

## FOOD CONSUMPTION CALCULATIONS BASED ON THE DANISH FAMILY BUDGET ENQUIRIES.

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### INTRODUCTION.

THE series of family budget enquiries which have been carried out in Denmark during the last fifty years enable us now to form a fairly clear idea of the food consumption both in the towns and in the rural districts, in the well-to-do homes as well as amongst the poor.

The initial step really dates back to the time when Dr Th. Sørensen conducted his investigations in 1879 and 1880 into the conditions under which town workers and agricultural workers were living in Jutland. Twenty-two working-class families in Hobro and fifty-three others in different moorland districts were dealt with. Dr Th. Sørensen went much more deeply into the conditions of living than the earlier investigators.

Among other investigations, the Home Office enquiry of 1872, which was conducted on a large scale, the works by Prof. Falbe Hansen and Prof. W. Scharling and an article by Dr Fr. Krebs should be specially mentioned. But, unlike these investigators, Sørensen went into details of the food consumption. His material was, therefore, well adapted for calculating the food consumption values. This was done by a subsequent mayor, P. Knudsen, who computed the food consumption of the workers' families in question. But Dr Th. Sørensen strongly objected, later, to the collected material being elaborated in this way.

In a work on the expenditure on food of seamstresses and poor-class families in Copenhagen, Sveistrup, in 1899, calculated the energy in their food. He unfortunately employed a special scale for converting the number of individuals of a family to consumption units. His investigations, therefore, do not altogether fall in line with the other Danish results.

In 1906 Dr Edward Mackeprang calculated the daily content of calories in the food of a wholesale merchant, an official, a lower-grade official, a skilled worker and an unskilled worker respectively in Copenhagen. His figures are minimum ones, as not only alcoholic beverages but groceries and several other articles of food are omitted from the calculations.

In 1908 Wieth-Knudsen in his Doctor's thesis concisely worked out the food consumption of the working-class families in Copenhagen from the Danish family budget investigations in 1897. He found that a Copenhagen labourer got 3200 calories in his daily diet, and pointed out that the big consumption of fat was an economic advantage in view of Danish food prices.

As will be seen later his rough result is 350 calories in excess of the actual figure.

#### THE NATURE OF THE MATERIAL.

Before proceeding to give the results of the Danish food consumption calculations, which are based on the official investigations into the food consumption, I will briefly outline the salient points of the latter. It goes without saying that the more carefully these investigations are conducted the better will be the diet calculations, and *vice versa*.

The enquiry consists of four series of observations, each extending over a period of a complete year, and of two other series made during the years when prices were high, each of which only covers a period of a fortnight. The first four series of enquiries were carried out during 1897, 1909, 1916 and 1922. The two short series date from the years 1915 and 1916 during the month of October.

As already mentioned, the first official family budget enquiry was made in the year 1897, and deals with the annual food consumption of 250 working-class families. The information was derived from accurate yearly accounts, kept in accordance with a previously planned schedule and which was published in such a form that they can be used in groups to determine the amount of energy contained in the food consumed.

There are three groups of working-class families whose food consumption can be calculated. They are from Copenhagen, the provincial towns and the rural districts.

The second family budget enquiry in 1909 dealt with working-class families in Copenhagen, in the provincial towns and in the rural districts as well as farmers' and smallholders' families—a total of 536 families. As regards Copenhagen it must be remembered, however, that the compiled annual budgets, when considered in the aggregate, exceed the current wages standard, as was also the case in 1897.

There was a considerable amount of unemployment in 1909. In that year the difference between the economic conditions of the investigated working-class families in Copenhagen and in the provincial towns was less marked than in 1897.

Relatively more of the prosperous working-class families were investigated in the provincial towns in 1909 than in 1897, which was not the case in Copenhagen. The aggregate annual income of the working-class families was estimated at about 30 per cent. above the ordinary wages standard, while that of 1897 was only 10–15 per cent. higher.

The results are not so certain in the rural districts in 1909. Several distinct factors contribute to this. In 1909 the material for the whole country was divided into agricultural workers, artisans in rural districts and smallholders, while in 1897 the Islands and Jutland were treated separately.

