorrect "man values" might have accounted for some of these differences, but it is interesting to find that individual diets show similar variations. It is clear that when individuals are being considered, the figure of 3000 calories may have little or no meaning. It is impossible, by comparison with an "average" figure of 3000, to say whether any diet is adequate or inadequate for an individual.

Relation between calorie intake and body weight

An attempt has been made to correlate calorie intake with body weight. The weight of each individual was calculated as a percentage above or below his normal weight for height and age. These normal figures were obtained from tables published by the Actuarial Society of America (1929), but it was found necessary to subtract 4 lb. from each normal weight, *i.e.* to allow 6 lb. for clothes instead of 10 lb. in order to obtain a correct balance of underweight and overweight persons. There appeared to be no significant correlation between body weight expressed in this way and total calorie intake, nor between body weight and calories per kg. This is contrary to the findings of Enghoff and Wastl (1933) who report that there is a significant correlation between calorie consumption and body weight, indicating that body weight is a valuable index

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Table II. *Chemical composition of the individual diets of sixty-three men*

No.	Age	Occupation	% above or below normal weight for height	Calories per day	Calories per kg. per day	Total protein g. per day	Animal protein g. per day	Fat g. per day	Carbo-hydrate g. per day	% calories from protein
1	18	Student	+18·4	2087	33	68	48	99	196	13·4
2	18	,,	+ 5·1	3669	60	105	62	150	396	11·7
3	19	Laboratory technician	0	4425	67	133	86	203	482	12·3
4	19	Student	− 2·6	2530	37	105	82	133	211	17·0
5	19	Mechanic	− 2·2	3510	56	131	90	134	421	15·3
6	20	Student	+ 6·4	4220	66	135	101	208	422	13·1
7	20	,,	+ 6·1	4445	60	128	85	203	479	11·8
8	20	,,	+14·3	3005	47	95	65	124	356	12·6
9	20	Clerk	− 2·8	2715	42	90	69	112	318	13·5
10	21	Laboratory technician	− 4·0	3475	51	107	76	147	401	12·4
11	21	Student	− 1·3	3043	43	92	55	116	387	12·4
12	21	Laboratory technician	+ 2·0	3977	58	103	49	169	480	10·6
13	22	Student	−14·4	2480	38	73	48	115	272	12·0
14	23	Laboratory technician	− 1·3	3851	55	110	81	162	452	11·7
15	23	,,	0	3429	55	116	75	139	405	13·9
16	23	Student	+ 9·0	2405	34	94	67	87	297	16·0
17	23	,,	+ 3·5	2977	45	84	53	105	403	11·5
18	24	,,	0	3188	41	91	59	127	398	11·7
19	24	,,	− 9·0	2470	35	71	44	90	327	11·8
20	24	,,	− 1·9	4582	63	93	52	215	535	8·3
21	24	Municipal engineer	− 7·2	2515	40	89	63	89	306	14·5
22	24	Mechanic	− 1·1	2935	35	118	93	134	290	16·5
23	25	Clerk	+15·8	3667	51	99	67	161	418	11·0
24	25	,,	+ 2·1	3057	48	86	59	131	363	11·5
25	25	Student	+ 2·8	3371	41	92	52	127	442	11·4
26	25	University teacher	− 7·6	2743	38	83	52	135	278	12·4
27	26	Doctor	−18·2	2358	34	69	48	79	291	12·0
28	28	University teacher	+ 1·4	1772	27	57	43	69	201	13·1
29	28	Research	+ 7·2	3174	46	105	73	146	329	13·6
30	28	Carpenter	+10·8	3252	52	88	51	137	387	11·1
31	28	Research	− 9·7	3575	42	127	95	164	373	14·6
32	29	Commercial traveller	+13·0	3448	52	97	62	130	446	11·3
33	29	Dentist	−10·0	3107	49	88	60	163	300	11·6
34	29	Electrician	0	4955	75	167	121	199	589	13·8
35	30	Research	+ 9·4	3572	49	113	81	174	365	13·0
36	30	,,	+ 2·5	4072	56	138	95	164	483	13·8
37	33	Student	+18·2	2420	32	94	80	132	198	15·8
38	33	Stoker	−18·6	3178	49	113	75	118	355	14·6
39	34	,,	− 1·5	2845	46	62	30	121	357	8·9
40	35	Research	−16·0	2503	40	75	55	91	330	12·2
41	35	Doctor	+ 4·4	2757	39	105	80	123	239	15·6
42	35	Research	−18·6	2137	29	74	53	96	228	14·1
43	36	Doctor	− 8·4	2650	35	78	48	106	328	12·1
44	38	Porter	−18·6	3073	40	120	86	155	278	13·2
45	41	Electrical engineer	− 4·4	2402	39	67	37	108	278	11·4
46	42	Porter	− 4·4	3806	62	142	104	136	412	15·3
47	45	,,	− 7·7	2691	38	126	96	113	284	19·3
48	45	Omnibus driver	+ 3·0	2659	35	104	80	92	331	16·0
49	45	Laboratory technician	+21·7	3693	49	114	83	164	363	12·6
50	46	Porter	− 6·2	2550	35	89	62	104	292	14·3
51	49	Engineer	+ 7·2	2460	28	90	60	87	312	15·0
52	49	Porter	− 2·6	3408	48	112	75	139	404	13·5
53	49	,,	+ 2·0	3229	48	105	69	148	342	13·4
54	51	Mason's labourer	− 2·1	3445	53	110	75	148	376	13·1
55	54	Secretary	+11·0	2236	32	69	50	92	271	12·7
56	54	Journalist	0	1920	28	75	57	97	171	16·0
57	55	Teacher	−11·7	2942	45	98	72	133	317	13·6
58	56	Commercial traveller	+19·5	3920	53	134	82	157	466	14·0
59	60	Retired	+15·9	2860	44	86	59	118	344	12·2
60	60	Doctor	−21·6	2073	28	53	33	96	233	10·4
61	67	Retired	+36·0	1885	25	67	47	81	210	14·6
62	79	Librarian	−20·7	2389	33	67	38	81	335	11·5
63	89	Retired	−13·0	2602	34	72	51	81	379	11·4

