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PROBLEMS OF CONSUMPTION OF AGRICULTURAL PRODUCTS

FIRST OPENING PAPER¹

E. P. CATHCART

Regius Professor of Physiology, University of Glasgow

IT is probably better realized by those interested in agriculture than by any other section of the community that 'all flesh is grass' is almost literally true, but it is not always appreciated by those interested in agriculture that the problem of human nutrition, and for that part also the nutrition of the lower animals, is not one solely of a plentiful supply of food materials. It is true, of course, that an ample supply of food is of primary importance, but other factors play important parts. Good nutrition implies far more than a plentiful supply of food. Unless the personal and physical environment is adapted to the needs of the individual it is difficult, if not indeed impossible, to attain optimum nutrition. In some ways those associated with farm stock have a much keener and more vital appreciation of these other factors than many of those primarily concerned with the welfare of mankind. It is not perhaps going too far to say that the leaders of the agricultural community have devoted far more attention and given more brains to the development of agricultural stock than have been given to the physical culture of man. Those who devote their energies to the raising of stock know, for instance, perfectly well that it is impossible to raise good animals from inferior stock, that no matter how well these inferior breeds are fed it is impossible to evolve first-class animals from such stock. In other words, stock-breeders realize that a knowledge of animal eugenics is a real and vital factor in raising the ideal stock.

It is perfectly true that the qualities in the case of man are more varied than those of animals. We require in our ideal man brains as well as physique, but nevertheless the hereditary factor is all important. Good food is a prime necessity, but it cannot work miracles. I am not maintaining here that better food can do nothing, nor advocating a state of *laissez-faire* on the grounds that the diets

¹ Professor Cathcart's paper deals with the problems from the nutritional or physiological standpoint. Professor Forrester's paper which follows deals with the problems from the economic standpoint.

consumed by the average man of limited means are ideal at the moment. Far from it, for, although there may be no actual starvation in this country, there are many who are living on diets which leave much to be desired. But I am stressing the point that before the ideal of a perfect race of man can be attained there are many other factors besides intake of food which must be taken into account.

The fundamental principles involved in the feeding of man are identical with those in the feeding of animals. There must be provided a diet adequate both in quantity and quality. The study of the quantity side is at present very much out of favour. It is held that the quantitative problem is solved if a sufficient amount of energy in proper form be ingested to cover, with perhaps a slight excess, the energy expenditure. The Technical Commission of the League of Nations have stated that the basic calorie (or energy) requirement of an adult, male or female, living an ordinary everyday life in a temperate climate and not engaged in manual work may be covered by the ingestion of 2,400 calories net per day with appropriate supplements for extra manual work done. Personally I am not quite so certain that the quantitative problem has been completely solved. Obviously a certain amount of readily available energy must be supplied to cover the expenditure. But is this a rigid amount? There is more than a suggestion that there is a relation of some kind between the quality of the diet and the quantity required.

When we turn to the consideration of the quality of the diet we can say definitely that it must contain protein, fat, carbohydrate, salts, vitamins, and water. The energy needs are covered by the first three components and more particularly by carbohydrate and fat. Further, a long series of dietary studies, when the foods were selected at random by normal housewives, has shown, on the average, calculating in terms of calories, that approximately 10 per cent. are derived from protein sources, 25 to 30 per cent. from fat, and the remainder from carbohydrate. Incidentally it may be remarked that in our collection of data we have been astonished at the regularity with which untrained housewives so apportion their purchases of the various foodstuffs available that the percentage range just referred to is kept wonderfully constant, especially in the case of protein. In the case of the non-nitrogenous materials it is found that as the income available for expenditure on food increases the percentage of calories derived from fat increases and that from carbohydrate diminishes.

If consideration be directed to the actual amount of the various essentials required by the average man, we enter a realm in which

our lack of knowledge is very marked. The Technical Commission of the League of Nations agreed that the body's need for protein might be covered by an allowance of 1 gramme per kilo of body weight, say by 70 grammes per day for the average man. Our studies showed a range from approximately 60 to 100 grammes with a mean value of about 80 grammes. The Commission refused to lay down any precise figure for fat although judging from our results it would probably be about 100 to 120 grammes per day. Carbohydrate, the most readily available form of energy, which may be regarded as an elastic reserve, is left unfixed.