Even if, as the Statistical Department maintains, a closer examination has shown that there is no difference in the manner of food consumption of

families of the same class in the Islands and in Jutland, enquiries of this kind may reveal other dissimilarities. Thus the average annual income in 1910 of agricultural labourers with fixed wages without board was no less than 120 Kroner higher in Jutland than in the Islands. Moreover, on account of the complication introduced by the consumption of home produce and because food is supplied at the place of employment, the accounts from the country districts can hardly be utilised so well as those from the towns. The home produce is generally valued at a fairly low price, and constitutes, in the case of certain food items, no small part of the whole consumption. This applies to bacon, pork, eggs, potatoes and green vegetables.

In addition to agricultural labourers, artisans in rural districts and smallholders, the family budget enquiry of 1909 also covers farmer's families. The problem is still more involved in the case of the farmer's families, as it is almost impossible to distinguish between servants working on the land and indoor servants.

It was generally stated in the account books that the female servant, the maid, was working half of her time in the house and half on the farm. But, where no such distinction was made, the female servant is regarded as an agricultural worker in the elaboration of the statistics.

A smallholder's means would hardly allow him to keep a female servant if it was not for the sake of the farm work, while in a farmer's family the actual housework is increased when male servants and hired men board with the family. In this case also, the female help is really kept on account of the work on the farm.

The third family budget enquiry in 1916 was based on 217 annual accounts, contributed by officials of the State, lower-grade officials and other families of similar means. This investigation is of special interest, because it was made use of in the negotiations concerning the payment of bonuses when there was an increase in the cost of living, and when a standard and permanent rate of pay for State Officials was under consideration.

These records, when tabulated, were arranged geographically under the headings Copenhagen, provincial towns and rural districts, and also classified according to income. Three income groups were adopted: 2000–3000 Kroner, 3000–5000 Kroner and over 5000 Kroner.

The fourth and last of the extensive family budget inquiries was, as already mentioned, conducted in 1922. It comprised 379 yearly accounts as well as 29 others dealing with the expenditure on food alone. As in 1916 the records were tabulated geographically, for Copenhagen, the provincial towns and the rural districts. But contrary to all common sense they were classified not according to income but according to expenditure.

The Statistical Department remarks about it: "As a basis for the grouping of the budgets according to the economic standard of the families in question it would seem reasonable to chose the aggregate income of the families for each consumption unit. But as in several of the budgets no information was

supplied as to the amount of the income, it was decided to classify the families according to the aggregate expenditure for each consumption unit as the best criterion under the circumstances for determining the relation between the economic standards of the different families."

In the author's opinion it would have been much better to have omitted the thirty-eight budgets which give no information about the annual income and to have classified the remaining material in the same income groups as in 1916. This would have rendered it possible to make a series of highly desirable comparisons with the conditions in 1916.

The form in which the material of 1922 is now published necessitates a complete transformation if it is to be used for such a comparison. As regards families with a yearly income of 4000–5000 Kroner, I have demonstrated the more prominent changes which have occurred between 1916 and 1922 in Copenhagen and the provincial towns in two articles published in periodicals. To discuss this question here would, however, lead too far.

As the corresponding food consumption calculations have not yet been made, I can only say that the family budget enquiries of 1922 are, in many respects, more suitable for this purpose than the earlier investigations, although in some ways they are more difficult to estimate.

All the earlier enquiries were published in such a form that, in calculating the food consumption, the material can only be handled in groups with all the obvious drawbacks which such treatment entails. But the family budget enquiries in 1922 make it possible for the first time to calculate the food consumption of each family separately—at any rate, in the case of 200–300 families. This permits us to observe the distribution about the mean value, and to probe more deeply into the matter. The difficulties arise when we are confronted with such indefinite phrases as "meals away from home," "meals at the place of occupation" and "preserved food."

It is to be hoped that, in future family budget enquiries, the accounts will be made to cover a period of two years. It will then be easier to judge the influence of the seasons, and it will be possible to get an idea of the variations from year to year in the consumption of the different families.

I have deemed it expedient to start with this long and not altogether interesting explanation of the material, so as to make it clear on what foundation the Danish food consumption calculations rest.

Before passing on to the actual subject-matter I should like to give a brief explanation of the technique and norms employed.