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Table II (*continued*)

% calories from fat	% calories from carbo-hydrate	calcium g. per day	Total phos-phorus g. per day	Avail. phos-phorus g. per day	Total iron mg. per day	Avail. iron mg. per day	Calories per penny	Milk pints day	Bread oz. per day	Meat oz. per day
44·0	38·5	0·48	1·18	1·17	15·4	11·1	93	0·24	3·4	2·6
38·0	44·2	1·20	2·34	2·30	16·2	11·4	92	1·35	7·5	3·7
42·7	44·8	0·55	1·83	1·82	21·8	12·2	154	0	16·2	11·1
48·8	34·3	0·65	1·61	1·59	23·1	11·0	100	0·37	3·9	7·7
35·4	49·0	1·27	2·53	2·18	26·3	18·7	87	1·18	14·0	6·9
46·0	41·0	1·96	2·68	2·67	17·2	12·0	137	1·33	10·5	3·9
42·5	44·4	0·93	1·94	1·91	19·4	12·2	102	0·55	7·9	8·1
38·4	48·7	1·26	1·57	1·49	15·5	9·6	131	0·47	8·6	4·6
38·2	48·0	1·05	1·48	1·46	13·8	10·5	98	1·07	4·4	3·0
39·2	47·3	1·14	1·86	1·82	18·1	12·3	135	1·12	5·2	5·0
35·5	52·2	0·67	1·48	1·42	16·6	10·4	122	0·46	6·8	5·4
39·6	49·5	0·67	1·81	1·67	18·8	13·0	164	0·50	11·4	6·2
43·2	45·0	0·43	1·16	1·15	14·0	8·7	158	0·11	7·5	3·9
39·1	48·0	1·58	2·40	2·34	19·4	10·6	114	1·15	3·9	5·6
37·7	48·5	1·27	1·97	1·95	18·0	13·8	122	1·18	11·1	5·3
33·7	50·5	0·78	1·43	1·42	15·8	9·6	114	0·85	5·7	4·7
32·8	55·5	0·85	1·51	1·50	13·1	9·2	134	0·88	7·4	4·2
30·5	53·0	0·84	1·36	1·36	17·8	14·3	93	0·45	7·2	4·7
33·9	54·0	0·47	1·05	1·02	10·1	8·2	135	0·31	6·2	1·4
43·7	48·0	0·83	1·71	1·54	18·5	14·0	132	0·46	14·7	3·5
32·9	50·0	0·55	1·48	1·47	14·5	9·3	109	0·43	4·6	5·8
42·4	40·6	0·63	1·90	1·90	18·1	12·5	86	0·21	6·0	6·7
40·8	46·7	0·89	1·70	1·70	17·1	10·2	106	0·31	8·6	4·6
39·8	48·5	1·04	1·50	1·50	14·4	9·5	133	0·92	7·3	4·6
35·0	53·5	1·06	1·55	1·51	14·1	11·2	141	1·02	10·6	2·7
45·8	41·8	0·48	1·46	1·31	15·0	10·4	114	0·10	8·7	5·1
31·0	50·1	0·53	1·33	1·31	11·4	6·0	91	0·40	5·4	4·7
36·4	46·5	0·77	1·05	1·04	8·1	5·3	106	0·51	1·9	2·7
42·7	42·3	1·02	1·66	1·63	17·1	10·9	85	0·70	8·3	4·4
39·1	48·8	0·88	1·87	1·62	21·2	14·9	114	0·36	11·9	4·6
42·7	42·8	0·81	1·56	1·55	27·8	13·9	124	0·40	7·2	10·0
35·0	53·1	0·66	1·51	1·51	13·9	11·0	140	0·44	12·0	4·7
48·7	39·5	0·66	1·40	1·38	13·3	10·1	139	0·54	6·1	4·3
37·4	48·8	1·96	2·79	2·73	28·5	17·8	117	1·46	11·0	8·3
45·3	41·9	1·40	2·21	2·08	19·8	14·3	110	0·71	3·8	4·6
37·5	48·5	1·27	2·20	2·14	25·5	16·7	86	0·57	8·8	6·9
50·8	33·5	0·39	1·16	1·16	19·8	11·9	103	0·20	3·7	8·4
34·5	45·8	0·79	1·85	1·83	19·3	10·7	89	0·54	11·8	6·4
39·6	51·5	0·40	0·98	0·95	10·2	6·0	155	0·38	7·4	2·5
33·7	54·0	0·49	1·23	1·16	12·8	8·1	117	0·08	4·2	6·3
41·5	35·5	0·80	1·67	1·67	20·3	13·2	53	0·57	2·9	6·0
41·6	43·7	0·46	1·10	1·09	11·2	6·9	116	0·26	6·5	5·3
37·2	50·8	0·97	1·22	1·20	16·6	12·1	120	0·61	0·6	3·9
46·8	36·9	0·98	1·79	1·78	19·1	11·9	122	0·39	8·2	6·7
41·8	47·5	0·50	1·05	1·03	12·9	7·1	119	0·28	6·9	2·7
33·2	44·2	1·10	2·24	2·22	25·4	14·3	93	0·92	12·3	9·3
39·1	43·3	0·79	1·75	1·74	20·3	11·2	108	0·52	11·6	8·4
32·0	51·0	1·09	1·75	1·75	20·1	11·7	118	0·76	3·3	6·8
41·3	40·2	0·78	2·03	2·02	18·9	9·6	98	0·71	9·9	6·0
37·9	47·0	0·56	1·30	1·27	17·4	9·6	146	0·51	7·4	5·2
32·9	52·0	0·46	1·16	1·16	15·9	10·0	119	0·34	8·9	6·2
38·0	48·7	1·08	1·92	1·88	18·6	12·1	164	0·54	11·4	6·3
42·5	43·4	1·02	1·61	1·61	16·0	7·5	146	0·58	12·2	4·8
40·0	48·0	0·61	1·47	1·37	22·1	9·3	130	0·19	9·9	8·9
38·3	49·8	0·79	1·28	1·23	10·4	8·3	71	0·51	2·5	2·2
47·0	36·5	0·36	1·09	1·07	13·2	8·1	91	0·17	3·0	5·2
42·0	44·2	1·26	1·77	1·75	13·4	10·2	102	0·64	5·7	4·6
37·2	48·8	1·06	2·06	2·04	23·8	14·4	134	0·49	13·3	6·2
38·0	49·0	1·09	1·68	1·67	14·9	9·8	131	0·89	6·9	3·9
43·0	46·1	0·56	0·87	0·85	7·8	6·3	85	0·34	3·6	2·0
39·8	45·5	0·61	1·04	1·04	10·9	6·2	132	0·19	7·0	2·9
31·5	57·5	0·90	1·08	0·97	10·5	8·0	154	0·94	8·4	2·5
29·0	59·8	1·38	1·43	1·43	10·4	6·5	165	1·05	3·4	2·3

