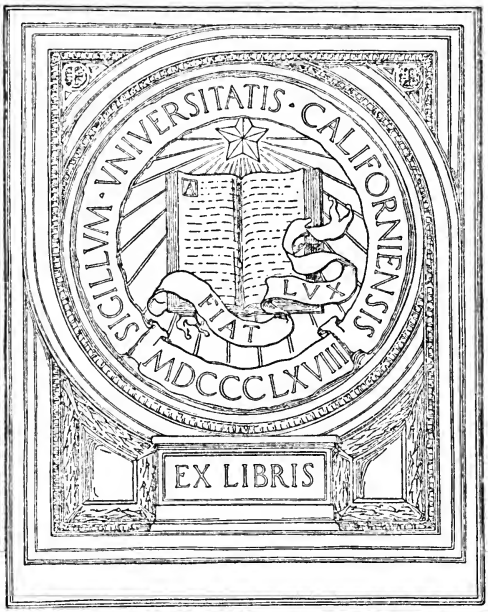
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FOOD ECONOMY IN WAR TIME

BY

T. B. WOOD, M.A.
Drapers Professor of Agriculture

AND

F. G. HOPKINS, M.A., F.R.C.P., F.R.S.
Professor of Biochemistry

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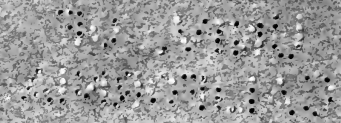

I

INTRODUCTORY

It is well understood by the public that at the present time a rigorous economy in food is not only desirable on general grounds, but absolutely necessary to the success of this country in the task before it.

While all may have the wish to economise, many will feel the need of some guidance with regard to the lines upon which economy may be practised without injury to health. Some such guidance this pamphlet is intended to supply.

A general economy in the use of food is clearly called for, since its practice will lead to what is now so greatly desirable, an appreciable increase in the current national savings. The country spends some £600,000,000 a year[1] upon its food and a saving of one-tenth of this would be no mean item. But, further, since there is likely to be a serious shortage in particular foodstuffs, and especially in meat, a wise course of economy will include a serious endeavour to substitute the more plentiful for the less plentiful foods. There exists, it is true, a consideration of importance which somewhat complicates the course of simple retrenchment; the necessity, namely, of giving first choice when possible to the foodstuffs which are produced at home, so that our indebtedness to other countries may grow no faster than is necessary during the war. On this point the Government must give the public guidance from time to time.

Subject to the qualification just mentioned economy is clearly possible upon each of two lines. Less may be eaten, and foods which cost less may be substituted for those which

[1] Calculated at retail prices.

cost more. But to each of these possible courses certain considerations must be applied. It must be recognised, for example, that the first course, that of eating less, is not open to the whole nation. A proportion of the population, probably not less than a quarter of the whole, is already limited by the smallness of its earnings to the consumption of a minimum. But for a great number a lessened consumption of food (and especially of meat) is possible, and that without any danger to health. This applies in particular, as will be later pointed out, to those who in the present crisis are not called upon to do strenuous physical work, be it in the field or in the factory. For those to whom such work is allotted, and for growing children, the nation must endeavour at whatever cost to maintain a generous food supply. To the application of the second method of economy—that of consuming the cheaper rather than the dearer foodstuffs—there are of course certain limitations. It is clear, for instance, that if there were a greatly increased consumption of some one cheap foodstuff—say oatmeal for example—an increase in the price would check the economy attached to its use. On the other hand if the dearer forms of food were too rigidly avoided by those accustomed to consume them there would be a dislocation of the market which (for a period at any rate) might lead to wastage rather than to economy. A careful consideration of the domestic budgets of different classes of the community would suggest the following possibilities. While the very poor cannot be expected to practise any appreciable economy at all, families in which the earning power reaches from 40*s.* to 50*s.* a week can economise by more careful marketing, and by the replacement of a certain proportion of dear foodstuffs by an equivalent quantity of cheaper forms. The well-paid artisan class and the lower middle classes can save by a similar replacement carried out to a greater degree (and especially by lessening to some extent their consumption of meat), but also by an appreciable reduction in the total amount of food eaten. The well-to-do, without perhaps greatly altering the nature of what they eat, can increase their savings for national investment and conserve the supply of available foodstuffs by consuming considerably less.

But to all classes, even to the wealthy, it is now more important than it would be under ordinary circumstances to watch the markets. If an article of food of which the price is falling (or rising but slowly) be purchased rather than a similar or comparable article of which the price is quickly rising, the supply and consumption of our various foodstuffs will be more equably adjusted, and this circumstance will in itself make for national economy.

But as we have said those who are prepared to make alterations in their consumption of food in order to conform with the urgent national needs of the moment may require information as to how far such alterations, whether of degree or of kind, can be made without danger to health and efficiency. Before presenting tables which are intended to show the relative cost of equivalent nutritive values when purchased in the form of different foods, we give therefore a brief account of the function of food in general and of the special importance of its individual constituents.

II

THE USES OF FOOD

The two distinct Functions of Food: (1) as a Source of Power, and (2) as Material for Repair

The human body, though doubtless, in many of its aspects, something more than a mere machine, resembles the steam-engine in two respects. It calls for a constant supply of fuel, and, as a result of doing work, it suffers wear and tear. The body must burn fuel in order that the heat which it is always giving off may be continuously replaced; and it must burn still more fuel whenever it does work. From this necessity there is no escape. The body must also undergo repair, and if it is to remain healthy, its repair must keep pace with the wear and tear which it daily suffers.

It is of course the food eaten which provides each of these fundamental needs of the body, and, if we are to understand properly the nutrition of mankind, we must bear in mind the two distinct functions of food: its function as fuel and its function as repair material. Obviously, when we are considering the nutrition, not of the adult but of the young, we must remember that something more is required of the food; it must supply material for growth and increase.

Measurement of Requirements in Respect of Fuel.

If information is available as to how much fuel and how much flesh-forming material are really necessary for the body under various conditions, it cannot fail to be a guide for economy in the use of foodstuffs.

Some people may vaguely feel that the nutrition of complex living creatures must involve factors which are too subtle for measurement. They may cherish a doubt whether the needs of the human body can be definitely expressed in pounds and ounces or other such units.

But there is no vagueness about our knowledge of the requirements of the body in respect of fuel. With suitable apparatus it is possible to measure with accuracy the total heat lost by the body of any individual in a given time. If the individual is doing work we can also measure, or calculate, the equivalent of that work in the form of extra heat lost by the body. Such measurements have been repeatedly made, with consistent results, upon individuals who during the investigation were resting, working moderately, or doing heavy work. It is clear that the least quantity of food which will serve the body under these various circumstances is that which will supply fuel to cover the loss of heat and the work-power expended. If less is supplied, the body burns its own tissues and suffers loss of weight. How exactly are we to decide on accurate lines how much and what kind of food will contain the requisite value as fuel to prevent such loss?

In the first place, we can burn the foodstuffs outside the body, treating them thus as actual fuel, and with proper apparatus

determine exactly how much heat each kind of food will give out when completely burnt. This, of course, is a perfectly constant quantity for a given food, but varies greatly with different foodstuffs. A given weight of fat, for instance, gives out more than twice the heat yielded by the same weight of sugar or starch.