#### NORMS AND TECHNIQUE.

One of the most important things in all calculations of the food consumption of families is the conversion of the amount consumed by women and children into terms of the consumption of adult men, or *vice versa*. In the first consumption investigation in 1897, 2843 calories were taken as the normal daily food requirement of an adult man and four-fifths of this amount

of an adult woman. The food requirement of the children was calculated for each sex separately and for each year of life until the age of 18, in accordance with a scale constructed by the German physician, Rubner.

Table I. *Rubner's conversion table.*

The food consumption of the child expressed as a percentage of that of the adult.

Age	%	Age	%
1	22	10	50
2	30	11	55
3	36	12	60
4	39	13	66
5	43	14	71
6	44	15	74
7	45	16	76
8	47	17	79
9	48	18	82

It will be seen from this table that very considerable and tedious calculations had to be made. In compiling the data the meals which the father consumes at his employer's must also be considered. The children's holidays away from home must be taken into account. Allowance must also be made for the food consumed by lodgers and boarders.

Elaborate preliminary calculations are, therefore, necessary before the information collected can be used for comparison with other investigations.

Since 1916 the Statistical Department has used another scale, the so-called United States scale, for converting the individual families to terms of consumption units (see Table II). This scale is much simpler, but it necessitated a rather arduous recalculation of all the older Danish food consumption calculations in order to compare them with the new results.

Table II. *Conversion table.*

For converting the food consumption of women and children into terms of that of an adult man.

A man over	15 years	= 1.00	consumption units
A woman over	15 "	= 0.90	"
A child from	11-14 "	= 0.90	"
"	from 7-10 "	= 0.75	"
"	from 4-6 "	= 0.40	"
"	under 4 "	= 0.15	"

The excellent little book<sup>1</sup> by the English author, Richardson, on the methods of conducting family budget investigations, gives many details about the numerous different conversion scales which are in use all over the world. The Atwater scale (1902) is, however, the only one which takes into consideration how much manual work the father has to do.

In converting albumin, fat and carbohydrates into calories, it is reckoned that 1 gm. albumin corresponds to 4.1 calories, 1 gm. fat to 9.3 calories and 1 gm. carbohydrate to 4.1 calories. Many English investigators, such as Rowntree in his well-known social investigations, take 1 gm. fat as equi-

<sup>1</sup> J. H. Richardson, *Methods of Conducting Family Budget Inquiries*. 1926. (International Labour Office.)

valent to 8.9 calories. This fact must not be overlooked when comparisons between English and Danish food consumption calculations are made.

When weights are given in the food investigations, the same values as were used by Schierbeck in the first food consumption calculations in 1897 have been used for the reduction to albumin, fat and carbohydrates. Thus rye bread is reckoned as being equivalent to 2425 calories per kg. and meat 1296 calories. When only the price of the item is given, as in the case of green vegetables, a rise in price had to be reckoned with when estimating the corresponding weights. As compared with 1897, for example, a rise of 20 per cent. in prices was assumed to have occurred by 1909.

In such calculations as these—that is to say, calculations of the food consumption of whole families—the question arises whether waste should be allowed for. This has not been done in the present calculations as, in the author's opinion, it introduces a very strong subjective element. The object is to find possible differences between the various groups or between the various families, and these differences are independent of whether waste is allowed for or not.

What degree of accuracy is attained in such investigations? This is, of course, difficult to determine, but it might be noted that the omission of merely half a litre of milk—300 calories—daily was enough to cause so great a divergence in the results for one group of families that a bad misprint in the published results of the war-time investigations of 1915 was detected. When, as in this case, a few million one- to four-figured numbers have to be entered and worked out by many different people, errors in writing and calculation cannot entirely be avoided. The graver errors can often be detected in various ways, and small errors can be ignored when dealing with a material of this enormous size, for it is to be expected that they will neutralise one another to some extent.

In making the final food consumption calculations, errors have been avoided as far as possible either by two persons working out the results independently, or by calculating the food consumption twice on a calculating machine.