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Table III. *Summary of previous studies of calorie intakes (results expressed per "man-value" per day)*

Author	Subjects of the investigation	No. of families studied	Mean calorie intake	Range	"Man value" scale used
Paton, Dunlop and Inglis (1900)	Labouring classes in Edinburgh	19	3233	1834–4796	Atwater (1902)
Sherman, Mettler and Sinclair (1910)	American families and College Students' clubs	20	3250	1500–6780	—
Tully (1921)	Working class families in Glasgow	11	2481	1610–3414	Lusk (1917)
Medical Research Council (1924)	Miners' families in England and Scotland	140	3035	1696–4880	Lusk (1917)
Tully (1924)	Artisan families in Glasgow	17	3070	2280–3924	Lusk (1917)
Hill (1925)	Rural families in Essex	98	2872	2000–4000 (approx.)	Lusk (1917)
Paton and Findlay (1926)	Poor families in cities and rural districts of Scotland	79	2686	1396–3916	Lusk (1917)
McKay (1929)	Farm families in Ohio	47	3587	2081–5828	Hawley (1927)
Hawley (1929)	American institutions (men and women)	227	3125	—	Woman = 0·8, Man = 1·0
Orr and Clark (1930)	Families in seven Scottish towns	607	3609	1500–6000	Cathcart and Murray (1931). Food as purchased
Banning (1931) (*a*)	Families in Dutch industrial town	33	3376	—	Lusk (1917)
Banning (1931) (*b*)	Farm families in Holland	10	3746	—	Lusk (1917) and Cathcart and Murray (1931 *b*)
Cathcart and Murray (1931)	Well-to-do families in St Andrews	154	3119	—	Cathcart and Murray (1931)
Cathcart and Murray (1932)	Working classes in Cardiff	56	3174	—	Cathcart and Murray (1931)
	Working classes in Reading	57	2906	—	" " Food as purchased
v. Tyszka (1932)	German families (all classes)	2000	2893	—	—
Davidson *et al.* (1933)	Poorest classes in Aberdeen	49	2479	1500–4250	Cathcart and Murray (1931)
	Poorest classes in Peterhead	66	2629	—	" "
Enghoff and Wastl (1933)	Workers and officials' families in Vienna	100	3279	2435–4384	Peller (1919)
Escudero (1933)	Working classes in Buenos Aires	5493	3000	—	—
Bigwood and Roost (1934)	Working class in Brussels	19	2500	1552–3402	Bigwood and Roost (1934) (average for men and women)

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in nutritional studies. The present study indicates that calorie intake is certainly not the main factor in determining body weight.

Total protein

The mean total protein intake (Table I) was 97·5 g. per day, very near the conventional figure of 100 g. Calculated as grams of protein per kilogram of body weight, the mean intake was 1·4 g., rather higher than Sherman's (1933) or the League of Nations' (1935) suggested figure of 1 g. per kg. body weight.

Actual observations of the protein intake have been made in most of the dietary studies already mentioned. The Medical Research Council (1924) found an average daily intake of 74 g. among miners' families, and Hill (1925) reported a similar figure for families of rural workers. McKay's (1929) study of forty-nine farm families in Ohio showed an average consumption of 93 g. of protein per day. If this had been calculated on the Cathcart and Murray scale the result would have been considerably higher. Orr and Clark (1930) found 108 g., and Cathcart and Murray (1931 *b* and 1932) daily averages of 84, 79 and 75 g. in St Andrews, Cardiff and Reading respectively. v. Tyszka (1932) reported 83 g., and Enghoff and Wastl (1933) found a mean intake of 95 g. of protein per day.

Studies of the daily urinary nitrogen excretion of 400 male medical students have been made by Denis and Borgstrom (1924), Beard (1927) and Brooks (1929), who found that averages of 10·63, 11·16 and 10·34 g. of total nitrogen were eliminated. If it is assumed that an additional 10 per cent. of nitrogen is excreted in the faeces, the total outputs are equivalent to intakes of 73·8, 76·7 and 71·3 g. of protein per 70 kg. body weight respectively.

Hence, the subjects of the present investigation were eating more protein on average than has been found in most previous studies, but this may be due to the fact that their incomes were higher than those of the subjects of most similar investigations.

The individual intakes varied from 53 to 167 g. per day. Generally speaking, those individuals with low protein intakes were those who ate only small amounts of meat. Meat consumption and total protein intake show a correlation of +0·74, while meat and animal protein show a correlation of +0·75. None of the diets studied was grossly deficient in total protein.

