needed to provide even 2 oz. butter/person/week. Almost all our butter is at present imported, as is, of course, almost all the fat needed for margarine manufacture. In this connexion, it is perhaps worth calling attention to the fact that if ground-nuts can be imported whole from the projected East African production areas and processed in this country, our fat supplies will benefit twice—by the extracted oil for margarine, and by the additional milk fat which will be produced in the improved yields of our cows, when they receive additional ground-nut cake in their production rations.

SUMMARY

1. The nutritionist's requirements call for an increase in milk production of some 25%. This cannot be met unless there is a very substantial increase—of the order of 600,000 t. annually—of concentrated feeding-stuffs for cows in milk. Much of this must come from abroad. Probably at least a 10% rise in milk output could be obtained, with our present size and genetic quality of cow population, by feeding more concentrates and by improved management on the farm.

2. An increase in the quality, rather than in the number, of dairy cows is also required. Artificial insemination from high-quality bulls, together with the more usual methods of herd improvement, should permit of the rest of the 25% increase being met over a period of years—perhaps 9 or 10 years—without any important change in the number of cows. Additional feeding-stuffs will, of course, be needed, as the quality of the cows improves.

3. The need for improved farm methods and generally increased efficiency of management of land for fodder production and of the dairy herd for milk production will put an immediate strain on the National Agricultural Advisory Service and will entail organized technical training in modern methods for the majority of existing dairy farmers and cowmen, as well as for new entrants.

4. As regards other dairy products, the large demands for milk for consumption in the liquid form will virtually mean that most of the requirements for cheese and butter will have to be met from sources abroad. The volume of milk needed to provide the cheese and butter requirements is approximately equal to that now consumed liquid.

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Home Production of Meat

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Needs

The best basis on which to start a consideration of needs is probably that of the food requirements of man as published by the U.S.A. National Research Council (1941). This recommends for a moderately active man a daily allowance of 3000 Cal., 70 g.

protein and 0·8 g. calcium. In deciding how much of these different constituents of the diet should come from animal, and how much from vegetable, sources there is little exact evidence but only some general principles to act as a guide. Experiments, especially those on pig feeding, have shown that the maximum rate of growth is obtained only when the diet contains a reasonable amount of animal protein in addition to vegetable proteins. Again, when the intake of calories is considered, the question of bulk of the ration plays an important part in determining from what source the calories should be obtained. Under present conditions, when necessarily a considerable part of the calorie intake has to come from potatoes and from high-extraction flour, it is important that fats should be available to reduce the need for too much bulk, if an active and vigorous life is to be led. As meat does not supply an appreciable amount of calcium to the diet it will be neglected here.

In animal experiments the 'free choice' method (Henry & Morrison, 1928) has been used to determine what proportions of the various foods give the best results. If one adopts this method for our requirements of meat in the ration one can go back to the figures for 1932, a time when there were no restrictions of any kind on food imported into this country, when there was a yearly consumption/head of 63 lb. of beef, 51 lb. of pig meat and 32 lb. of mutton and lamb (Imperial Economic Committee, 1935). This would supply the approximate quantities of nutrients set out in Table 1. On this basis meat should supply 586 Cal. of the total 3000 Cal. and 21 g. of the 70 g. total protein required in the daily ration.

Table 1. *Calories and protein supplied by meat, 1932 basis*

		Nutrients			
		Protein		Calories	
Meat	Annual consumption (lb./head)	g./lb.	g./head/day	Cal./lb.	Cal./head/day
Beef and veal	63	55	9·5	1200	207
Mutton and lamb	32	52	4·6	1300	114
Pig meat	51	50	7·0	1900	265
Total	146	—	21·1	—	586

Even in 1932, however, a limitation on complete 'free choice' was set by financial considerations. Lloyd (1936) who made surveys of food intake of families on different income levels, obtained for 1936 the results quoted in Table 2.

Table 2. *Relation between income and consumption of meat*

Income level (*s.*/head/week)	Up to 10	10–15	15–20	20–30	30–45	Over 45
Meat consumed (lb./head/year)	75	103	121	135	146	161

This indicates that with removal of financial restrictions meat consumption increases rapidly, at any rate to a level of 160 lb./head/year.

The financial restriction limiting intake of meat is illustrated by the meat consumption in different countries. For example, the Argentine, Australia and New Zealand, countries producing surplus meat, where the local meat prices are low, have an annual

consumption of about 250 lb./head. In U.S.A. and U.K., where the income level of the working classes is relatively high, the pre-war annual consumption was approx. 146 lb./head, while in France and Germany with a lower income level it was about 90 lb., and in Italy and Mediterranean countries with a still lower income level it was about 70 lb. (Tomhave, 1925).

At the present time in this country full employment and comparatively high wages, together with the present Government subsidy on food, keeping it at a reasonable price in relation to wages, have increased the demand for meat, so that the present limited ration (about 87 lb.) is fully taken up and more is demanded.

Resources

Since agricultural conditions have changed considerably during the war, any consideration of possible future supplies should take into consideration not only present supplies but those which existed before the war. Estimates of these are set out in Table 3. How far our own resources of meat supply can be brought back to the

Table 3. *Comparison of meat supplies in* 1932 *and* 1946

	Consumption/head/year		Consumption in 1946 as	Home-produced meat	
Meat	1932 (lb.)	1946 (lb.)	percentage of that in 1932	1932 (lb.)	1946 (lb.)
Beef and veal	63	44	70	30	24
Mutton and lamb	32	28	84	15	8
Pig meat	51	15	30	20	6
Total	146	87	60	65	38

1932 level or increased beyond it depends on what steps are taken to increase production. This will now be considered for each class of meat in turn. Before this is done, however, the general position of British agriculture in relation to national economy has to be taken into account. During the war, when shipping was the bottleneck, it was more economical for us to import animal products rather than feeding stuffs for animals. Now, however, when dollars or exports and not shipping are limiting food imports, it will be much more economical for us to import and grow animal feeding-stuffs again and produce our own animal products—thus getting back to the position which existed pre-war.