#### WHAT ARE WE TRYING TO DISCOVER?

The value which it is really of most importance to know is not the gross or net number of calories corresponding to each consumption unit, but the number of calories which are available daily for each family for physical labour. As the greater part of the manual work is done by the adults, as a rule by the man and his wife, we are dealing with a value which may be expected to be fairly constant in the different groups, if we assume that the work is similar in the individual groups. In N. P. Schierbeck's detailed food consumption calculations for twenty-three workers' families in Copenhagen, there were two similar baker's families. Employing the usual methods of calculation it is found that the number of calories corresponding to each consumption unit in one family exceeds that of the other family by 20 per

cent. If, on the other hand, the not unlikely assumption is made that the amount of physical work done is the same for these two identically placed families, and if this constant is introduced into the calculations, it is found that the daily usage of calories for vegetative purposes—for the maintenance of the living machine—is the same for each consumption unit in the two families, namely 2350 calories, while 1600 calories are left over for physical labour in both families.

When there is a sufficient excess of calories for physical labour the man is able to do a good day's work, and it is very probable that he will do so, as the impulse for exertion will presumably be great enough to make him keen on working. But if only a few calories can be spared for physical labour, he will be unable to do more than a short day's work, and will probably feel more or less disinclined to exert himself to work.

#### THE RESULTS.

We will now proceed to examine the results of the food consumption calculations based on the official Danish family budget enquiries.

In order to get a general idea of the facts, the best course will be to examine the results obtained from the rural districts first.

In view of the considerable amount of muscular work done by the agricultural workers their diet, as recorded in the first investigation in 1897, must be rather meagre. This enquiry, however, must have caused difficulty, especially in the rural districts, in recording all the food items consumed. The results obtained in 1897 are, therefore, lower for the rural districts than those obtained in 1909. But in the 1909 enquiry we find an adequate amount of energy—of working capacity—of 3400 to 3500 calories (gross) in the diet of the agricultural workers, which is equivalent to a working-day of 219,000 kg.-metres for each family. It must be remembered that we are here dealing with the combined work of husband and wife, and that Sundays and other holidays are included as working days.

A working day of 100,000–125,000 kg.-metres is not a very strenuous one. In ascending a fairly steep mountain in 8 hours a climber does 200,000–300,000 kg.-metres of work.

As only one-fifth of the amount of heat supplied to a man can be used for muscular work, a quantity of heat, that is to say, a number of calories, equivalent to half a million kg.-metres is necessary if he is to do an ordinary day's work of 100,000 kg.-metres. The equivalent of half a million kg.-metres is approximately 1200 calories, one calorie being equal to 425 kg.-metres. These 1200 calories must, of course, be added to the 2400 calories required by a man who is doing no work.

It has been demonstrated experimentally that a man of normal weight—70 kg.—uses 3600 calories daily in the process of living and doing a day's work of 100,000 kg.-metres, 2400 calories being used to keep the living machine

going and the remaining 1200 calories being consumed in work. But, as one-tenth of the energy of the food passes unutilised through the intestines, the number of calories a man requires every day is actually 4000.

Reverting to Table III, it will be noted that the more well-to-do classes in the country, both in 1909 and in 1916, obtained a fair supply of energy, particularly when their restricted amount of muscular work is taken into account.

It will be observed that the artisan in the rural districts needs less than the agricultural worker, and the lower-grade official (with a yearly income of

Table III.

