

MARGARINE

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EARLY HISTORY

IT is unlike the French to be unmindful of a son of their country who has rendered notable service in so important a matter as food, yet I am not aware that the achievement of Mège-Mouries is commemorated in France by a public monument or inscription or even by a street name. Equally surprising is the scanty information supplied by biographical works of reference about that most ingenious inventor. Perhaps we can attribute this to the lack of sympathy one would expect from a nation which appreciates above all other things good food and good cooks, towards one who hoped to pass off the greasy and rather unpalatable products of his laboratory as butter. Whatever the reason for such neglect, the fact remains that the French might well be proud to claim the inventor who made possible one of the greatest food industries of our time.

It is often erroneously believed that Mège-Mouries set out to concoct a substitute for butter. It is true that he was stimulated by the desire of the Victualling Department of the French Navy to find such a substitute; but he himself was more ambitious. He attempted to produce butter itself, and that by a series of laboratory treatments that he thought would reproduce exactly the changes by which he believed body fat to be converted into milk fat in the animal body. His laborious process, in which beef fat was digested at blood heat, first with macerated sheep's stomach and then with chopped cow's udder and milk, actually gave him nothing more unusual than the softer portion of the original fat, carrying, presumably, some traces of a milky flavour. Nevertheless, in the early days he was quite satisfied that he had made butter. Others, less optimistic, were content to believe that he had solved the problem of preparing an edible substitute for butter, and for this achievement he was honoured in 1870 by Napoleon III.

Had it not been for the Franco-Prussian War, it is probable that France would have led the world in the technical development of the new process. As it happened, the opportunity was seized in the United States and in Holland. In a remarkably short time factories were springing up in these countries for the manufacture of what was then called 'butterine'. It was soon found that Mège-Mouries's complicated digestion was quite

unnecessary, and that all it was necessary to do was to mix as thoroughly as possible with skimmed milk, preferably slightly sour, a fat of the appropriate melting point. On separating the fat again it was found to have acquired a buttery taste. It could then be 'worked', salted and coloured to taste.

Manufacture in Great Britain lagged far behind in the seventies. So far as can be judged from the contemporary press, the home-produced material was, moreover, of very inferior quality. Most of it was made in small, dirty, 'back-street' premises under highly insanitary conditions. To a large extent it was knowledge of these facts that gave 'butterine' so bad a reputation at that time. The English public was ready to believe any fantastic yarn about the doubtful nature of the fats used by the manufacturers, and they also suspected, often with more reason, that a good deal of the despised stuff was employed as an adulterant for butter. The passing of the Margarine Act in 1887 did something to allay uneasiness; nevertheless, the reputation of the new food remained an unsavoury one for a good many years.

IMPROVEMENTS IN MANUFACTURE

Then in 1889, Otto Monsted opened the first up-to-date factory in Great Britain. The pioneers were faced with a truly formidable task. Prejudice against margarine was at that time shared by rich and poor alike, and opposition from certain other trades, particularly the dairy industry, was vigorous and none too scrupulous. The product Monsted turned out was made from that fraction of beef fat which is known as 'oleo' or 'premier jus'. It was, in fact, a highly digestible fat possessing a calorific value equivalent to that of ordinary butter and, what was of great importance although unknown at the time, its vitamin A, and probably also its vitamin D, content was by no means negligible. It is probable that its nutritive value was not far below that of ordinary 'average' butter; but it is difficult to make a proper estimate because it is a curious fact that an extensive modern literature on the vitamin contents of foods does not give us any information as to the A and D value of the common edible body fats such as those of beef or mutton.

By comparison with our modern margarines these primitive materials were undoubtedly very crude. They were inclined to be unpleasantly

greasy, to stick to the knife, and to spread in a manner unattractive to those used to butter. Moreover, they often had a 'fatty' taste and smell which many people disliked.