Now when, in carefully conducted experiments, we are measuring the total heat lost by the body, and the heat value of the work it is doing, we can, at the same time, exactly determine the amount and kind of material which is being burnt in the body. On these lines we have arrived at the very important knowledge that food material burnt in the body produces just that amount of heat which it yields when burnt as actual fuel in a fire-grate or boiler furnace. The human body with all its subtleties has no power of extracting more than this. This is the justification—and it is a complete justification—for the quantitative statements concerning fuel values which occur in what follows, and which appear in the tables. But statements concerning quantities cannot be made without the use of some unit. The unit of fuel value usually chosen is known as a *calorie*. It represents the amount of heat which will raise the temperature of a kilogramme (about $2\frac{1}{4}$ lbs.) of water one degree centigrade. The layman from lack of familiarity can hardly grasp what this amounts to, in the sense that he can grasp the meaning of, say, a pound weight; but in comparing the fuel value of one foodstuff with that of another, there is no need to form a mental picture of the absolute value. When we are told that a pound of steak yields 1270 calories and a pound of oatmeal 1860 calories we understand that the latter yields nearly half as much again as the former. This kind of comparison is all that is necessary.

All the natural foods are in the main made up of four constituents, namely: fat, carbohydrate (starch or sugar), protein, and mineral salts. Of these the first three all have value as fuel. The mineral salts have no such value, though they must be eaten in order to maintain a proper store of mineral constituents in the body. Knowing as we do the exact fuel value of pure fat, starch, sugar, and protein, we might,

after chemical analysis, calculate the value of any given foodstuff, meat, or flour, or vegetable, but it is more satisfactory to determine it directly. All the values in the tables which follow have been so determined.

We may now make a statement as to the actual requirements of individuals in respect of the fuel value of their food. It is clear that these will vary with the nature of the employment. They will also vary to some extent with the weight of the body. With regard to the latter factor we shall be content to give figures for average individuals with a body-weight of about 11 stone. In speaking of light muscular work we mean such as that done, for instance, by clerks, tailors, shopmen, and most professional men. Medium work is that done, for instance, by mechanics, porters, joiners or ordinary farm labourers. Heavy work would be represented by that of blacksmiths, dock labourers, soldiers in the field, etc.

	Fuel value required in calories per diem
Sedentary occupations	2500
Light muscular work	3000
Medium muscular work	3500
Heavy muscular work	4000 or more

Exceptional employments, especially those which involve heavy work done rapidly, may call for quantities considerably in excess of the above. Women require on the average about four-fifths of the requirements of a man doing moderate work; a child of ten years wants from half to three-fifths, and a girl or boy of sixteen about seven-tenths of a man's ration. Growing children require always proportionately more than an adult.

The Average Requirement for Flesh-forming Food.

When we come to deal with the growth and repair of the body one particular constituent of foods becomes of special importance. Nine-tenths of the solid matter of our flesh consist of protein, and in order to make flesh we must eat protein. This does not mean that we must obtain all we need

in the form of animal flesh, for vegetables also contain this important material. While everybody is perfectly familiar in a general way with the nature of the other chief foodstuffs—fats and starches—familiarity with the nature of proteins is perhaps less general. It will be sufficient to remember that they are the most prominent constituents of our muscles and our blood, and are contained in all tissues, animal or vegetable, that are living or have lived. What should at any rate be clearly understood is that they form highly necessary constituents of our diet. It is not enough, as has already been pointed out, to supply the body with fuel; the diet must at the same time contain enough protein for maintaining the repair of the working organs.

It is usually taught that a man not engaged in heavy work requires about four ounces of protein in his daily food. Now this amount is contained in about 18 ounces of lean beefsteak, while to obtain the same amount wholly in the form of white bread we should have to eat $2\frac{3}{4}$ lbs. If we were depending upon potatoes alone nearly 9 lbs. would have to be eaten. Such figures illustrate the value of mixed dietaries. Potatoes alone would clearly be an unpleasantly bulky food, and so would many other vegetable foods if we had to rely upon them singly. On the other hand, lean meat alone would be equally unsatisfactory, for though the 18 ounces mentioned would supply the necessary flesh-forming material, something like 5 lbs. would have to be eaten to supply the necessary fuel value. By combining foods rich in flesh-forming material with others proportionately rich in fuel value we can supply both needs of the body without eating undue amounts. There has been a tendency during recent years on the part of some authorities to claim that 4 ounces of protein is too much for ideal conditions of nutrition, and to suggest that a reduction would make for economy. If, however, any rational combination of ordinary natural foodstuffs is eaten, the consumption of enough material to supply the requisite fuel value will, because of the constitution of such foodstuffs, actually involve the simultaneous consumption of a quantity of protein which is never very much below the standard 4 ounces. An economical diet may indeed

contain as little as $3\frac{1}{2}$ to $3\frac{3}{4}$ ounces, but any attempt to reduce the protein much below this, and yet keep up a proper standard of fuel value, calls as a matter of fact for the addition of materials which are not economical. An individual duly provided with a supply of the commoner natural foodstuffs sufficient to maintain his body temperature, and to enable him to work, is at any rate secure from the risk of a serious deficiency in flesh-forming material.

The protein of vegetable foods is not so completely digested as that contained in animal foods, nor does it seem to be quite so suitable for repairing the working parts of the body. For these reasons the daily requirements of protein are somewhat higher than those stated above in cases where a large proportion of the protein eaten is in the form of vegetable foods.

Special Properties of Meat Foods. The Requirements for Heavy Work.

We have hitherto been thinking of the average conditions of life in this country. The existence of other conditions may considerably modify the desirable standard of protein consumption. Protein, in addition to its special flesh-forming powers, has one other property as a food which is scarcely shared by fats or starches. It directly increases the processes of combustion in the body, not so much because it is itself a fuel (it has indeed a fuel value no higher than that of starch and much less than that of fat) but because it directly stimulates combustion in the body. It makes so to speak the fires burn more brightly.

It is thus desirable that protein, as well as the total fuel value, should be increased in the diet of those who have to suffer cold or exposure, and of those who have to do heavy work under stress. We have already pointed out, and it will be readily understood, that with increase of work there must be proportionate increase in the food consumed. But there is a further point which needs emphasis in this connection. A man taking only so much food as will just cover the work he has to do must perform the work slowly. He must be, as it

were, economical in his movements. Such, for example, is the usual condition of ill-paid labourers whose food amounts to the bare minimum. The man who has to work rapidly and be prepared for sudden and severe calls upon his energy needs a larger margin in his food supply. He should be always like a steam-engine with full steam up. To such a condition of the body a good sufficiency of protein undoubtedly contributes. Other foods may be, and are, good fuel for the muscles, but a generous consumption of protein secures that the maximum muscular power shall be always and quickly available. Such protein is most readily obtained in the concentrated form of meat. During exposure to cold protein has again a special function because of its power to quicken combustion in the body. The Eskimo eats much fat as a source of body-heat; but only when he has eaten, as he usually does, a large amount of protein also, can he perform such a feat as sleeping without cover in spite of the rigor of his climate. This he frequently does with impunity when well stuffed with seal flesh. In winter it is especially desirable that troops in the field shall receive a good supply of meat as well as abundance of other foods.

The Requirements of a Sedentary Life.

The moral of what has been said in the last section is that during such a crisis as is involved in war the civil population, and especially that part of it which leads a sedentary life, or follows pursuits which do not necessarily call for physical activity, should, if there be any danger of shortage, eat meat sparingly in order that soldiers in the field and workmen engaged in strenuous physical labour for national ends should be in no danger of a deficiency. Meat certainly has, as we have already stated, special stimulating properties which, in its absence, are missed by those accustomed to it. But in so far as these properties are valuable to health their effect can be sufficiently obtained with a comparatively small daily consumption, while the main supply of protein as well as of fuel food can be eaten in cheaper forms. The necessary minimum

of protein may be obtained, as the tables in this pamphlet abundantly show, at a startlingly less cost in foodstuffs other than meat. Thus while one pound of protein costs five or six shillings in the form of beef, it costs only 5½*d.* when purchased in bread, 3*d.* in oatmeal, and 6*d.* in such vegetables as peas. If it be true that individual vegetable proteins are somewhat less valuable to the body than meat proteins, the difference largely disappears when the vegetable foods are eaten in combinations, and in sufficient variety.