	American units	No. of calories daily per consumption unit		No. of calories remaining for physical work*	No. of 1000 kg.-metres†	
		Gross	Net		Per unit	Per family
<b>COPENHAGEN</b>						
1897. 27 workers' families	@ 3.65 (4.9 persons)	2848	2563	218	18	66
1909. 76 " "	@ 3.43 (4.6 " )	2730	2457	112	9	32
1916. 9 middle-class families	@ 2.76 2000-3000 Kroner	3274	2947	602	50	138
1916. 49 " "	@ 3.00 3000-5000 " "	3330	2997	652	54	163
1916. 23 " "	@ 3.82 over 5000 " "	3488	3139	794	66	253
<b>PROVINCIAL TOWNS</b>						
1897. 23 workers' families	@ 4.01 (5.6 persons)	2617	2355	10	1	4
1909. 99 " "	@ 3.47 (5.0 " )	2863	2577	232	19	67
1916. 21 middle-class families	@ 2.59 2000-3000 Kroner	3164	2848	505	42	109
1916. 41 " "	@ 3.49 3000-5000 " "	3128	2815	470	39	137
1916. 9 " "	@ 4.91 over 5000 " "	3475	3128	783	65	320
<b>RURAL DISTRICTS</b>						
1897. 115 workers' families in the Islands	@ 3.46 (4.9 persons)	3056	2750	405	34	118
1897. 86 workers' families in Jutland	@ 3.38 (4.9 " )	3183	2865	520	43	146
1909. 65 workers' families	@ 3.32 (4.7 " )	3485	3137	792	66	219
1909. 70 artisans	@ 3.17 (4.5 " )	3413	3072	727	61	192
1916. 15 middle-class families	@ 2.95 2000-3000 Kroner	3140	2826	481	40	118
1916. 37 " "	@ 4.05 3000-5000 " "	3246	2921	576	48	194
1916. 13 " "	@ 4.06 over 5000 " "	3517	3165	820	68	277
1909. 84 smallholders' families‡	@ 3.54 (4.8 persons)	3778	3400	1055	88	311
1916. 142 farmers' families	@ 6.41 (7.8 " )	4509	4058	1713	143	915

\* This figure is obtained by deducting the number of calories (2345) necessary for a man at rest from the net value. The latter, in turn, is obtained by deducting 10 per cent. for the loss of heat discharged in the excrements, from the gross value.

† As 100,000 kg.-metres are the physical equivalent of 235.2 calories, then, according to the usually adopted efficiency standard of 20 per cent., 1176 calories (in round figures 1200) will be necessary to do this amount of work. The number of calories left over for physical labour must therefore be divided by 0.012 in order to obtain the amount of kg.-metres they will yield.

‡ As a certain amount of the food is consumed by domestic animals, these figures can only be compared with those of other smallholders' and farmers' families.

from 2000-3000 Kroner), in turn, needs less than the artisan. The better placed official (with an income of 3000-5000 Kroner) needs a little more than the lower-grade official.

The most prosperous of the investigated families again reach the same level as the agricultural worker in their consumption of calories. One-half of these well-to-do families are doctor's families, the doctor taking a certain amount of active exercise in travelling about in the district. In these families there are indoor servants who often have a good deal of physical work to perform.

We do not, of course, find the same distinct family types in the more well-to-do classes as are met with in the poorer classes.



The house-keeping of an agricultural worker's family or of a smallholder's family is, on the whole, typical of his class. On the other hand, a middle-class family with an annual income of from 10,000–20,000 Kroner lives a much more individual existence. In the working out of the latter material many disturbing factors, such as long travels, entertainment on a large scale and visits to restaurants have to be dealt with. Moreover, the variable amount of waste going on in the different homes cannot be ignored altogether.

It is an old experience that the excrement of well-to-do people is more valuable as manure than that of poor people. In Prof. Eschricht's century-old travel reminiscences it is stated that the Italian peasants paid more for the excrement of the rich English tourists than for that of their own people. This, however, has very little influence on the percentage.

When we examine the conditions in the towns we find that the results are less satisfactory. It appears that both in Copenhagen and in the provincial towns the amount of energy, the working capacity, which the workers' families obtain from their food is smaller than that which our investigations have proved to be most suitable for the working of the human machine.

The results are the same for both of the one-year periods covered by the investigation. The very lowest result—only 2350 calories net per consumption unit—was found in the provincial towns in 1897, but in this enquiry the aim was to reach the lowest level possible from an economic point of view. On the other hand, the result in Copenhagen is lower for 1909 than for 1897, but there was much unemployment in Copenhagen during that year and food prices were rather high. Nevertheless, all the four series of investigations yield the same result.

The diet of the workers' families investigated in the towns does not contain sufficient energy to enable the man to do satisfactory work—a good day's work—unless the rest of the family go short. It is a common enough complaint in Denmark that the amount of work done by the industrial worker is so small because the rate at which he works—the intensity of his work—is too slow. But can the Danish town workers on the ordinary Danish working man's fare do a greater amount of work? Is not the greater speed of working in America due to the higher standard of living?

In order to do a good day's work of only 125,000 kg.-metres, not less than 1450 calories are necessary for this alone, but some of the Danish town workers can hardly spare more than 600 calories (that is to say, 50,000 kg.-metres) for physical work, with the diet specified.