No problem has given the margarine manufacturers more trouble than that of producing a texture resembling that of dairy butter. The introduction about 1890 into margarine manufacture of vegetable oils suitable for blending with 'oleo' helped them to some extent; but it was not until some years of the new century had passed that their fortunes turned. By this time the small producer was dropping out of the picture and with him many brands of dubious quality which had served to keep alive an unenviable reputation. To an ever-increasing extent manufacture was passing into the hands of large commercial organizations guided by directorates not only anxious to provide the consumer with an article of high quality, but also prepared to spend very large sums of money on scientific and technical research to that end. One by one the problems were attacked and solved. Care in the selection of oils for blending; improved methods of emulsifying the mixture with pretreated separated milk; controlled crystallization of the final product to get the right 'grain'; special precautions to be taken in 'working' a mixture differing in many subtle characteristics from butter; such knowledge, gained by patient and costly research, brought about remarkable improvements in respect of that almost indefinable but all-important character of texture. Chemists, biochemists and bacteriologists collaborated to select the appropriate bacterial flora which would produce in the separated milk just the right blend of substances necessary to impart to the margarine that elusive 'butter flavour'. Others ingeniously prepared chemical flavouring substances to serve the same end.

Another important milestone was the introduction of 'hardened' vegetable and animal fats.

Such have been the labours that have gone to produce the high quality of the popular butter substitute we know to-day.

VITAMIN REINFORCEMENTS

The period of the War of 1914-18 is very important in the history of margarine. At that time most authorities on dietetics regarded margarine as a reasonably good substitute for butter, because it was well digested and for all practical purposes provided the same heat-producing power. It was one of the cheaper forms of energy.

During the latter part of the War, however, the importance of the fat-soluble vitamins, discovered a few years before, gradually came to be recognized. The nutritive worth of edible fats could

no longer be assessed solely in terms of digestibility and energy equivalents. It was necessary to ascertain whether they would also provide the newly discovered constituents. Butter was found to contain them. On the other hand, most of the vegetable oils and fats then being used more and more extensively in margarine manufacture, as well as the hardened fats which had come into use soon after 1910, were found to be defective in this respect. Following up the obvious line these observations indicated, the late Prof. W. D. Halliburton and I examined a number of typical margarines and found that their nutritive value for the growing animal was determined by the vitamin contents of the constituent oils and fats. Margarines prepared almost solely from beef 'oleo' appeared to be as nutritive as butter, whereas the vegetable oil margarines, in spite of being excellently assimilated, did not supply the fat-soluble 'growth-promoting' factors needed by the young animal.

These observations made little impression on the margarine industry at the time. Such reaction as there was consisted of frank scepticism. Some people challenged the conclusion that vegetable oil margarines were devoid of vitamins by directing attention to the fact that milk, which in a vague sort of way was thought to be one of the richest sources of the accessory factors, was employed in the manufacture of the products. Others refused to acknowledge that experiments on rats could have any bearing on human nutrition. Others, again, argued that such small differences in composition of a single article of diet could scarcely be of any practical significance. Nearly ten years passed before serious attention was given to the matter. Then, at last, the margarine manufacturers moved. Many of the earlier attempts to raise the nutritive value of their products by the addition of vitamin preparations were failures. For the most part they were attempting to employ materials and concentrates prepared from cod liver oil. It was not a difficult matter to add sufficient of such supplements to bring the vitamin value of margarine up to that of an 'average' butter; but it was found that such additions almost invariably ruined the flavour and palatability besides materially increasing the cost.

The first real progress was made after the discovery of the method for preparing pure crystalline vitamin D₂ from ergosterol. It then became possible to raise the antirachitic value of a margarine at a very slight cost without affecting edibility in the slightest. To confer on margarine a vitamin D activity of 30 units per ounce, it was necessary to add only one ounce of vitamin D₂ (calciferol) to 120 tons of margarine. What was next required was a cheap and effective source of