Apart from saving in meat it is easy and safe for those who have no special calls for physical endeavour, and they still form a large proportion of the population, to eat less altogether. Many people in making a substantial reduction in their food will only be bringing their consumption down to a normal and healthy level. But should unforeseen difficulties arise in connection with the national food supply it is possible for individuals to go further than this without actual danger to themselves. Many modern investigators have shown indeed that the consumption of protein may, at least for several months, be reduced from the normal 4 ounces to 2 ounces, and the total consumption of food reduced by a third or more without any obvious effect upon the health. Such facts are not to be applied to the fighter or the strenuous worker, and the need for such a reduction as this is not likely to arise for anybody in this country. But those of whom a much smaller economy is asked at the present juncture may well bear these facts in mind. Normal food consumption in this country, if that of the poorest classes be excepted, leaves a good margin to draw upon before the limits of safety are reached. Even if abstinence calls for some effort, and causes some discomfort, the effort will be for a period only, and the discomfort is after all soon forgotten. Intellectual activity, it should be understood, makes very small demands upon food.

Those who reduce their consumption of food should perhaps be advised to lessen the amount of exercise taken for pleasure. This is a suggestion which will not be welcomed by the majority, but it should be understood that, with many, the need felt for constant exercise is in part due to the fact that the

food eaten is in excess of what, without the exercise, would cover the needs of the body.

The Need for Natural Foodstuffs.

One further point must be touched upon. A healthy dietary, whether for workers or non-workers, should contain always a fair proportion of natural foodstuffs which have undergone no artificial treatment. White bread, polished rice, condensed milk, and "separated" patent foods may be quite satisfactory sources of protein and energy. They are perfectly wholesome if they do not form too large a proportion of the total food eaten; but the treatment they have received results in a deficiency in certain essential properties, and they must be supplemented by other foodstuffs; if not by meat, then by fresh vegetables, whole grain foods, fresh milk, eggs, etc. Lastly, the occasional consumption of uncooked foods is important for health, and in times of scarcity it is better to sacrifice something in the total quantity eaten rather than to dispense altogether with such accessories as fresh fruit and salads.

III

TABLE OF FOOD VALUES AND THEIR COST AS BOUGHT IN DIFFERENT FOODSTUFFS

In the preceding pages it has been shown that the food must supply every day a certain amount of protein, about 4 oz. per day for a full grown man. In these times of war when economy is so desirable it is important to know the cost of everything we buy, so we will calculate the cost of protein in several common articles of food. The calculation is not quite a simple matter for no common feeding stuff owes its value to protein alone. How this difficulty can be surmounted a few examples will show.

The cheapest cuts of beef nowadays cost 10*d.* per lb. From the average of published analyses it appears that they contain as purchased about 15 per cent. of waste and 50 per cent. of water. Neither of these constituents has any definite value though a careful housekeeper will probably utilize the waste for making soup or gravy. The two constituents for which we buy the beef are protein of which there is present on the average 15 per cent., and fat of which the beef contains on the average 14 per cent.

To find the cost of the protein we must subtract from the whole cost of the meat the value of the fat, which we can find from the price of suet and lard which contain practically fat and nothing else of value. Suet containing 80 per cent. of fat costs 8*d.* per lb. and lard containing 95 per cent. of fat costs about 10*d.* per lb. Fat therefore costs about one-tenth of a penny per one-hundredth of a pound. A pound of the beef we are dealing with contains fourteen-hundredths of a pound of fat which is worth fourteen-tenths of a penny or almost exactly 1½*d.* Subtracting this sum from 10*d.*, the cost of the pound of beef, we get 8½*d.* as the cost of the 15 per cent. of protein, from which it appears that 1 lb. of beef protein costs 4*s.* 9*d.*

In the case of milk the calculation is still more complicated for milk contains sugar as well as protein and fat. It is quite easy however to allow for the value of the sugar, for we know that ordinary sugar at the present time costs 3*d.* per lb. which makes the price of one-hundredth of a pound three-hundredths of a penny. The retail price of milk as the housekeeper buys it is 2*d.* per pint which is almost exactly 1½*d.* per lb. Milk contains on the average 87½ per cent. of water, 3½ per cent. of protein, 3½ per cent. of fat and 4 per cent. of sugar. The fat and the sugar together are worth 47 hundredths of a penny or almost exactly ½*d.*, which leaves 1*d.* as the cost of the 3½ per cent. of protein. Milk protein therefore costs per lb. 2*s.* 4½*d.* or exactly half as much as beef protein.

These calculations serve to show how we have arrived at the cost of a pound of protein in all the common foodstuffs. The results are given in the third column of the following table.

The fourth column shows the value of 1 lb. of each foodstuff considered as fuel. It illustrates the relative ability of different foods to yield heat and work in the body. The fifth column shows the relative cost of such fuel as bought in different foods. For convenience we have calculated this in terms of 1000 calories on which basis one food can be compared with another. This comparison of relative cheapness or dearness is the only point that matters in practice.

It will be of course understood that in using the table combinations have to be thought of. One food may be a cheap source of protein, quite another a cheap source of fuel. It must be remembered that each adult requires every day about 3000 calories, and the supply of this must be so selected as to give him at the same time from $3\frac{1}{2}$ to 4 ounces of protein.

One more point in explanation of the tables. The figures all refer to the foods as purchased. For instance potatoes are bought at $\frac{1}{2}d.$ per pound. Before they are cooked they are usually peeled and the eyes and other defects are removed. This causes some waste. But as one intention of this little book is to help people to buy, the amount of protein and the number of calories are given in the potato in the condition in which it is bought and not in the potato peeled ready for cooking.

In the case of articles which are sold at per head and not per lb., we have bought several and weighed them, working out from the weight and price per head the price per lb.

We have taken some trouble to ascertain the latest average war prices per lb. of all the articles mentioned in the tables. We do not fail to recognize that some may be open to criticism. Prices vary rapidly in these times, from day to day and from place to place. The differences in price per lb. of protein and per 1000 calories are however so great that considerable variations of price do not affect the lessons shown by the tables. Also where the local price varies from that stated, the price per 1000 calories can be calculated at once by multiplying the price per lb. by 1000 and dividing the product by the number of calories per lb. as stated in column 4

The prices given are as a rule the average prices at which

small quantities can be bought in Cambridge. The keen marketer or the contractor for large quantities may be able to buy to greater advantage.