The rest of the town families, the so-called middle-class families, appear to get sufficient nourishment, in the case of the economically most favoured class perhaps to be a little over-fed, in spite of the fact that the manual labour of the servants will drive the figures up.

Series of investigations into the food consumption of smallholders' and farmers' families in the rural districts were also undertaken in 1909. The comparatively high figures, 3800 and 4500 calories daily for each consumption

unit, which were obtained in the case of these agricultural workers, must be taken in conjunction with the fact that quite a large proportion of all the individuals are manual workers, and that the foal, the calf, the dog, the cat and the poultry partake of the food consumed. In other words, the results arrived at are only suitable for comparison with those of other smallholders' and farmers' families, and such food consumption calculations have not yet been made.

The Danish food consumption results seem to be at variance with the old maxim that a population with a free choice of food commodities eats neither too little nor too much.

This is, however, the first time that it has been possible to estimate the food consumption of an entire population—to estimate the food consumption of the different classes.

I will here refer to information gained from other sources which seems to support the above results, and to the obvious objections which can be raised against the material used in the present work.

#### CORROBORATIVE EVIDENCE FROM OTHER SOURCES.

That part of the Danish population not only during the Great War but also in peace time have been, and still are, under-nourished, the following investigations indicate. The medical statistician, H. J. Hansen, has found that there is a difference in weight of 50 grm. between the new-born children of poor and well-to-do mothers. Further, the old report of 1884 concerning the state of health in Danish schools contains some measurements and weighings, showing the difference in bodily development in the different classes of society. Thus the public school boy at the age of 12 is about 5 cm. higher than the board school boy, and weighs 2 kg. more than the latter.

Knowledge of the height-measurements of young men obtained at the recruiting stations indicates that the nourishment of the population has improved in the course of years. At any rate the average height of an adult male has risen from 165 to 169 cm. This increase has taken place gradually during 70 years, except in the spare years of the Great War.

#### OBVIOUS OBJECTIONS.

Amongst the objections which can be raised against the present food consumption calculations, I will point out the following.

The household accounts were not kept in the same year, but the large series refer to three different years, 1897, 1909 and 1916, while the small series during the "dear period" refer to two consecutive years, 1915 and 1916. This is, of course, not very satisfactory. Between the first and the last of the investigations there is an interval of about 20 years, during which period there was at first a time of steadily increasing prosperity accompanied, however, by a steady rise in the price of foodstuffs, and followed later for a couple of years—the first years of the war—by rapidly increasing prices.

In future food consumption investigations the first care must be unity of time—just as in a well-written stage drama. But also the second essential of a drama, namely, unity of place, is an indispensable condition. It has been found that the difference in food consumption between the people living in Jutland and the inhabitants of the Islands is very considerable, so that future investigations into the food consumption of the different social classes cannot very well avoid taking them into consideration. By ensuring uniformity of time and place in the investigations, the important classification of the articles of food into groups and sub-groups is the same for the whole of the material. A change of habit in the mode of living will not then interfere with the results.

Another objection is that these investigations, as far as the workers' families are concerned, deal with relatively prosperous working-class families. Such families are supposed to economise in food and spend their money on other things. But, as between one-half and two-thirds of their expenditure is on food, this objection has little significance.

In the nature of the case the workers must necessarily be of a superior type, as only such persons are able to keep the household records for a whole year in such a manner that they can be utilised. It is generally the householder who has kept all the accounts, the general account and the accounts of food expenditure.

The consumption of alcohol is not of much moment in these households. The calories obtained from noxious alcoholic drinks are, of course, not included in the calculations. "Go into the streets and look at all the fat, fleshy necks and leave off speaking about insufficient nourishment in this country" is the objection made by a Danish statistician. But one has more confidence in the results which are obtained by weighing, counting and measuring than in any individual opinion.

I shall now briefly discuss the question of the validity of the norms employed. An investigation of this nature rests on hundreds of earlier investigations in other fields, and some of the scales and figures adopted will naturally later be found to be either a little too large or too small. It is, however, presumably only a question of a rather immaterial distortion of the picture drawn of the standard of living of the population. The norm, the measure which is of special importance, is the number of calories per consumption unit which are the daily requirement of a man doing no bodily work. The Danish food consumption calculations are based on 2345 calories. This is the number generally used in the country, and taking into consideration the results obtained, the norms and scales cannot well be changed.