As regards the non-energy-yielding items of the diet certain figures have been arrived at for calcium, phosphorus, iron, and perhaps iodine, but much work requires yet to be done on these and the many other essential inorganic constituents about which we know next to nothing. It is fortunate in a way that these substances are usually components of many of the ordinary foodstuffs. Again we know that a variety of vitamins are also requisite, but the actual quantitative needs are unknown. Sir F. Gowland Hopkins has stated that the vitamins are best taken in the form in which they exist in natural foodstuffs.

We know little or nothing about the specificity of any of these basic materials, if indeed, except in the case of protein, specificity exists at all. Although so far as I am aware no definite scientific work on which to base our evidence, at least quantitatively, exists, there is a general consensus of opinion, and I believe a correct consensus, that a certain amount of the protein consumed should belong to the class of 'good' or 'first class' protein or protein of high biological value, i.e. proteins in the main derived from animal sources such as meat, milk, or eggs. It is generally accepted that the amount of this protein should form about one-third of the total protein ingested. I may say that our analysis of a large number of diets of those on a very low-income level shows that as a matter of fact the percentage but rarely falls below 40 per cent.

To turn now to a consideration in quantitative terms of what is actually eaten by the various households whose diets have been carefully studied. Mrs. Murray and I have analysed in terms of foodstuffs the diets we collected. We selected for our grouping of the households the expenditure per man per week on food. The following table (Table I) gives a summary of the average consumption in pounds per man per week of some of the commoner foodstuffs in St. Andrews, Cardiff, and Reading.

It will be noted incidentally that the consumption of meat per man

is higher at the various expenditure levels in England than in Scotland despite the fact that the St. Andrews families are drawn from a more mixed and on the whole a higher social level.

TABLE I. *Average Quantities of Foods in lb. consumed per Man per Week*
(Grouping in average expenditure weekly on food)

ST. ANDREWS

	<i>Aver. Exp. on food</i>	<i>Meat</i>	<i>Fish</i>	<i>Bread</i>	<i>Legumes and Cereals</i>	<i>Margarine and Butter</i>	<i>Sugar</i>	<i>Vegs.</i>	<i>Fruit</i>
	<i>s. d.</i>								
I	18 5	3.04	1.26	4.59	1.29	1.84	1.86	4.39	3.17
II	18 0	2.22	0.45	4.96	1.07	1.89	1.58	3.45	3.25
III	13 8	2.43	0.48	5.79	1.12	1.48	2.06	3.36	2.24
IV	12 0	2.17	0.49	5.46	1.27	1.42	1.80	3.69	1.51
V	9 3	1.64	0.34	5.80	0.88	1.23	1.67	2.97	0.73
VI	6 2	1.25	0.44	4.50	0.71	0.99	1.20	2.68	0.30
VII	11 0	1.59	0.66	4.79	1.31	1.50	1.99	4.24	1.44
Av.		2.04	0.49	5.40	1.13	1.42	1.74	3.48	1.54

CARDIFF

	<i>s. d.</i>								
I	6 8	1.38	0.30	7.53	0.81	1.45	1.54	3.19	0.48
II	7 1	1.70	0.31	6.49	0.83	1.44	1.46	3.89	0.80
III	9 3	1.86	0.45	7.47	1.07	1.84	1.63	4.92	0.70
IV	10 2	2.23	0.34	6.11	1.08	1.94	1.84	4.22	1.58
V	12 0	2.48	0.60	5.60	0.93	1.40	1.65	4.79	2.44
Av.		1.73	0.36	6.94	0.90	1.57	1.58	3.92	0.87

READING

	<i>s. d.</i>								
I	5 2	1.68	0.16	5.82	0.74	0.75	1.52	4.01	0.42
II	7 6	1.99	0.29	6.14	1.03	0.96	1.65	6.07	0.72
III	8 5	2.22	0.24	4.59	1.01	1.00	1.50	4.85	1.13
IV	8 11	2.39	0.54	4.04	1.01	1.13	2.15	5.40	2.69
V	9 4	2.05	0.43	5.53	0.96	1.16	2.57	3.70	1.10
Av.		1.92	0.26	5.71	0.91	0.90	1.67	5.00	0.79

I have also given a comparison (Table II) to show the interesting differences which exist in the mode of expenditure of families of like expenditure on food.