Animal protein

The average intake of animal protein was 67 g., or 68·5 per cent. of the total protein. This is considerably higher than the British Medical Association's (1933) suggested allowance of 50 g. The minimum intake was 30 g., which was that of one of the stokers. Apart from this, no individual was eating less than 37 g. per day, the minimum figure prescribed by the Ministry of Health (1934). Three individuals, a student, an electrician and a porter, consumed more than 100 g. of animal protein a day. It must be concluded from these observations that judged by accepted standards middle-class men in this country are

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obtaining adequate protein, and that their animal protein intake is especially high. More than half of this animal protein is derived from meat. About 17 per cent. comes from milk and the remainder is derived from cheese, eggs and fish.

Fat

The daily intake of fat had a mean value of 129 g. No evidence is available as to the optimum amount of fat in the diet, and standards of fat intake proposed by physiologists show wide variation—from 52 g. per day suggested by Rubner (1913) to 100 g. proposed by the British Medical Association (1933). Actual intakes of fat vary enormously in different parts of the world. Thus Richards and Widdowson (1936) have recently shown that a tribe living in North-Eastern Rhodesia subsist on a fat intake of about 13 g. per day, while the Esquimaux eat twice as much fat as carbohydrate (Heinbecker, 1928). So far as European and American diets are concerned, the various workers already referred to found average daily intakes of fat varying from 57 g. per day among the poorest classes in Aberdeen (Davidson *et al.* 1933) to 161 g. per day among farming families in north Holland (Banning, 1931 *a*). Apart from this study by Banning, however, no other workers appear to have recorded such a high fat intake as that found in the present investigation. 75 per cent. of the subjects were taking more than 100 g. of fat per day, while four individuals (three students and a laboratory technician) had intakes of more than 200 g. per day. These four subjects were all eating more than 400 g. of carbohydrate in addition, so there was no fear of a ketosis!

One subject was eating only 69 g. of fat per day, but apart from this the minimum intake was 81 g. No diet can therefore be considered to be deficient with regard to fat. The fat is derived mainly from butter, meat and bacon, and from pastry, cakes and puddings. Butter is the most important single source.

Carbohydrate

The average carbohydrate intake was 348 g. per day. As in the case of fat, no information as to the optimum intake of carbohydrate is available, and it is well known that fat and carbohydrate are interchangeable in the diet within wide limits. Earlier workers have reported carbohydrate intakes varying from 344 to 580 g. per day, so the intake of carbohydrate in the present study is as low as any previously recorded. The maximum intake was 589 g., while three subjects were eating less than 200 g.

Percentage of total calories derived from protein, fat and carbohydrate

The percentage of the total calories derived from protein has a mean value of 13·1, in fairly close agreement with the results of previous workers.

The division of calories between fat and carbohydrate is, however, of considerable interest. 39·1 per cent. of the total calories come from fat and 46·7 per cent. from carbohydrate. No other British or American workers appear to have recorded so high a proportion as this from fat, and hence so low a pro-

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portion from carbohydrate, though Banning (1931 *b*) in a study of the diets of ten farming families in Holland records an average intake of 161 g. of fat per day, which provides 40 per cent. of the total calories. In a Dutch industrial town the same author (1931 *a*) found an average daily intake of 126 g. of fat, accounting for 36 per cent. of the total calories. Cathcart and Murray (1931 *b*) in their investigation on the food eaten by all classes in St Andrews found the intake of fat was 118·6 g. per day, providing 35 per cent. of the total calories.

It is a well-known fact that the higher the income the larger the proportion of calories usually derived from fat, and it is probably also true that a higher proportion of the total calories is derived from fat to-day than it was 20 years ago. Flux (1930) has compared the food supply of this country before and after the war, and has shown that whereas during the period 1909–13 the supply of fat would provide 30 per cent. of the total calories, during 1924–8 the average proportion of calories derived from fat had risen to 32·7 per cent.

Mineral salts

A summary of previous results for intakes of calcium, phosphorus and iron is given in Table IV. These have all been obtained from family studies by the "account-book" or "family" method and different scales of man values have

Table IV. *Summary of previous studies on intakes of mineral salts*

Author	Subjects of the investigation	Calcium g. per man value per day	Phosphorus g. per man value per day	Iron mg. per man value per day
Sherman, Mettler and Sinclair (1910)	20 American families and college students' clubs	0·57	1·40	16·3
Sherman and Gillett (1917)	29 American dietaries	0·72	1·52	16·3
Hawley (1929)	227 institutions for American college students	0·86	1·53	16·5
McKay (1929)	47 farm families in Ohio	1·09	1·59	16·3
Orr and Clark (1930)	607 Scottish families	0·86	1·70	14·3
Davidson *et al.* (1933)	49 poor families in Aberdeen	0·71	1·26	10·7
Davidson *et al.* (1933)	66 poor families in Peterhead	0·68	1·28	11·5
Bigwood and Roost (1934)	19 working class families in Brussels	0·67	1·30	15·0

been employed. Hawley (1929) and McKay (1929) have used the Hawley (1927) scale which allows for the greater requirements of children for the inorganic constituents, but the results of each of the other studies are based on scales of family coefficients which apply to calories only. Orr and Clark (1930) have calculated the diets for one town on both the Cathcart and Murray and the Hawley scale. On the Cathcart scale the intakes per man value per day for calcium, phosphorus and iron were 0·70, 1·44 and 0·0113 g. respectively. On the Hawley scale these values came to 0·53, 1·101 and 0·0087 g., nearly 25 per cent. less than by the first method. These differences only serve to emphasise the fact that results obtained from dietary studies carried out by the "family" method should be accepted with caution until more is known as to the actual

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intakes of children for each of the individual dietary constituents. Results obtained by the "individual" method for the inorganic constituents of the diet are of far more value than results obtained from groups of people which include adults and children.

Calcium.

The average intake of calcium in the present investigation was 0·87 g. per day, an amount well above Sherman's figure of 0·68 g. for the calcium requirement of adults, though 38 per cent. of the subjects were taking less than this amount. The mean intake compares favourably with values found in most previous investigations (Table IV), although Tigerstedt (1910) reported an almost unbelievably high intake of 3·79 g. per day for the adult male.