Beef

Although our home production of beef has been maintained better than that of other classes of meat, there is now much more necessity for increased supplies. In previous days much beef was sent here from the Argentine as interest on capital invested; this is no longer the case and beef has to be paid for in dollars or exports. In recent years the numbers of beef cattle kept in this country have been reduced owing to the increase in numbers of dairy cows from 2·4 million in 1889 and 3·1 million in 1929 to 4·0 million in 1944. This increase in numbers of dairy cows need not necessitate, however, much increase in the amount of cow beef. The steps at present being taken to make the dairy industry more efficient (better breeding for milk production and elimination of disease

from herds) should lengthen the life of the dairy cow in the herd from 2·5 to 3·5 years and so reduce the turnover from about 20% to about 10%. If these steps are successful the number of dairy heifers which have to be reared for replacements will be much reduced and this should leave room for rearing many more beef cattle. The additional milk we still require could be more economically produced by the better breeding and feeding of the cows we have, rather than by further increasing numbers to any considerable extent. We can no longer afford, however, to rear beef cattle from pure beef cows which yield no other return than the calf. Fortunately the bulk of our cows in this country are of dual-purpose type and these mated with a pure beef bull will produce calves suitable for beef production. Steps are now being taken to supply free artificial insemination from colour-marked beef bulls, i.e. those with dominant colour markings by which the beef calves are easily distinguishable from dairy animals. It is hoped to increase rapidly by this measure the number of cattle suitable for beef production. It will be 3 years at least, however, before this can become effective. The chief factor preventing great increase in the number of calves reared is lack of an adequate supply of concentrated foods for their 1st year of life. Two main steps can be taken to increase this supply. First, to import more feeding-stuffs for cattle: the African ground-nut development scheme, for example, should provide much ground-nut cake for cattle feeding as well as oil for margarine making. Secondly, to utilize more economically for feeding young cattle, which have a greater capacity for growth, the large quantity of feeding-stuffs now used for winter fattening of cattle. By concentrating on the summer grass-fattening of cattle we could produce much more beef, but we should have to develop cold storage to hold the autumn surplus over the winter months.

Mutton and lamb

Owing to the ploughing-up policy adopted, the numbers of sheep in this country were reduced from about 26 million pre-war to about 18 million at the end of the war and, in addition, some 4 million were lost in the blizzards last winter, so that the drop in home-produced supplies is likely to continue for about 4 years. The rate of recovery will depend on the avoidance of slaughter of any ewes capable of breeding and the Ministry of Agriculture have already issued a request for this to be observed. It will also depend on the breeds of rams widely used during the next few years, for fertility in the different breeds varies from 180% in Border-Leicester to 128% in Romney Marsh (Nichols, 1926). As with cattle, the bottleneck is winter feed and a change in the seasonal prices of mutton and lamb from a maximum in the spring to a maximum in late summer and autumn would encourage summer, rather than winter, fattening.

Pig meat

Pre-war supplies were based on cheap imported cereals and on the larger quantities of milling offal derived from the original 75% extraction of flour as compared with the present 85% extraction. Collection of swill from cities supplied a partial substitute during the war, but with the end of the war and dispersal of army camps this source

of supply decreased considerably. Recovery depends on recovery in the world supply of cereals, but much might be done to increase supplies of pig meat by keeping a few pigs on every farm, where they obtain their maintenance requirements from scavenging. In Poland and Germany pig production is based on surplus potatoes, but here this crop requires too much labour to make it a feasible proposition at the present time.

SUMMARY

Our needs in meat are about 146 lb./head/year, of which we now produce only about 38 lb., though pre-war we produced about 65 lb. The total amount we could produce depends on the steps taken to implement production; with the increase in the productivity of the new long-ley grassland, meat production should be greater than in pre-war days.

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The Contribution of British Sea Fisheries to the Nation's Food Supply

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The productivity of sea fisheries depends ultimately, as that of animal stocks on land, on primary producer organisms deriving their energy from the sun by photosynthesis. Green plants fulfil this role in terrestrial communities, but their place is taken in the sea by minute unicellular green organisms floating freely in the upper waters. All important fish, however, are carnivorous, with the consequence that fish stocks become inter-related in a complex way. Moreover, fish populations cover large areas as a single unit, and are fished by several countries simultaneously. While it does not seem practicable at the present time to increase the basic productivity of sea fisheries by increasing the quantity of primary producer organisms, it is possible to adjust the fishing effort so as to derive the greatest yield from the growth of fish stocks. In some regions, particularly the North Sea, the maximum level of yield had been reached some years ago, and by 1938 fishing had increased beyond the optimum. The result was over-fishing, with a consequent fall in productivity of the stocks and in profit to the industry. From such regions, and for the fish which suffered from over-fishing, the potential yield, though limited, is somewhat greater than the 1938 level. The difference, amounting to a rough figure of 20% for the demersal fish of the North Sea, could be achieved by suitable regulation of the fishing effort. During the war, fishing was