The next table (Table III) is of equal interest as it gives some clue to the nature of the appetite of the people and hence of the demands which require to be met by the market. Here the percentage of the total families in the different studies consuming particular items of diet is given.

TABLE II. *Comparison of Groups of approximately Same Expenditure per Man on Food*

		Aver. Exp. on food		Meat	Fish	Bread	Legumes and Cereals	Margarine and Butter	Sugar	Vegs.	Fruit
		s.	d.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
I.	A. IV*	12	0	2.17	0.49	5.46	1.27	1.42	1.80	3.69	1.51
	C. V	12	0	2.48	0.60	5.60	0.93	1.40	1.65	4.79	2.44
II.	A. V	9	3	1.64	0.34	5.80	0.88	1.23	1.67	2.97	0.73
	C. III	9	3	1.86	0.45	7.47	1.07	1.84	1.63	4.92	0.70
	R. V	9	4	2.05	0.43	5.53	0.96	1.16	2.57	3.70	1.10
III.	A. VI	6	2	1.25	0.44	4.50	0.71	0.99	1.20	2.68	0.30
	C. I	6	8	1.38	0.30	7.53	0.81	1.45	1.54	3.19	0.48

* The symbols in this column refer to the groups in Table I; e.g. A. IV stands for St. Andrews Group IV and C.V. stands for Cardiff Group V.

TABLE III. *Percentage of Families in the Various Studies consuming Particular Items of Diet*

	St. Andrews				Glasgow	
	Total	Groups IV, V, and VI			1933	1911
Beef	98.7	98.2	90.6	96.5	100	100
Mutton	45.0	42.7	60.4	54.4	50	66.7
Pork	16.8	13.6	22.6	19.3	8.3	16.7
Veal	1.3	0.0	1.9	0.0	8.3	4.2
Ham and Bacon	92.6	90.9	94.3	70.4	83.0	70.8
Sausages	73.8	78.2	37.7	54.4	100	66.7
Fresh Fish	68.5	64.5	50.9	49.1	75.0	87.5
Butter	88.6	85.5	94.3	61.4	33.3	100
Margarine	67.8	71.8	56.6	94.7	91.7	0.0
Eggs	98.7	98.2	88.7	56.1	91.7	83.4
Cheese	74.5	71.8	90.6	82.5	83.0	70.8
White Bread	100	100	100	100	100	100
Brown Bread	41.6	30.9	9.4	5.3	25.0	0.0
'Tea' Bread	95.3	93.6	58.5	63.1	66.7	66.7
Oatmeal	75.8	71.8	17.0	44.0	58.3	95.8
Potatoes	100	100	100	100	100	100
Root Vegetables	96.0	96.4	60.4	89.5	91.7	79.2
Leafy Vegetables	53.7	49.1	92.6	100	75.0	45.8
Fresh Fruit	79.2	74.5	75.5	82.5	75.0	0.0

Two points are especially worthy of note in Table III. The first is that St. Andrews is recorded as percentage of total families and also as percentage of total families belonging to groups IV, V, and VI, the groups in this study which approximate most closely to the groups in the Cardiff and Reading studies. The second is that two short studies carried out in Glasgow, one in 1911 and the other in 1933, are included.