The main source of calcium was milk, and milk and calcium gave a correlation coefficient of +0·79. Cheese was seldom an important source of calcium, for large amounts were not commonly eaten. Intakes of less than 0·5 g. of calcium per day indicated low milk intakes. One man, whose daily calcium intake was 1·96 g., consumed nearly $1\frac{1}{2}$ pints of milk per day, while another, who was taking only about 3 oz. of milk per day, had a calcium intake of 0·36 g. There was no evidence that the first was in any way more healthy than the second, and in fact the second was particularly fit and strong, although his calcium intake was considerably below the "minimum" requirement (0·45 g.) suggested by Sherman, and only about half of the commonly accepted normal requirement. No individual was taking as much as 2 g. of calcium per day.

Total phosphorus.

The average intake of total phosphorus was 1·61 g. per day. This is higher than that found by most previous workers (Table I). Orr and Clark (1930) reported a mean intake of 1·70 per day, but the result would have been considerably lower if the Hawley scale had been used for the calculation. Only two subjects were eating less than 1 g. of phosphorus per day, and the minimum intake was 0·87 g. Hence the supply of phosphorus appears to be adequate.

"Available" phosphorus.

There is evidence that phytin phosphorus, which constitutes half or more of the total phosphorus in whole cereals, nuts and legumes, is unavailable for nutrition (Plimmer, 1913; Bruce and Callow, 1934; McCance and Widdowson, 1935). If this is so, then the "non-phytin" phosphorus in a diet is of more importance dietetically than the total phosphorus. Available non-phytin phosphorus has accordingly been calculated, and it has been found to be very little less than the total phosphorus (average intake 1·57 g., maximum 2·73 g., minimum 0·86 g.). In all cases more than 80 per cent. of the total phosphorus was taken in an available form, and in most cases more than 90 per cent. These results reflect the fact that most of the phosphorus is derived from animal and not from vegetable sources. There is evidence, therefore, that the average middle-class diet of men contains ample available phosphorus.

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Total and available iron.

These have been made the subject of a separate paper (Widdowson and McCance, 1936) and will not be discussed further.

Effect of age on food intake

An attempt has been made to determine whether the intake of any of the individual dietary constituents varied significantly with age. The men were divided into three approximately equal groups (see Table II), and the average intakes for each group were calculated.

Group I included all men between 18 and 24 years.

Group II included all men between 25 and 36 years.

Group III included all men of 37 years and over.

Table V. *Variation in food intake with age*

	Mean for Group I 18–24 years	Mean for Group II 25–36 years	Mean for Group III 37–89 years
Total calories per day	3270	3080	2812
Calories (per kg. body weight per day)	48	44	40
Total protein (g. per day)	102	96	95
Animal protein (g. per day)	68	66	66
Animal fat (g. per day)	139	132	117
Animal carbohydrate (g. per day)	375	348	320
% calories from protein	12·9	12·8	13·7
% calories from fat	39·0	39·8	38·6
% calories from carbohydrate	47·1	46·0	47·0
Calcium (g. per day)	0·91	0·84	0·85
Total phosphorus (g. per day)	1·74	1·57	1·52
Available phosphorus (g. per day)	1·69	1·52	1·49
Total iron (mg. per day)	17·3	17·0	16·1
Available iron (mg. per day)	11·6	11·0	9·6
Intake of milk (pints per day)	0·67	0·53	0·55
Intake of meat (oz. per day)	5·2	5·3	5·2
Intake of bread (oz. per day)	7·9	7·1	7·8
Calories per penny	119	113	121

The results are shown in Table V. It will be seen that there is a definite decrease in most cases as the age increases. This is especially marked for calories, fat and carbohydrate. These variations are not mathematically significant, but it must be remembered that the number of subjects in each age group is small, while the variations among the individual diets are very large. If the number of observations had been ten times as great, the intakes of the individuals would probably be between the limits observed in the present investigation and the results would probably have been significant. On the other hand, it is equally true to say that these figures demonstrate conclusively that it is quite impossible to make any rule to guide the individual as to what his intake should be at any particular age, for one man, aged 18, was maintaining health on 2087 calories and 68 g. of protein per day, while another, aged 56, was apparently equally healthy on 3920 calories and 134 g. of protein.

Fig. 1 shows the frequency distribution diagrams of some of the dietary constituents. These are normal in every case.

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Amounts of individual foodstuffs consumed

Milk.

The intake of fresh milk has been calculated for each individual, and has been found to vary from 0 to 1½ pints (850 c.c.) per day, with a mean daily consumption of 0·58 pint (330 c.c.). This includes milk taken in puddings. It would appear that health can be maintained without difficulty if no milk whatever is taken.

Jones and Cowie (1934), in a study of the milk consumption in Cardiff, found an average intake of 0·55 pint per day among the well-to-do middle class, and only half this quantity among the working class. Makings (1935) has collected data as to the amount of milk consumed by 600 families in Nottingham and has found a variation of from 0·59 pint per head per day for the middle class, to 0·33 pint for poor working class families. The present findings are in extraordinarily good agreement with these results, and it would appear that the average intake of fresh milk is about ½ pint per head per day, among the middle classes.

Meat.

The average consumption of meat and bacon, including the meat in puddings, pies, sausages, etc., was 5·2 oz. per day on a cooked weight basis. This is equivalent to approximately ½ lb. of raw meat. Meat contributes largely to the animal protein, the phosphorus and total iron in the diets.

Bread.

The subjects of the investigation were eating an average of almost 8 oz. of bread per day. One subject was consuming over 1 lb. a day, while another was eating only about ½ oz. Bread provided about 16 per cent. of the total calories and the variation was from 28·5 to 1·4 per cent.

Alcohol.

38 per cent. of the subjects recorded that alcoholic beverages had been taken. Those who had recorded none were questioned in order to ensure that drinks had not been omitted from the diet sheets. Figures for the alcohol contents of drinks were compiled from various sources, and the intake of alcohol calculated in each case. The maximum intake of alcohol provided 7·5 per cent. of the total calories, and, calculated on the basis of sixty-three subjects, the average proportion of the total calories derived from alcohol was 1 per cent.