Name of food	Price per lb.	Oz. protein in 1 lb.	Cost of 1 lb. protein	Calories per lb.	Cost per 1000 calories
Butcher's meat	*s. d.*	oz.	*s. d.*	calories	*s. d.*
Beef, cheaper cuts	0 10	2½	4 9	1006	0 10
„ sirloin	1 2	2½	6 5	1108	1 1
„ rump steak	1 6	3¼	6 7	1110	1 4½
„ heart	0 8	2½	3 6	1320	0 6
„ liver	0 6½	3½	2 6	555	0 11¾
„ tripe	0 8	—	—	955	0 8½
Veal, breast	0 10	2½	5 0	750	1 1½
„ loin	1 3	2¾	5 11	690	1 7
„ cutlets	1 8	3¼	8 0	690	2 5
Calf's liver	1 3	3	6 4	575	2 2
Mutton, neck, scrag end	0 10	2	5 7	1055	0 9½
„ leg	1 2	2½	7 0	900	1 3½
„ chops	1 3	2	7 8	1575	0 9½
Lamb, breast	0 11	2½	5 0	1090	0 10
„ shoulder	1 2	2¼	6 10	1265	0 10
„ leg	1 3	2½	6 9	1130	1 1
Sheep's heart	0 6	2¾	2 5	845	0 7
„ liver	1 2	3½	4 9	905	1 3½
„ head	0 2	1½	1 4½	290	0 7
Pork, leg	1 0	2¼	5 8	1345	0 9
„ loin	1 2	2	7 4	1340	0 10½
„ sausage	0 11	2	4 2	2125	0 5¼
Poultry					
Chicken	1 9	2	13 4	295	6 0
Fowl	1 3	2¼	8 4	775	1 8
Preserved meats					
Ham	1 1	2¼	5 10	1670	0 7¾
Bacon	1 2	1½	7 5	2685	0 5¼
Corned beef	1 0	2¼	3 2½	1280	0 9½
Tinned tongue	2 0	3¼	9 5	1340	1 6
Dairy products					
New milk (per pint)	0 2	¾	2 4½	406	0 4¾
Separated milk (per pint)	0 0½	¾	0 7	212	1 3
Condensed milks:					
Whole sweetened (per tin, 6*d.*)	0 6½	1½	5 6	1618	0 4
„ „ („ 5*d.*)	0 5¾	1½	5 0	1680	0 3½
Skimmed („ 4*d.*)	0 4¼	1½	3 9	1252	0 3½

Name of food	Price per lb.	Oz. protein in 1 lb.	Cost of 1 lb. protein	Calories per lb.	Cost per 1000 calories
	s. *d.*	oz.	*s.* *d.*	calories	*s.* *d.*
Cheese, Cheddar	1 0	4¾	2 6	2055	0 6
„ curd	0 3	2	1 10	445	0 6½
„ half cream	0 8½	2	4 2	1159	0 7¼
Fresh eggs, 1½*d.* each (8 eggs weigh 1 lb.)	1 0	2	7 0	635	1 6¾
Fresh fish					
Lobster	1 6	1	25 0	140	10 9
Salmon	2 6	2¾	13 5	935	2 9
Hake	0 10	1¼	12 0	150	5 6
Halibut	1 6	2½	9 9	740	3 2
Haddock	0 8	1¼	8 4	165	4 1
Mackerel	0 8	1½	6 3	365	1 10
Cod	0 10	2¾	5 0	335	2 6
Herring	0 3½	1¾	2 7	375	0 9½
Preserved fish					
Tinned salmon	1 4	3¼	6 4	680	2 0
Tinned lobster	2 0	3	12 6	390	5 2
Frozen salmon	1 3	—	—	—	—
Smoked haddock	0 8	2½	4 2	305	2 2
Smoked codling	0 6	2¼	3 4	365	—
Kippers	0 8	3¼	2 11	750	0 10¾
Sardines in oil	2 0	3¾	12 0	950	2 1
Fried fish	0 5¼	2½	2 1	1000	0 5¼
Vegetable foods					
Bread	0 2	1½	0 5½	1225	0 1¾
Oatcake, home made	0 3	2	0 3	1840	0 1¾
Oatmeal	0 3	2½	0 3	1860	0 1¾
Dried peas	0 3	4½	0 6	1655	0 1¾
Dried beans	0 4	3¾	0 9	1605	0 2⅓
Lentils	0 4	4¼	0 10	1620	0 2½
Macaroni	0 6	2	2 7	1665	0 3½
Rice	0 2½	1¼	0 6¼	1630	0 1½
Sago	0 4	1½	1 10	1635	0 2½
Cereal breakfast foods	1 1	2	6 10	1700	0 7¾
Flour	0 2½	1¾	0 4½	1650	0 1½
Nuts					
Brazil nuts	0 7	1½	3 4	1655	0 4¼
Filberts	0 10	1¼	7 6	1575	0 6½
Chestnuts	0 2	1¼	0 3	945	0 2
Pea nuts	0 3	4	—*	2353	0 1¼
Almonds	2 0	1¾	15 6	1660	1 2½

* Valuing the fat in pea nuts at $\frac{1}{10}$th of a penny per one per cent. per lb., the protein costs nothing.

Name of food	Price per lb.	Oz. protein in 1 lb.	Cost of 1 lb. protein	Calories per lb.	Cost per 1000 calories
Fresh vegetables					
	s. d.	*oz.*	*s. d.*	calories	*s. d.*
Potatoes	0 0½	0¼	0 7¼	310	0 1½
Green peas	0 5	1	5 1	465	0 10
Carrots	0 0¾	0⅐	5 1	160	0 4¾
Turnips	0 0¾	0⅐	5 6	125	0 6
Brussels sprouts	0 1¼	0¼	5 5	80	1 4
Artichokes	0 1¼	0½	2 7	365	0 3½
Beetroot	0 1	0¼	5 2	170	0 6
Cabbage	0 1¼	0¼	6 8	125	0 10
Cauliflower	0 1½	0¼	6 2	140	0 11
Celery	0 1	0¼	8 6	70	1 2
Leeks	0 1½	0⅛	11 2	130	0 7¾
Onions	0 1	0¼	4 6	205	0 5
Spinach	0 2½	0¼	9 6	110	1 11

Foods containing very little protein

Name of food	Price per lb.	Calories per lb.	Cost per 1000 calories
Fatty foods	*s. d.*	calories	*s. d.*
Butter	1 6	3605	0 5
Lard	0 10	4010	0 2½
Suet	0 8	3540	0 2¼
Margarine	0 6	3525	0 1¾
Dripping	0 6	4000	0 1½
Cream	1 2	910	1 3½
Starchy foods			
Tapioca	0 5	1650	0 3¼
Arrowroot	0 7½	1815	0 4¼
Cornflour	0 4	1645	0 2½
Pearl barley	0 2¾	1650	0 1¾
Sugar	0 4	1860	0 2¼
Jam	0 5	1400	0 3½
Treacle	0 4	—	—
Dried fruits			
Figs	0 5	1475	0 3½
Prunes	0 6	1190	0 5
Dates	0 4	1450	0 2¾
Raisins	0 6	1445	0 4¼
Apricots	0 9	1290	0 7
Apples	0 7	1350	0 5¼

The analytical data from which the above table was constructed were mainly obtained from American sources (*Bulletin* No. 28, U.S. Dept. of Agriculture, Washington), but in the case of many of the items we have ourselves determined the protein and calories present.

No one can look through the above table without admitting at once that it contains much useful information. It is of course impossible to mention in detail every food given in the table. Nor is this necessary, for the foods fall naturally into classes. In the form of fresh butcher's meat 1 lb. of protein costs from 5 to 8 shillings. There are a few exceptions. Chicken is a very expensive source of protein. The cheapest source of fresh meat protein is beef's heart or liver. Neither of these articles can however be bought in considerable quantities, nor are they likely to be very desirable as staple articles of diet. They are to be regarded as economical sources of fresh animal protein for occasional use as a change.

Among preserved meats corned beef is a cheap source of animal protein but in using it the housekeeper must not forget that preserved foods lack something which fresh foods contain. It is likely to be quite satisfactory if used in conjunction with fresh vegetables or salads.

New milk and cheese are very cheap sources of animal protein. Their protein costs only about 2*s.* 6*d.* per pound or about half as much as the protein of fresh butcher's meat, and as far as we know milk protein is as good as the protein of fresh beef, mutton or any other form of fresh meat. The use of milk and its products is to be recommended, but it must not be forgotten that butter contains practically no protein. The protein of fresh eggs costs about as much as the protein of fresh meat.