It is very clear from this table that beef is easily the most highly prized meat. Considering the availability and relative cheapness of imported mutton and lamb it is curious that the consumption should be so low on the average. The Glasgow figures would even suggest that mutton has gone out of favour, as although in 1911 the market did not have the same supplies of imported meat the consumption was definitely higher than in 1933. It is also interesting to note how much more popular sausages are in Scotland. The consumption of fresh fish is also of interest, as despite the fact that both St. Andrews and Cardiff are sea-coast towns the use of fish is low whilst that of an inland town like Reading is astonishingly high.

As regards butter and margarine it will be noted that in the Glasgow 1911 study all the families ate butter, and none of them margarine, yet in 1933 over 90 per cent. of the families consumed margarine, and only one-third of them butter. Is this due to the immense improvement in the quality of the margarine or to a change in social outlook? I sometimes wonder if all the 1911 families did eat only butter. A family who openly purchased margarine, like those who bought skimmed milk, was looked down upon and would not readily admit such an indiscretion. Two other points are of interest. It will be noted that one-quarter of the 1933 families ate brown bread whereas none of the 1911 families did so, and, secondly, not only is there a very definite rise in the consumption of vegetables, but three-quarters of the 1933 families purchased fresh fruit whereas none of the 1911 families did so. These various points are very strong pieces of evidence that a steady change is taking place in the dietary outlook of families even with very low incomes.

There is another question with a marked economic bearing. How much of the foodstuffs purchased are actually eaten? What is the extent of the loss? There are three types of loss: (1) the loss incurred between the purchase and cooking, (2) that in cooking, serving, and eating, and (3) the loss due to incomplete utilization in the body.

Part of the first loss may be due to losses in preparation quite apart, for instance, from the washing off of the soil almost inevitably

purchased with potatoes. The following table (Table IV) was compiled from data kindly supplied to me by Miss Aitken of the Glasgow College of Domestic Science.

TABLE IV. *Percentage Loss calculated on the Basis of Weight of Foodstuff before Cooking*

<i>Foodstuff</i>	<i>No. of samples</i>	<i>Loss in preparation (trimming)</i>	<i>Residue</i>
Beef (Sirloin) . . .	18	2.7	12.5
Mutton (Leg) . . .	26	0.8	12.4
Veal (Leg) . . .	18	0.5	21.7
Pork (Loin) . . .	10	0.4	9.96
Steak (Fillet) . . .	26	0.7	..
Cod (Middle cut) . . .	5	..	10.2
Cod (Tail cut) . . .	8	..	17.0
Cod (Steak) . . .	15
Haddock (Fillet) . . .	14
Sole (Fillet) . . .	16
Potatoes (Skinned) . . .	14	23.9	..
Potatoes (Baked in skin) . . .	3	..	?
Brussel Sprouts . . .	14	25.5	..
Cabbage (Winter) . . .	7	29.7	..
Cabbage (Summer) . . .	18	27.3	..
Onions . . .	25	10.1	..
Turnips . . .	21	31.0	..
Carrots . . .	23	27.1	..
Cauliflowers . . .	21	37.8	..

It will be noted that in the case of meat the losses during preparation may be regarded as negligible, but, on the other hand, depending on the cut, there may be quite definite amounts of refuse in the shape of bone, whereas in the case of vegetables the principal loss, which may be very large, depending on the season and the condition of the purchased material, e.g. old potatoes, takes place during the preparation for cooking.

Mrs. Murray and I have been able to obtain some insight into the nature of the household losses, as in the dietary surveys all the discarded material for the week of the study was carefully collected in pails specially provided. Some of the loss is inevitable, the material being non-edible, some of it preventable. The inevitable loss depends solely on the nature of the foodstuffs consumed. It is interesting to note that the much maligned tinned foods give rise to less inevitable loss than do many of the ordinary foodstuffs. As regards the loss of edible material it depends in part on the nature, and to some extent

the quality, of the food, but in greater part on the habits of the housewife and her family. The following table (Table V) gives the percentage loss of the total calories purchased in the form of refuse and

TABLE V. *Percentage of Total Calories purchased as Food lost by Housewife in Form of Refuse and Waste*