Vitamins.

No attempt has been made to assess the vitamin contents of the diets. There is not sufficient quantitative data available at the present time as to the vitamins in foodstuffs to make this possible, but if this data is forthcoming at any future time, the vitamin intakes can be calculated from the original records.

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Cost.

The cost of each diet has been calculated, but in order to do this certain assumptions had to be made. A price list was drawn up, after consultation with various shopkeepers, which represented the average cost of the various foodstuffs. The prices were not the cheapest nor were they the most expensive, but were probably such as would be paid by the subjects of the investigation. It was assumed that these men were not individuals living alone, but were members of small families, and it was also assumed that all food was cooked and eaten at home. All diets were priced from this list, and by these means comparative results were obtained for the actual cost of the food, but they did not represent the amount really spent on food, since in most cases one meal a day was taken away from home.

An average of 117 calories per penny was obtained. One man (a doctor) had only 53 calories per penny, and his food alone cost him 4*s*. 4*d*. per day. The "grandfather" of the investigation, however (aged 89), who was consuming only 150 calories per day less than the doctor, obtained his food for 1*s*. 4*d*. per day.

An attempt has been made to estimate the amount of variety in each individual diet by counting up the number of different foodstuffs (including drinks and beverages) consumed by each of the men during the course of the week. An average of thirty-nine different foods was obtained, and the figures varied from seventeen to sixty-six.

A vegetarian diet

No vegetarians were included in the survey, and meat was eaten by all the subjects. One strict lacto-vegetarian has, however, kept a complete record of the weight of all his food during the course of a week. His diet consisted entirely of bread and other cereal foods, milk, cheese, butter, cream, jam, fruit and vegetables. The results obtained from the calculation of its chemical composition are given in Table VI.

Table VI. *Composition of a vegetarian diet*

Calories per day	2835
Total protein (g. per day)	94
Animal protein (g. per day)	60
Fat (g. per day)	130
Carbohydrate (g. per day)	304
Calcium (g. per day)	2·31
Total phosphorus (g. per day)	2·54
Available phosphorus (g. per day)	2·25
Total iron (mg. per day)	15·9
Available iron (mg. per day)	14·3

The calorie intake was 2835 per day. The total and animal protein were similar in amount to the average values found for the non-vegetarian diets, though here the animal protein was derived entirely from milk and cheese. The intakes of fat and of carbohydrate were almost exactly the same as those given in Table I, while the amounts of calcium and phosphorus were about

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twice those previously found. These high intakes of calcium and phosphorus were due almost entirely to milk (more than 1 pint per day) and cheese, of which about 5–6 oz. were eaten daily. Brown bread also provided a considerable amount of total and available phosphorus.

The total iron intake was just below the average, but owing to the absence of meat from the diet, the available iron was nearly 90 per cent. of the total iron, and the actual amount of available iron was higher than the average intake already discussed.

A study of the diet of six unemployed men by the individual method

The food intakes of six unemployed men living in Lincoln were studied by the individual method already described. Records were kept of the expenditure on various items during the week under investigation, and information was also obtained as to the total income, and the number, ages and sexes of persons in the families of each. It was found that the total income per man value per week varied from 6*s*. 8*d*. to 10*s*. 2*d*., and the amount spent on food from 3*s*. 6*d*. to 5*s*. 8*d*. Calculated per person the amount spent on food varied from 2*s*. 1*d*. to 3*s*. 10*d*. per week. The families were spending less than the British Medical Association's (1933) minimum figure of 4*s*. 10*d*. per man value per week on food. It must be emphasised that the six diets investigated are probably not representative of the average diet of the unemployed man in Lincoln, since only the more intelligent housewives were able or willing to co-operate in the investigation, and these women were presumably spending their money more wisely than their less intelligent neighbours. It can probably be assumed that very few families were having better diets than those investigated, and many were probably having ones which were far less satisfactory from every point of view.

The chemical composition of the individual diets is shown in Table VII. The average intake of each dietary constituent is given, and these values are also expressed as a percentage of the corresponding values found for employed men of the middle class, and shown in Table II. It will be observed that the intakes of bread and of carbohydrate are higher for the unemployed than for the employed, but the intake of every other constituent is lower. This is especially marked in the case of fat and calcium. The percentage of calories derived from fat was lower, and the percentage from carbohydrate higher than was found among the employed men. The intake of fresh milk is only 0·22 pint per day in the case of the unemployed, or 38 per cent. of the amount taken by men of the middle class. Sweetened, skimmed, condensed milk was frequently used in tea in addition to several teaspoonsful of sugar. Several cups of tea were usually drunk at every meal. In two cases no fresh milk at all was taken during the week. Burns (1933) in a study of the milk consumption in 1000 families in County Durham, where the average income for food ranged from 5*s*. 10*d*. to 3*s*. per person per week, found a maximum intake of 0·25 pint of milk per head per day, and in many families no fresh milk was purchased.

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Fresh fruit was rarely if ever eaten, except tomatoes. These were cheap at the time of the investigation and were consumed by four of the subjects. Very large amounts of potatoes were eaten, boiled, roast and chipped, but other vegetables only at infrequent intervals.

Fried fish was bought by five out of the six families investigated. The meat most usually eaten was stewing beef, but corned beef or sausages were also quite commonly used.