There can be no doubt that vegetable foods are far the cheapest source of protein. In such common foods as bread, oatmeal, and dried peas and beans the protein costs only from 3*d.* to 9*d.* per pound, which is only about as many pence per pound as fresh meat protein costs shillings. In other words a penny buys as much protein in the form of oatmeal or dried peas as a shilling buys in beef or mutton. It would probably be inadvisable for people who are accustomed to a diet containing a great deal of meat to take all their protein in the form of vegetables, but there is no doubt that a considerable part of the meat usually eaten could be replaced by beans, peas, lentils, oatmeal and such vegetable foods rich in protein without risk

to health and with very considerable economy. For instance, an ordinary man, as we have seen, eats about 4 oz. of protein per day. In the form of fresh meat this costs at present prices about 1*s.* 3*d.* to 1*s.* 9*d.*, say 1*s.* 6*d.* A heavy meat diet might very well be replaced by one in which 1 oz. of protein was taken as fresh meat, 1 oz. of protein as milk and 2 oz. as oatmeal, beans or peas. This would cost at present prices $4\frac{1}{2}d.$ + 2*d.* + $\frac{3}{4}d.$ or $7\frac{1}{4}d.$, a very great saving on the cost of a diet in which nearly all the protein is supplied as meat.

The purchaser may at times be glad to know whether in buying a more costly rather than a cheaper variety of a given foodstuff he is obtaining a proportionate increase in actual food value.

Groceries, for instance, are usually offered for sale in various qualities, the prices of which differ considerably. In order to find out if the quality depended on real food value or on appearance we have analysed a number of samples with the following results:

Article	Price per lb.	Per cent. protein	Calories per lb.	Cost of 1000 calories
	s. *d.*			*d.*
Rice	0 2	7·4	1664	$1\frac{1}{4}$
„	0 3	6·0	1665	$1\frac{3}{4}$
„	0 5	8·0	1702	3
Oatmeal				
Aberdeen	0 $2\frac{3}{4}$	13·8	1986	$1\frac{1}{2}$
Midlothian	0 3	13·6	1992	$1\frac{1}{2}$
Proprietary	0 $3\frac{1}{4}$	—	1900	$1\frac{3}{4}$
Tapioca	0 4	0·22	1620	$2\frac{1}{2}$
„	0 5	0·15	1595	3
Cornflour				
"Genuine"	0 4	0·40	1635	$2\frac{1}{2}$
Proprietary	0 6	0·35	1632	$3\frac{3}{4}$
Prepared cereals				
Breakfast food	1 1	9·4	1760	$7\frac{1}{2}$
„	1 1	10·0	1761	$7\frac{1}{2}$

The figures are instructive. The most striking results are those giving the composition of three qualities of rice. The price varies from 2*d.* per lb. to 5*d.* per lb., but the composition of all three samples is almost identical, especially as regards

the fuel value per lb. In working out the cost of 1000 calories in each of the three samples from the price and the fuel value per lb., the figures in the last column are obtained—from which it appears that the cost of 1000 calories varies from $1\frac{1}{4}d.$ to $3d.$ For actual value obtained therefore the rice at $5d.$ per lb. is more than three times as expensive as the sample at $2d.$ per lb.

On trial the three samples were found to differ very slightly in ease of cooking. Their only real difference is in appearance. There can be no manner of doubt that the cheapest rice is the most economical.

In the case of the oatmeals the results are not so striking. The figures show practically no variation in composition, though the price varies from $2\frac{3}{4}d.$ to $3\frac{1}{4}d.$ and the cost of 1000 calories from $1\frac{1}{2}d.$ to $1\frac{3}{4}d.$ Again the cheaper oatmeal is the more economical.

The two samples of tapioca show exactly the same results. The dearer sample was certainly whiter in appearance, but the composition is practically identical. The extra $1d.$ per lb. is charged for appearance only.

The two samples of cornflour are also instructive. The proprietary preparation costs an extra $2d.$ per lb., in this case for the name only, for both appearance and composition are almost identical.

Altogether the results teach a very clear lesson, that the great variation in price of many articles of food is due rather to appearance or reputation than to variation in actual food value, and that it is therefore in most cases the cheaper article which gives the better value for the money expended.

A word may be added about the various prepared "cereal breakfast foods" as they are called. Two different kinds have been analysed, both giving practically the same results, which work out at $7\frac{1}{2}d.$ per 1000 calories. This is five times as dear as oatmeal and more than twice as dear as other foods of the same class. A point in their favour is their convenience. They are ready cooked and can be used without further preparation, but this can hardly be regarded as an adequate set off against so great a disparity in price.

Finally we give the figures for home-made oatcake which can be made at 3*d.* per lb.

In the next section we discuss in more detail the nutritive value and the cost of certain of the more important individual foods.

IV

NOTES ON INDIVIDUAL FOODSTUFFS

Butcher's Meat.

The cost of a given quantity of protein, though it differs greatly when prime joints or cuts are compared with cheaper cuts, does not vary very much on the average with the nature of the animal from which it is derived. Economy does not at present limit our choice as between beef, mutton, pork, etc. Whether or not it is desirable for a community wishing to economise to purchase the meat of immature animals—to eat, for instance, lamb or veal instead of mutton or beef—is a somewhat complicated question depending upon the current cost of fodder and other factors; the assumption that it is necessarily undesirable is by no means justified. We may assume that all meats will tend to rise in price so long as the war lasts; but the rise may not be uniform. Perhaps the best guide for the consumer who wishes at the present time to put economy before the satisfaction of personal taste is to buy whatever variety of meat is at the moment rising most slowly in price; and this not so much on account of the immediate and direct saving involved, which may be small, but because of the assistance which such a course, if widely adopted, would give to the adjustment between supply and demand. On the other hand it is undesirable that the well-to-do should economise too freely by the unaccustomed purchase of what are held to be inferior parts of the animal; otherwise the poor may suffer by a rise in their price. Apart from the less prized "cuts" reference to the tables will show that protein is particularly

cheap when purchased in such forms as liver, sheeps' or beef's hearts; in sheeps' heads, tripe, black puddings, etc.

A word may be said as to the economic difference between fat and lean meats. Increase in the amount of fat proportionately reduces, of course, the amount of protein purchased in a pound of meat, but the fuel value rises rapidly with the richness in fat. As a matter of fact reasonably fat meat is a more economical purchase than lean meat, because fat replaces water. Lean flesh with 1·5 per cent. fat contains no less than 76 per cent. of water; meat with 29 per cent. fat contains only 53 per cent. So long as the fat is not left upon the family plates, but is actually eaten, whether with the meat itself or later in the form of dripping, etc., more total food value is obtained for a shilling in fat meat than in lean. Moreover the net cost of the protein in the former is not increased proportionately with its degree of replacement by fat. It should be remembered however that in most households there is a tendency to waste fat. It is clear that very fat meat should be supplemented by foods rich in protein, and lean meat with others proportionately rich in fuel value. Beans and bacon; leg of mutton and potatoes; these are time-honoured and justifiable combinations.

Fish.

Fresh fish, largely owing to cost of transport, is never a cheap source either of protein or fuel, as a glance at the tables will show. Even the less expensive forms, sometimes—as in the case of hake—because of the large proportion of water contained in the flesh, do not compare favourably with meat in this respect. Fish as a whole is chiefly valuable in adding variety to a dietary.

Dried or smoked fish are of course much cheaper foodstuffs but it is doubtful if they should contribute more than a small quota to any dietary. Tinned salmon and lobster, though largely bought by the poor, are extravagant foods.

Dairy Products.