Even if it has been possible to keep some already very emaciated American students fit for work for a few months on 1900 calories per diem, this figure cannot be used as the norm in investigations into the food consumption of families, because in the first place the students were hungry and often felt cold. They had to take their meals at a separate table in order to prevent them from taking some of the other students' food.

In the investigations in October 1915, when food-prices were abnormally high, it was found that the lowest income group in Copenhagen—which, however, only included three families—were just as badly nourished as the above-mentioned American students, but in the following year, October 1916, this income group entirely disappeared from the records. The reason was that in October 1916 some of the poorer families returned the account books not filled in, because “they lived so poorly that they were ashamed of it.”

Table IV. *The “expensive” period diet during a fortnight in October 1915 and 1916.*

		American units	No. of calories daily per consumption unit		No. of calories remaining for physical work	No. of 1000 kg.-metres	
			Gross	Net		Per unit	Per family
<b>COPENHAGEN (THE CAPITAL)</b>							
1915.	I.	3 families	@ 7.55 (10.7 persons)	2122	1910	-435	—
	II.	11 "	@ 5.28 (7.9 " )	2933	2640	295	25 130
	III.	51 "	@ 4.43 (6.0 " )	3007	2706	461	38 170
	IV.	42 "	@ 3.75 (5.0 " )	3154	2839	494	41 154
	V.	81 "	@ 3.24 (4.0 " )	3308	2977	632	53 171
	VI.	33 "	@ 2.31 (2.6 " )	3833	3450	1105	92 212
1916.	I.	33 "	@ 2.31 (2.6 " )	3833	3450	1105	92 212
	II.	6 "	@ 6.47 (8.5 " )	2786	2507	262	22 141
	III.	17 "	@ 4.68 (6.4 " )	3126	2813	568	47 222
	IV.	17 "	@ 4.25 (5.7 " )	3327	2994	659	55 239
	V.	57 "	@ 3.55 (4.3 " )	3424	3082	736	61 218
	VI.	32 "	@ 2.80 (3.1 " )	3655	3290	945	79 220
<b>THE PROVINCIAL TOWNS</b>							
1915.	I.	48 families	@ 5.38 (8.4 persons)	2947	2752	407	34 183
	II.	101 "	@ 4.62 (6.5 " )	2897	2607	262	22 101
	III.	61 "	@ 3.71 (5.1 " )	3262	2936	591	49 183
	IV.	31 "	@ 3.51 (4.4 " )	3477	3129	784	65 226
	V.	34 "	@ 2.94 (3.6 " )	3526	3173	828	69 203
1916.	I.	19 "	@ 5.71 (8.7 " )	2678	2410	65	5 31
	II.	76 "	@ 4.82 (6.8 " )	3034	2731	386	32 155
	III.	65 "	@ 4.04 (5.4 " )	3214	2893	548	46 184
	IV.	36 "	@ 3.41 (4.4 " )	3446	3101	756	63 215
	V.	52 "	@ 2.86 (3.4 " )	3776	3398	1053	88 251

The investigations made when prices were high which only cover a fortnight's expenditure are, of course, less reliable than those covering a whole year. I have, however, included them, chiefly because in some respects they seem to show clearly that the most important value in these family budget enquiries is the number of kg.-metres which each family can accomplish daily (see Table IV). Thus, if the conditions in Copenhagen in October 1916 are studied, it will be noticed that in four of the income groups—the third to the sixth—the daily number of kg.-metres is the same for each family, namely about 220,000, while the four remaining rows of figures show a steady increase.

That the actual number of kg.-metres is so high is probably due to the fact that during October 1916 three times as many fresh herrings were consumed as in October of the preceding year. There was an unusually large catch of herrings in the Sound in October 1916.

In the provincial towns also the number of kg.-metres for each family is seen to be about the same for the third, the fourth and the fifth income groups in October 1915, while the remaining four rows of figures show a steady rise.