Table VII. *Individual food intake of six unemployed men*

	Subject 1	2	3	4	5	6	Average	Intake as percentage of employed men's intake
Calories per day	2643	2660	2429	2040	3835	3492	2850	90
Calories (per kg. body weight per day)	41	31	30	31	48	60	40	91
Protein (g. per day)	86	82	66	66	94	104	83	85
Animal protein (g. per day)	52	56	39	47	49	68	52	78
Fat (g. per day)	82	90	78	87	130	102	95	74
Carbohydrate (g. per day)	372	363	350	229	545	520	397	114
% calories from protein	13·4	12·6	11·1	13·3	10·0	10·6	11·8	90
% calories from fat	28·8	31·2	30·0	39·8	31·5	27·0	31·4	80
% calories from carbohydrate	60·0	56·0	59·2	46·0	58·2	61·1	56·8	122
Calcium (g. per day)	0·52	0·57	0·12	0·59	0·90	0·99	0·61	70
Total phosphorus (g. per day)	1·11	1·35	0·81	1·01	1·56	1·58	1·24	77
Available phosphorus (g. per day)	1·08	1·32	0·75	0·98	1·47	1·55	1·19	76
Total iron (mg. per day)	12·5	12·8	13·5	11·2	17·5	16·7	14·0	83
Available iron (mg. per day)	8·5	8·7	9·5	6·1	13·4	8·9	9·2	85
Fresh milk (pints per day)	0·26	0·61	0	0·32	0·12	0	0·22	38
Meat (oz. per day)	4·4	3·7	4·4	3·2	2·6	5·6	4·0	77
Bread (oz. per day)	11·1	8·9	6·7	6·3	9·6	10·6	8·9	117

It must be concluded from these results that the diets of these unemployed men were not, as a whole, grossly deficient. In one case (subject No. 3) the calcium intake was extremely low (0·12 g. per day). It must not be assumed that these results provide any information as to the average diet of the unemployed. They do, perhaps, show what can be done by a comparatively intelligent housewife, but the number of diets investigated was too small to warrant the drawing of any general conclusions. They are given merely as a comparative study.

CONCLUSION

Objections are sometimes raised that dietary studies such as this are of little or no value. To quote Greenwood (1934): "The nutritional habits of different peoples differ enormously. Some of these differences are inevitable, others are not. We do not eat calories or even protein, but food, we obtain food from different sources and cook it in different ways. Each nation has something to learn and something to teach, but the information is not exchanged; what is exchanged is a balance sheet of energy and proximate principles. This has taught us something, but, in my submission, little that is of direct practical importance. We need to pass beyond these comparatively unhelpful averages to the immediate data of human experience."

Be that as it may, it is the "balance sheet of energy and proximate principles" that ultimately matters. The Englishman may prefer to take his protein in the form of roast beef rather than as baked hippopotamus. Never-

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theless, it is the protein which is necessary and not the beef nor the hippopotamus *per se*.

It is impossible to publish detailed information as to the varieties and amounts of different foodstuffs consumed by each individual in the present investigation, but the original records are being deposited in the library of the National Institute for Medical Research, Hampstead, where they may be consulted if desired.

SUMMARY

1. A study of the freely chosen diets of sixty-three men of the English middle class has been made by the "individual" method. All food was weighed for the period of a week, and the amounts of protein, animal protein, fat, carbohydrate, calories, calcium, total and available phosphorus and total and available iron in the individual diets have been calculated. Detailed and averaged results for the diets are given.

2. The average calorie intake was 3067 per day, but a very wide variation was observed (1772–4955 calories), and it is suggested that the adoption of 3000 calories as the requirement of an individual man may be most misleading.

3. There was a definite, but mathematically insignificant, decrease in calorie intake with increasing age. The individual variation at each age was so great, however, that no rules for the guidance of individuals as to their dietary requirements at different ages can possibly be formulated.

4. No significant correlation existed between calorie intake and body weight.

5. The proportion of calories derived from fat was higher than any figures previously recorded in this country. The proportion of calories derived from carbohydrate was correspondingly lower.

6. The total calcium, phosphorus and iron intakes were 0·87 g., 1·61 g. and 16·8 mg. per day respectively. 98 per cent. of the total phosphorus eaten was in an "available" form, while only 66 per cent. of the iron could be considered to be physiologically available.

7. A similar study has been carried out on six unemployed men, and the chemical composition of these diets is compared with that of employed, middle-class individuals.