A study of the tables will show that among animal foods milk is an exceptionally cheap source both of protein and of fuel. A pound of protein in meat costs five or six shillings while the same amount in milk at twopence a pint costs only two shillings and fourpence. One thousand calories cost on the average about one shilling in meat but only fourpence three-farthings in milk. So great a disproportion is a somewhat surprising circumstance of no small economic interest. The protein in skim milk costs only sevenpence a pound. It is extremely unfortunate that this is not more readily obtainable by the public. While whole milk is essential for infants, skim milk is a most useful food for growing children who are getting a supply of fat from other sources. It is especially desirable as a food for the children of the poor who else depend far too much upon bread and margarine. The extreme cheapness of skim milk protein has led to its appearance in the market, under various names, as a dry powder. But in these proprietary articles its cost is greatly increased, and its digestibility is lessened. It is cost of transport which results in skim milk being left to the pigs, and it seems highly desirable that during the present crisis at any rate some effort should be made to cheapen its distribution. The public should certainly purchase, and encourage the manufacture in this country of, the simple curd cheeses which are made from skim milk; they are wholesome and cheap sources of protein.

Condensed milk because of its great convenience is always likely to be freely consumed; but it should be understood that the cost of the protein obtained in it is more than double that of the same quantity purchased in new milk. The calories contained in it are relatively cheap, but this is because they are largely due to the added sugar. Condensed milk does not represent an economical food. It should never replace new milk in the diet of infants or young children.

Eggs.

Eggs form a source of convenient and agreeable food, but it should be remembered that at the price usually paid for them in this country they are a somewhat extravagant food. New milk yields corresponding food value at less than one-third the cost.

Bread and Flour.

It need hardly be said that those who are able to bake at home can obtain similar food values at a lower cost in the form of flour than in that of bread. But from this saving the cost of baking has of course to be deducted, and home baking, though its adoption may in individual cases help to conserve a diminishing income, cannot be universally recommended. The baker can make bread more economically and efficiently than private individuals and his activities represent a division of labour which, on the balance, is of advantage to the community under any circumstances.

A decrease in the consumption of meat almost necessarily involves an increase in the consumption of wheat bread, so that the properties of the latter as a foodstuff have an increasing interest at the present time. When a given amount of fuel is consumed in bread the amount of protein received will very nearly reach what is a desirable ratio, and from this standpoint bread is a satisfactory basal foodstuff. But it is deficient in fat; a circumstance which accounts for the universal and instinctive use of fat as an adjunct to bread. In the diet of the labouring classes, both in town and country, nearly two-thirds of the whole fuel value and one-half of the protein is supplied in bread. With increase of earning power the relative amount of bread eaten almost always diminishes, and in middle class dietaries it usually supplies no more than one-fourth of the calories and one-fifth of the protein. It is clear that no serious harm could accrue to the latter classes if, as a temporary measure, a part of their meat consumption were replaced by bread. When bread comes to form a relatively large portion of the total food eaten, it is desirable that a part at least should

be made from whole meal. Not enough advantage is taken in this country of the fact that bread may be eaten in a variety of forms with varying flavours. To vary the source, colour and size of the loaf adds to the enjoyment with which bread may be eaten.

Oatmeal.

Oatmeal contains more protein and more fat than wheat flour, and should be recognised as being at once one of the cheapest and most valuable of foodstuffs. Although it appears in the food budgets of most families, the quantity consumed per head in South Britain is relatively very small. Among the working classes the expenditure upon it does not amount to one-twentieth of that upon bread. This proportion might under any circumstances be increased with definite advantage, especially to the children. Oatmeal porridge is, of course, a common breakfast dish among the wealthier classes, but the actual amount eaten in this form is but small, not more than perhaps 1 ounce per head per day of the dry meal. This in fuel value would represent less than one-twentieth of the day's consumption.

During a period of meat shortage it is necessary that the consumption of cereal foods should increase. It is highly desirable that this increase should not be too exclusively in the form of bread. There is a real advantage in eating a variety of cereals rather than one only, and oatmeal represents perhaps the best variant from wheat bread. It can be obtained in more than one form, and may be prepared in various ways, so that monotony can be easily avoided if some trouble be taken.

Oatcake for instance forms a pleasant and valuable variation from porridge. It is readily made by melting an ounce of margarine in rather more than $\frac{1}{4}$ pint of hot water and mixing with $\frac{1}{2}$ lb. of oatmeal. The dough is well worked, and rolled into a flat cake and baked. Thus prepared it costs just over 3*d.* per lb., which works out at about $1\frac{3}{4}$*d.* per 1000 calories.

We have been told officially that a reduction in the amount of meat eaten to the extent of some 2 lbs. per head per month will cover the probable shortage of the current year. Supposing

this sacrifice to be made it is somewhat striking to realise that the whole of the flesh-forming material involved could be replaced by the consumption of a small plate of oatmeal porridge extra each day, and the exchange would increase the yield of energy from the food. If the individual takes a gill of milk with this daily extra ration of oatmeal he will get altogether twice as much protein as he is asked to give up, and a considerable increase in total food values. The meat sacrificed would have cost at least 2*s*., while the oatmeal costs 5*d*. or 6*d*., and the oatmeal and milk 1*s*. 8*d*. to 1*s*. 9*d*.

Beans, Peas and Lentils.

These foods differ from the cereals in that they contain far more protein, in fact they actually contain more protein weight for weight than butcher's meat. They also contain large quantities of starch and their price being low they are among the cheapest sources of both protein and energy. Unfortunately they are inclined to be difficult of digestion unless very thoroughly cooked. Soaking over night in cold water shortens the time of boiling. Being rich in protein and starch and deficient in fat they go well with fat meats such as pork or bacon. They may be curried along with enough fat meat to give a flavour.

Rice.

As is well known rice forms the chief food of whole populations in the East. Of late years evidence has accumulated to show that the process of "polishing" removes certain essential properties from the grain, so that polished rice is not a good basal foodstuff. But although the grain as sold in this country is almost always polished, the deficiency is quite unimportant when the rice forms only a small part of the whole diet. Rice yields a very economical supply of protein and of calories. Like oatmeal it provides an opportunity of increasing variety in our consumption of grain foods, and at the present time decidedly more should be eaten. Its use should be less confined

to the preparation of sweet puddings, and boiled rice should be served more freely with meat and fish. Cooked with cheese like macaroni, it makes a very cheap and nutritious dish, which is also extremely palatable.

Tapioca, Arrowroot, Cornflour.

It should be understood that foods of this class, though they possess high fuel value, supply scarcely any protein. They are often given to invalids under the impression that they possess high restorative power, but they possess no flesh-forming properties and they should never form a large proportion of the day's food.

Fresh Vegetables.

When bought in small quantities fresh vegetables are not economical as a source of protein and energy. This applies to green vegetables especially, the reason being that they contain about nine-tenths of their weight of water which of course makes the cost of transport to the market come out high per pound of protein and per 1000 calories. For the same reason they are very bulky and on this account it would be difficult to take any very large proportion of one's protein and energy in this form. For instance, it would be necessary to eat more than one stone of most green vegetables in order to get the 4 oz. of protein which is required for the daily ration of an average man.

Potatoes however are an exception. They contain much less water, and much more dry matter than green vegetables, and cost less money per pound. They are in fact one of the cheapest sources of energy and at the present time their consumption in this country should be increased. The proportion of protein which they contain however is small, and they should be eaten with meat, milk, cheese or some other article containing protein in reasonable proportions. Artichokes are also a fairly cheap source of energy, and so are carrots, turnips and onions.

These remarks must not be taken as a warning against the purchase of fresh vegetables. It is in fact desirable that every one should eat green vegetables from time to time, not as a source of protein or energy, but to ensure health. For the same reason every one should occasionally eat salad or uncooked fruit. Such materials do not provide cheap protein or energy, but they do undoubtedly help to keep the body in a healthy condition.