Table V. *Income groups in the "expensive period" investigations of 1915 and 1916.*

I.	Up to 3.50 Kroner weekly per member of family		
II.	3.50- 5.25	"	"
III.	5.25- 7.00	"	"
IV.	7.00- 8.75	"	"
V.	8.75-14.00	"	"
VI.	14.00 and over	"	"

## CHANGES IN OUR DIET IN THE NEAR FUTURE.

When in 1910 I undertook the diet calculations of the Danish family budget investigations in place of the late N. P. Schierbeck, I was inclined to regard the kind of food which formed the diets in 1897 as something which would remain unchanged from year to year, and from decade to decade. But by degrees, as the calculations advanced and covered longer periods, it became evident that this was not the case. In the span of years during which the Danish food consumption investigations have been conducted there have, in fact, been great and important changes in the mode of living of the population. Margarine—especially in the country—has almost supplanted butter, and has also been the cause of a decrease in the consumption of pork. In the towns green vegetables and fruit have been more and more freely partaken of. In other words, the mode of living proved to be readily affected by modern conditions; the influence of various factors such as the level of prices, increased cost of living, scarcity of supplies and, no doubt, to some extent the prevailing fashion, was quickly felt.

With these facts before us the question arises whether a change in the Danish mode of living, that is to say, in the diet, can be expected in the immediate future.

There are a few relevant facts to which attention may be drawn, quoted chiefly from the Swedish plant geographer, Gunnar Andersson.

During the last few years it has been possible to convert the liquid vegetable oils of the tropics into solid fatty substances. The result of this is that it has not only become easier to send these cheap fats from tropical countries to Scandinavia, but they have also become more palatable to the people. The entire Danish production of animal fat, especially of pork fat, is threatened with such keen competition from the tropical solidified vegetable oil that it may even necessitate a reorganisation of the agriculture of the country.

There are other factors which will affect the future diet. The present-day fast cargo boats, the freight rates of which will doubtless be cheap before long, will be able to bring large quantities of tropical fruits, notably dates and bananas, to Denmark. The banana especially will be exploited. This will happen all the sooner if the duty is abolished.

In a large part of North America the banana is already a very important item in the people's diet. They are seldom absent from the rich man's table, and the poor man spends his last penny on them. It is, however, not only

as a fruit that the banana will be useful; it will be increasingly employed in the form of banana flour. As is known, banana flour can be mixed with wheat flour in the proportion 1 : 5.

But apart from the facts mentioned there is still another thing which will affect the diet of the future. Efforts are being made in many countries to create new cultivated plants and to improve upon the older varieties. The cultivation of the common cereals dates farther back than the earliest historical records; the potato and a few others were introduced later. There exist, all told, only about 450 cultivated plants which can be used as food, and of these only 20 to 30 varieties are of any real importance.

Of late years it has been possible to improve upon several of the older cultivated plants. Thus the soya bean and the sugar cane are now highly productive plants. Food prepared from the soya bean will perhaps, before long, vie with our expensive meat dishes. As a result of the improvement of the sugar cane, sugar from the tropical sugar plantations has again come into competition with Danish beet sugar.

Taking all the facts into consideration, considerable changes in the diet of the population may undoubtedly be expected during the coming years. The schnaps will soon be a thing of the past. The produce of the tropics, the tropical fruits, will gain ground in many different forms, while the consumption of animal fat will decline.

#### CONCLUSION.

In spite of the great scope of the Danish food consumption investigations—the food consumption of 1000 families for a whole year and of 800 families for a fortnight—it is hardly justifiable to regard them as more than one great preliminary experiment. It must be left to future research to amend or corroborate the results which so far have been obtained.

It has only been possible, of course, to give a very rough sketch of the subject here. Many points have had to be omitted, such as changes in constitution of the diet, the significance of the substitution of one food product by another, the importance of the fact that Danish food is relatively so rich in fat, and many others<sup>1</sup>.

The subject of this work is so familiar to the author that it has been difficult to give prominence to just those things which engage the attention of others. Many a fact, which seems too insignificant to mention, would perhaps catch the eye of others, while much that has been included is perhaps so well known to the reader that it has lost interest for him.

But, if, in this review, I have succeeded in drawing attention to the Danish food consumption investigations, I feel that my work has not been in vain.

<sup>1</sup> *J. Hygiene* (1922), 20, 366.

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