vitamin A. It was found in one of the by-products of the whaling industry operating in Antarctic waters. Like other mammals, the whale stores considerable amounts of vitamin A group in its liver, though on the other hand it has curiously small reserves of D. The development of the factory-ship organization in the far southern waters made available large quantities of whale liver fat. It had the advantage not only of being valuable as a source of A but also of yielding material which could be employed without impairing the flavour of the finished margarine. By employing this supplement and at the same time adding artificially prepared vitamin D, the production of a satisfactory 'vitaminized' margarine for the ordinary market was achieved. Brands prepared with such additions first came on the market about six years ago. Not unexpectedly, they aroused a good deal of hostility from the butter industry, and there have been sharp controversies between the rival interests. With the many and widely differing aspects of these controversies we cannot be concerned here. Suffice it to say that in one country at least a rather bitter trade war has been terminated by a government-inspired 'gentleman's agreement' to 'live and let live'.

More recently, success has rewarded efforts to prepare from fish liver oils concentrates of A and D suitable for adding to margarine. They are prepared from liver oils of very high initial potency. So small an addition is required that the palatability of the final product is unaffected, and, what is so important, the cost is almost negligible.

MARGARINE IN THE NATION'S DIET

It is very important, particularly at a time like the present, to try to get such a valuable foodstuff as margarine into proper perspective with the diet of the nation. In 1938, a year in which butter was, generally speaking, cheap, the weighted average consumption per head of the population of Great Britain was 7.6 oz. a week, while the corresponding figure for margarine was 2.3 oz. Even the people classified in the poorest category of the population purchased, on an average, 4.5 oz. of butter per head per week.

If we take, as a peace-time basis for our argument, 10 oz. per week as a rough and ready estimate of the consumption of butter and margarine by the people of Great Britain in 1938, and if we also assume that the whole supply had the same vitamin content as an 'average' butter, we find a weekly intake of, approximately, 5,500 units of A and 150 units of D. Had the whole ten ounces been an 'average' vitamin-reinforced margarine, the intake of A would have been somewhat less, whereas the D supply might have been

nearly twice as large. In either event, these quantities approximate more closely to the requirements of the individual for one day than to those for a whole week.

In other words, the 'average' individual is more dependent on milk, eggs, green vegetables, etc., than on butter and 'vitaminized' margarine for vitamins A and D.

It is very important to remember, therefore, that the consumption of these alternative sources of fat-soluble vitamins is pitifully small among the poorer sections of the community. Under such conditions the question of the vitamin content of margarine assumes greater importance.

A consumption of 4.5 oz. of butter weekly—which is slightly more than the official ration—together with the balance of 5.5 oz.—assuming once again a total intake of 10 oz.—in the form of a 'non-vitaminized' margarine, would provide a mere 2,500 units of A and 70 of D. That is scarcely a conspicuous contribution to what the body requires. Such figures signify that a good proportion of the poorer people were receiving insufficient of these two vitamins under the relatively good conditions prevailing in 1938. There is evidence from other sources that this was so.

The deficiency was, of course, very much more serious at the end of the War of 1914–18, when rationing restricted weekly supplies to 1 oz. of butter and 4 oz. of margarine, none of the latter being 'vitaminized'. From these foods the individual could count on little more than 550 units of A and 15 units of D in a week—about one tenth of an adult's daily needs!

With rationing of butter in force, and having in mind the limited purchasing power of the poorer sections of the community, the desirability of enriching all margarines with vitamins A and D supplements must appear obvious.

At the present time a large proportion of the margarine sold over retail counters is so enriched. Unfortunately, there does not appear to be uniformity between the various brands, although for the purpose of general estimates such as have been made in this article, the content of an 'average' vitaminized product can be taken as 450 units of A and 30 units of D per ounce. A weekly supplement to the butter ration of 6 oz. of reinforced margarine could be regarded, therefore, as adding some 2,700 units of A and 180 units of D to the diet. It is certainly nothing to boast about; but one must remember how valuable is every unit where poverty diets well below the marginal nutritional level are concerned.

It will not be possible to plead ignorance this time if vitamin deficiency is allowed to be responsible for a decline in general health such as occurred during the years of 1914–18.