V

FOOD BUDGETS

We propose in this section to illustrate certain aspects of the subject by a reference to the expenditure of typical families upon their food as observed in actual practice. The careful studies of Mr S. B. Rowntree supply statistical material of a kind suitable for our purpose.

In 1912–13 Mr Rowntree obtained accurate information concerning the food budgets of 42 families of rural workers in five English counties. They comprised in all 85 adults and 194 children, the average number of children in a family being therefore between four and five.

Suitable calculations show that the food consumed by these families corresponded with what would be an allowance of 3400 calories and 95 grammes (3·4 ounces) of protein for a man[1]. These figures are strikingly close to those calculated by one of us from the results of a Board of Trade return made in 1902 which dealt with the food of agricultural labourers in all parts of England, namely 3357 calories and 97 grammes (3·5 ounces) of protein per man. Such figures show a fairly adequate, though by no means generous, allowance of fuel

[1] See page 6. Since the number and age of the members vary it is necessary in comparing the expenditure of one family with that of another to reduce them to some common standard. This is usually done by counting a woman's needs as eight-tenths of a man's, and by assigning a definite fractional value to the needs of each child according to its age. Thus a family with father, mother, and six children might work out as equal, say, to four and three-quarter men. The total food consumed divided by $4\frac{3}{4}$ would then give the consumption "*per man.*"

value, but an amount of protein which, for conditions of life in this country, is too small.

We have calculated from Mr Rowntree's data that the average earning power of the families studied was sixteen shillings and sixpence per household weekly. The average weekly expenditure upon food was twelve shillings. This sum did not quite suffice to purchase the food values mentioned, as in nearly all cases the food bought was supplemented by a certain amount (never large) of home-raised garden produce, and, to a small extent, by charitable gifts. In the case of agricultural labourers it is at any rate clear that an expenditure of more than seventy per cent. of the total cash income upon food did not, even before the war, suffice to buy more than at most the bare necessary minimum. The Board of Trade returns of 1904 gave for town workers in all parts of the country a consumption of 3291 calories and 102 grammes (3·6 ounces) of protein per man. But the poorer elements in a town population may show conditions of nutrition considerably less satisfactory than those of the agricultural labourer. Thus Mr Rowntree found that fourteen families in York of which the average income was less than 26*s.* per week showed an average consumption of 2685 calories and 89 grammes (3·15 ounces) of protein.

These figures were all obtained before the war. We cannot put the current increase in the cost of the food of the poorer classes at less than 20 per cent. and it is probably more. Bread, as was shown in a previous section, forms more than 60 per cent. of their food and bread has risen 40 per cent.

Returning then to the case of families which before the war spent 12*s.* weekly upon food we have to realise that they must now be spending at the very least 14*s.* 6*d.* for a bare minimum of nutriment. Since their average income was 16*s.* 6*d.* it is clear that there must now be, without rise of wage, a wholly inadequate margin for other expenditure. Doubtless wages will in many cases be raised, and war allowances will ease certain families; but it is evident that no saving whatever can be expected in the food expenditure of households depending upon a wage of 25*s.* or less. War bonuses will, in the case of the labouring

classes as a whole, at most compensate for the rise in food prices.

We will now consider the case of a family with an appreciably higher income, that namely of a foreman earning 38*s.* weekly.

We give in the first place the complete budget for a week's expenditure upon food together with the price of the articles as purchased in York before the war and the cost of similar articles when bought at current prices.

Food Budget of a Family consisting of Father, Mother, and Six Children aged from 4 to 13 years. Expenditure for one week in the month of September.

Food bought	Amount	Protein	Calories	Cost in York before the war		Cost to-day	
Animal foods		ozs.		*s.*	*d.*	*s.*	*d.*
Beef	6½ lbs.	16	6500	3	9	5	5
Pork	1 „	2	1340	0	7	1	0
Ham and bacon.	3 „	6	7500	1	7	3	3
Sheep's head ...	3½ „	5	1015	0	6	0	8
Sheep's reeds ...	2¾ „	5¾	2172	0	4	0	6
Fish ....."portion" of fried		¾	150	0	2½	0	3
Sardines	1 tin	1	240	0	4½	0	6
Cheese	1 lb.	4¾	2000	0	7	1	0
Milk	11 pints	8	4500	1	4½	1	10
Condensed milk .	2 tins	2¾	2800	0	9	0	10
Butter	½ lb.	0	1800	0	8	0	9
Dripping	2 „	0	8000	0	6	1	0
Vegetable foods							
Flour	4 stone	102	92500	5	8	10	8
Quaker oats	2 lbs.	5	3800	0	5½	0	6
Potatoes.....	3½ stone	16	15200	1	5½	2	0½
Vegetables, etc. .	—	—	—	1	0	1	2
Mushrooms	1½ lbs.	1	315	0	7½	0	9
Grapes	1 „	—	335	0	6	0	6
Sugar	8 „	—	14880	1	2	2	6
Tea	½ „	—	—	1	2	1	2
Drinks, etc.....	—	—	—	0	9	0	9
Total consumption and cost..		11 lbs.	165047	£1	4 0	£1	17 0½

This family was exceedingly well fed. Calculated to the usual "per man" standard the food eaten would yield daily 145 grammes (5¼ ounces) protein and 4800 calories. The marketing was certainly carefully and skilfully done, and the food was

well chosen in respect of variety and other factors. But whereas before the war the expenditure involved was only 24*s.* for the week—a reasonable if somewhat large proportion of the total income—with current prices the cost of the food would have been 37*s.* 0½*d.*, showing an increase sufficient to swamp nearly the whole income of the family. This budget is instructive, as we have reason to believe that it represents fairly well the average expenditure of a large class of artisan families, though, as already suggested, the marketing was probably better than the average. The only economy to be suggested would consist in an all round reduction in the quantity of food purchased. A few luxuries appear: the grapes, mushrooms and sardines for instance. Upon these the sum of 1*s.* 6*d.* was spent. Such a sum might well have been spent upon cheaper materials, but the outlay was no great extravagance. The bread which was all made at home supplied no less than 56 per cent. of the whole fuel value of the diet. The meat purchased was wholly in the form of the cheaper cuts, such items as the sheep's head and sheep's reeds (a variety of tripe) yielding protein in a particularly cheap form. The protein in the animal food amounted to considerably less than one-third of the whole protein eaten, a very economical proportion. The supply of fat bore a satisfactory relation to the starchy foods, and this moreover with a very small expenditure upon butter—the most expensive of fats. Altogether this budget is extremely difficult to criticise from the standpoint of economy and wisdom in the choice of foodstuffs. It represents however a supply of nutriment in excess of actual needs, and in times of financial stress the principal items purchased could be reduced by a fifth without danger to health or efficiency.

The following budget illustrates the expenditure upon food when the income is of the order of £150 to £200 per annum. It is that of a clerk's family in Cambridge. It represents a week's expenditure as observed in actual practice, the week chosen showing figures which agree closely in every respect with the average calculated from several consecutive weeks.