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MEN

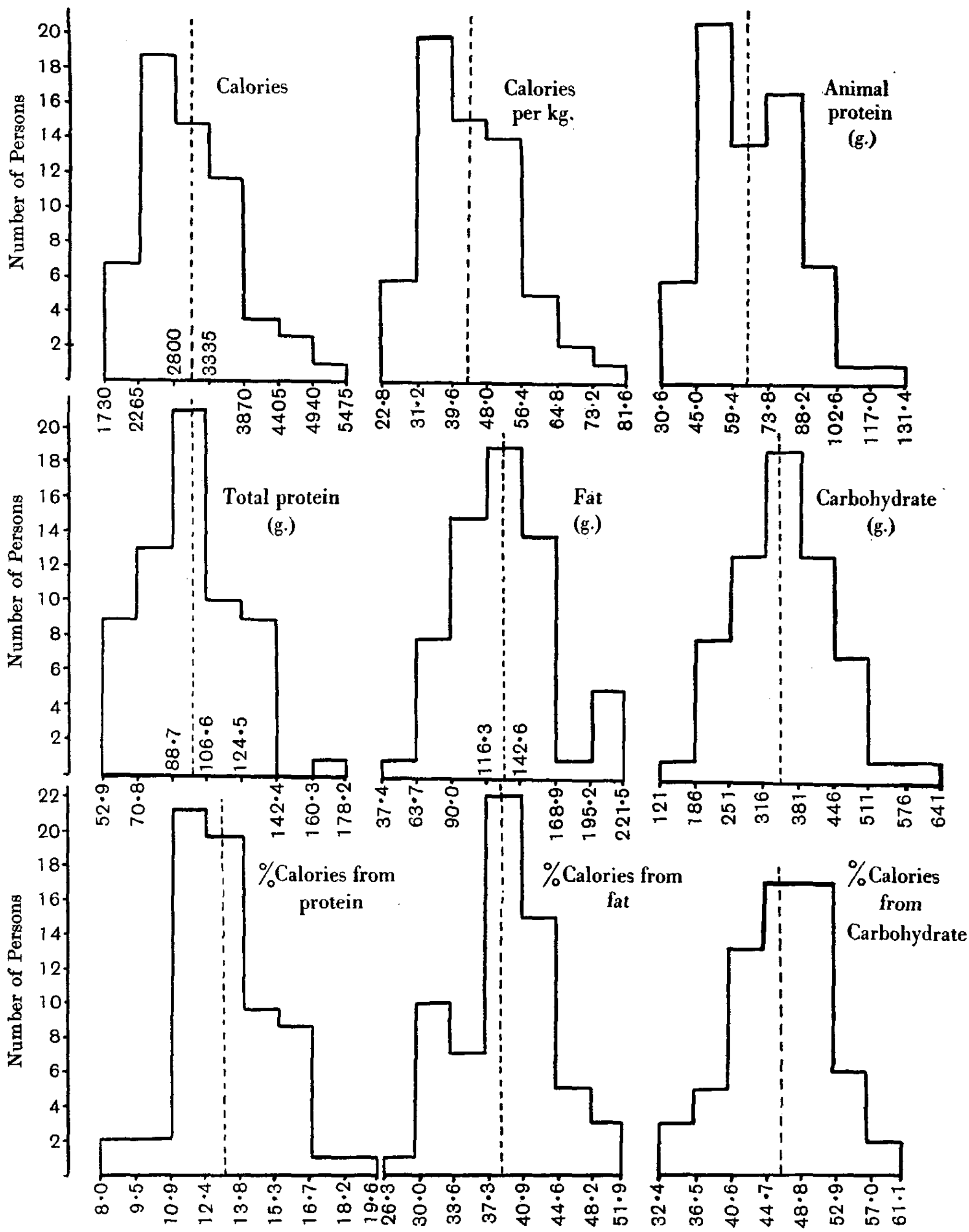

Fig. 1. Men's frequency distribution diagrams of daily intakes of various dietary constituents.

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MEN

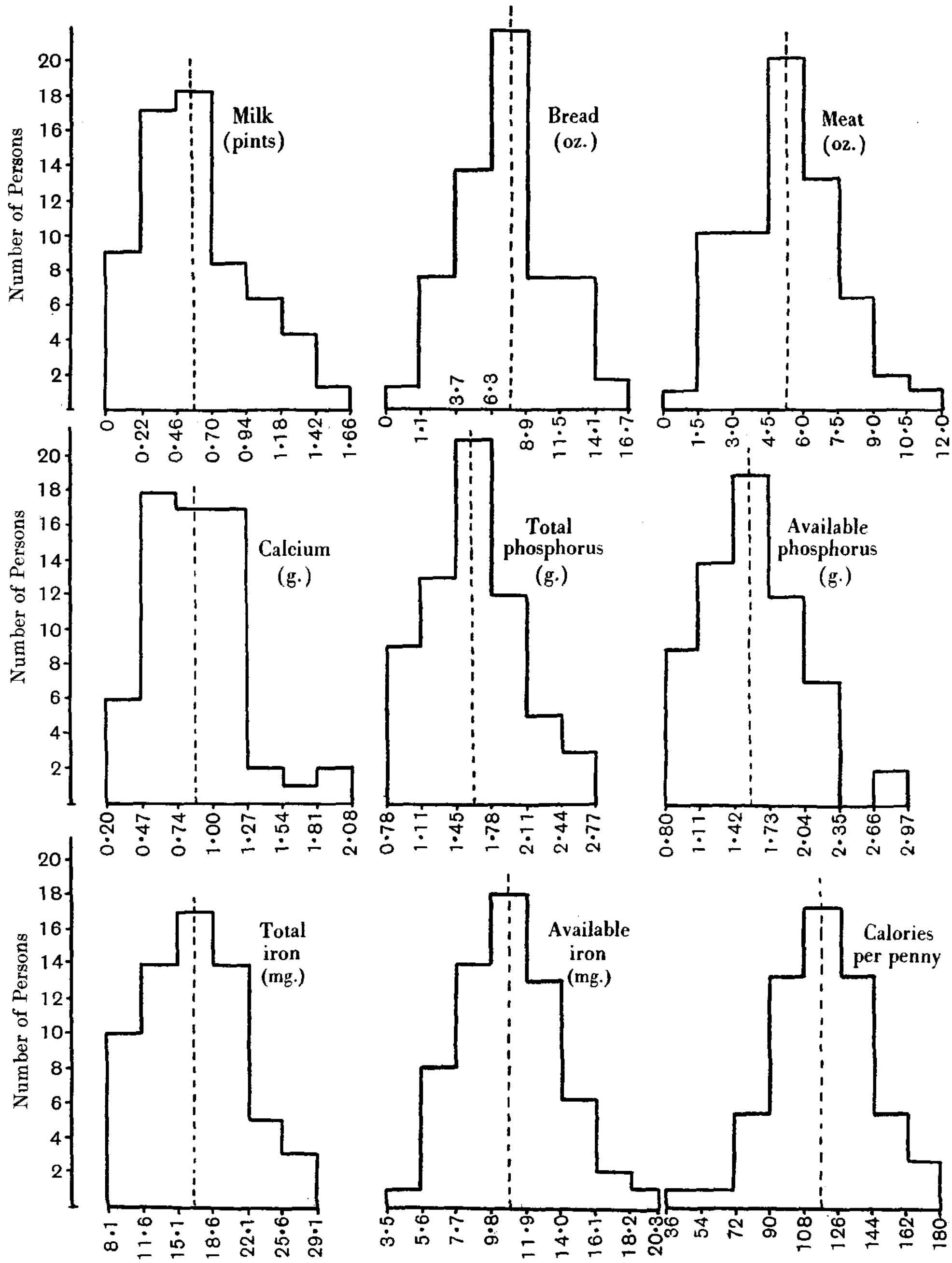

Fig. 1 (*continued*).

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