Family	Series	
	I	II
1	5.7	5.6
2	2.5	2.8
3	4.4	2.9
4	2.1	2.4
5	1.9	1.9
6	2.7	6.2
7	1.2	1.4
8	1.9	1.5
9	2.4	1.9
10	1.9	2.8
11	5.0	4.9
12	4.3	1.4
13	4.4	3.7
14	3.3	1.6
15	2.7	4.2
16	3.2	3.2
17	3.3	2.8
18	4.5	3.0
19	1.5	0.7
20	4.2	2.1
21	2.3	3.0
22	0.8	1.9
23	0.4	1.7
24	3.3	1.5
25	2.3	3.9
26	3.9	2.5
27	2.8	4.8
28	0.9	0.8
29	1.8	3.0
30	2.6	1.4
31	2.4	2.0
32	0.6	1.4
Mean and P.E.	2.7 ± 0.16	2.6 ± 0.16
S.D. and P.E.	1.3456 ± 0.1135	1.3438 ± 0.1133

waste as determined by our analysis of the contents of the waste-pail of the household.

This table is particularly interesting as it gives the result of duplicated analyses at an interval of six months. It shows that the actual loss is remarkably small with an average of just over 2.5 per cent. The percentage range of loss is from 0.4 to 6.2 per cent. It is, moreover, remarkable that the agreement between the two studies is so

astonishingly close both as to mean and standard deviation. The table also shows in the individual families that as a rule if the loss is low or high in one study it is low or high in the other.

Finally there is the fact, well recognized by agricultural economists, which tells against any cast-iron cost of living standard, that

TABLE VI. *Range in Lowest Retail Prices on a Given Date in March 1935 in 35 Centres in Scotland*

Commodity*	Price range in pence per lb.	Cost in		
		A†	B†	C†
Butter . . .	10 — 16	10	16	12
Margarine . . .	3½ — 8	4	6	6
Jam . . .	3 — 8½	3	4½	7
Tea . . .	10 — 28	16	24	20
Mutton . . .	6 — 16	6	12	14
Beef . . .	4 — 14	4	10	12
Bacon . . .	8 — 18	9	14	12
Sausages . . .	5 — 12	5	8	12
Mince . . .	3½ — 16	3½	12	16
Cheese . . .	4 — 11	4	9	11
Potatoes (stone) .	4½ — 10	5	6	5

* Bread, flour, sugar, and milk are not included in the table as there was little variation in the prices.

† A = a city. B = a village about 20 miles from A.
C = a small country town.

the prices of common articles of diet are subject to a wide range of variation not merely from seasonal but also from geographical considerations. The above table (Table VI) gives the result of a brief inquiry I had made for another purpose, which clearly shows the influence of the geographical factor.

I hope I have managed to give you a brief outline of the physiological needs of the human organism and the mode of their satisfaction. I have already stated that many of the diets are not ideal. How is the ordinary housewife who has to go into the open market and make her purchases from the wide variety of foodstuffs offered for sale to be assisted in her choice? One hears repeated demands that the housewife should be more highly educated regarding the composition and the calorific value of foodstuffs. As I have already mentioned we have been astonished how well the average housewife seems to buy by mere instinct. True she perhaps often makes inferior purchases or more commonly tends to buy expensive cuts of meat when less expensive cuts would more than suffice, but I am convinced if the average woman concentrated on a strict academic conception of dietetics the chances are she would not do so well.

She would probably become 'food conscious', a lamentable and dangerous state. Nevertheless, it is true that many valuable foodstuffs are neglected. It is astonishing, for example, that more use is not made of fish and more particularly of herrings; that cheese is not eaten in greater amount; that skimmed milk either in liquid or dried form is practically ignored. Yet all these foodstuffs are excellent sources of first-class protein and some of the most valuable of the inorganic constituents. It is largely a matter of suitable education—education I mean suited to the skill and intelligence of those who require the help. They must be trained in marketing so that they are not hidebound by tradition. Tradition and lack of imagination are tremendous handicaps. And intimately associated with improved marketing is a better knowledge of simple cooking.