Food Budget of a Family consisting of Father, Mother and one Daughter aged 14. *Expenditure for one week in the month of April.*

Food bought	Amount	Protein ozs.	Calories	Cost in Cambridge before the war s. d.	Cost to-day s. d.
Animal foods					
Beef	5¾ lbs.	14½	6325	4 9½	5 9
Pork	2 „	4	2680	1 4	1 6
Ham	1 lb.	2¼	1670	1 6	1 10
Bacon	1 „	1½	2685	1 1	1 5
Fish	1 „	2¾	335	6	8
Eggs	2 lbs.	4	1270	2 0	2 0
Milk	20 pints	15	8010	3 4	3 4
Butter	1½ lbs.	—	4800	2 0	2 1½
Lard and Dripping	1 lb.	—	4010	8	8
Vegetable foods					
Bread and flour	25 lbs.	36	29400	2 9	4 0
Potatoes	14 „	3½	4340	8	1 2
Rice	½ lb.	½	815	1½	1½
Vegetables	—	—	—	10	1 0
Currants	1 lb.	—	—	5	5
Apples	7 lbs.	—	700	6	6
Jam	2 „	—	1860	1 0	1 1
Sugar	3 „	—	5580	9	1 0
Tea	½ lb.	—	—	1 0	1 0
Beverages	—	—	—	1 3	1 3
Total consumption and cost		5 lbs. 4 ozs.	74480	£1 6 6	£1 10 10

The average expenditure of this family upon food before the war was something under thirty shillings weekly. The family being small this expenditure yielded high food values per head, namely 4250 calories and 140 grammes protein (5·0 ounces) when calculated in the usual way. We believe nevertheless that the budget is fairly typical of its class. When, in the case of families depending upon an income of £150 or thereabouts, the number of children increases the consumption of food per head tends to fall somewhat, though there is of course increased expenditure upon food. But to judge from our own observations (made in Cambridge and London) the food eaten by this class of the community is, on the average, decidedly in excess of the actual physiological requirements. In the case of the budget just given a reduction even of a fourth would leave an

adequate supply of nutriment. Since families of this class are likely to be considerably incommoded by war prices, the facts contained in this pamphlet would seem to be of special value to them.

We give finally, in a somewhat different form, the budget of a middle class family keeping three servants.

This budget shows the weekly expenditure of a family which in respect of its food appears to be of economical habits. Although meat is consumed three times a day, the meals taken are of a comparatively simple nature; only one flesh course being eaten at dinner. But whereas in the budget first quoted meat supplied less than 30 per cent. of the total protein, in this it provides 60 per cent. Bread is responsible for only one-fourth of the total fuel value instead of yielding considerably more than half. Calculated in the usual way to man value the cost of the food amounts to eleven shillings per head per week, instead of five shillings and eightpence as in the artisan budget. The protein works out at 143 grammes and the calories are 4379. Considerable economies are possible in such a budget. The total food purchased might be safely reduced by about one-sixth, and about one-fourth of the meat could be replaced by bread, oatmeal, or other cheap vegetable foods. The figures of the budget just discussed may be taken as fairly representative of middle class expenditure before the war, though in many districts, and especially in the London area, they would be decidedly below the average. We are of opinion that as a rough indication of economies which are possible and perfectly safe for families with average middle class incomes and habits the changes suggested above may serve; namely a reduction of about one-sixth in the total food purchased, and a replacement of one-fourth of the meat by cheaper foodstuffs.

Those whose income has so far shrunk as to call for more rigorous economies may profit by a study of the tables in this pamphlet, purchasing, so far as is consistent with obtaining a reasonable variety, only such foodstuffs as show a good proportionate yield in protein or calories for a given expenditure. Not every one realises how greatly the kind of food bought may affect the amount of nutriment obtained for a given sum of

Food Budget of a Family consisting of 5 adults and 2 children, equivalent to 5·14 men.

Kind of food	Quantity in lbs.	Cost in York, 1901	Approximate cost to-day
Animal	lbs. ozs.	*s. d.*	*s. d.*
Beef	9 8	6 0	8 4
Mutton	7 0	3 9	5 3
Blackcock	2 0	3 0	4 0
Lard	1 4	0 11¼	1 0
Bacon	5 8	3 11	4 7
Suet	0 8	0 3	0 4
Cheese	0 14	0 8	0 11
Eggs (20)	—	2 0	2 6
Cream (¾ pint) ..	—	1 3	1 6
Fish	1 0	0 6	0 10
Anchovies	0 1½	0 1	0 1
Butter	4 0	5 4	5 4
Milk (54 pints) ..	—	6 9	9 0
Total Animal food ..	31 11½	£1 14 5½	£2 3 8
Beverages			
Cocoa	0 4	0 8½	0 8½
Tea	1 4	2 11½	3 3
Coffee	0 8	0 10	0 10
Total Beverages ..	2 0	4 6	4 9½

Kind of food	Quantity in lbs.	Cost in York, 1901	Approximate cost to-day
Vegetable	lbs. ozs.	*s. d.*	*s. d.*
Flour	27 0	3 2	4 7
Yeast	0 2½	0 2½	0 2½
Prepared barley flour	0 12	0 6	0 6
Vegetables	9 0	1 8½	2 0
Potatoes	24 8	1 2	1 6
Onions	1 0	0 2	0 2
Biscuits	2 0	1 0	1 3
Sugar	6 10	1 3	2 0
Rice	1 0	0 4	0 5
Peas	1 0	0 1	0 1
Cornflour	0 4	0 1½	0 2
Currants	0 8	0 3½	0 2
Jam, etc.	1 14	1 2½	1 4
Cherries (bottled) ..	2 0	1 0	1 2
Gooseberries ..	1 0	0 6	0 6
Dates	1 8	1 0	1 0
Prunes	1 0	0 3	0 3
Tomatoes (tinned) ..	2 0	0 5	0 6
Oranges	4 8	0 8	0 8
Bananas	1 5	0 7	0 8
Grapes	3 0	2 0	2 0
Figs	0 4	0 1½	0 1½
Total Vegetable food	92 3½	17 9	£1 1 3

Total cost of week's food before the war, £2. 12*s.* 2*d.* Cost at present prices, £3. 4*s.* 11*d.*

money. Necessity teaches the poor to buy the foodstuffs which are relatively the most profitable in this respect, even though their choice may be more or less unconscious. The effect of increase in income always results in a less economical choice, though this again may be to some degree unconscious. To please the palate money must be spent over and above that which will provide the necessary nutriment. Within reason such extra expenditure is justifiable, because the better we enjoy our food the better it is for our health. But very often the more dainty dish is necessary to stimulate appetite only because too much food as a whole is being eaten. Remembering that it is, after all, the amount of nutriment that really matters (the actual weight of protein and the number of calories eaten) the following comparison is striking enough. It gives the amount of nutriment obtained for one shilling by the labouring class, the artisan class, and the "servant keeping" middle class respectively. The figures represent averages obtained from the data of Mr Rowntree's studies and other sources.

Amount of Nutrients obtained by the Expenditure of One Shilling (at prices before the war)

	Labourers' families	Artisans' families	Middle class families
Protein	179 grams	140 grams	92 grams
Calories	5500	4250	2850

Comparing the expenditure of the poor with that of the well-to-do we find that the former get nearly twice as much for their money. Otherwise, under their economical conditions, they could not live.

The facts hitherto discussed in this section bear scarcely any relation to the expenditure upon food of the more luxurious classes. Only those who have consciously thought about the matter fully realise how greatly the element of pure luxury may increase the cost of maintaining a human being. We have seen that many thousands of families, averaging (with the children) six or seven individuals each, were fed before the war upon a weekly outlay of some 12*s*. It is therefore no mere

fashion of speech, but literally true, to say that one man's expenditure upon his dinner may keep another man's family for a week.

Allowing, as seems certain from the facts we have discussed, that the poorer classes are unable to make any retrenchment at all in their food expenditure, there is no doubt that the wealthy classes, assisted to no small extent by the middle and lower middle classes, could effect such a saving as would average 10 per cent. of the whole national expenditure upon food. This would amount to £60,000,000, and probably to more. It would be a saving won at the expense of some discomfort but one with no danger to health. If a course of economy in food involves effort and discomfort it should be the more welcome to those who do not otherwise share the much greater discomforts of active service, and the money saved in such a way might well be specially ear-marked for providing the sinews of war.

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