

and is therefore absent from all cooked foods and from lime juices, lemon syrups, etc., that are boiled in the course of manufacture, as most of them are.

Coming now to the practical application of these facts to the feeding of human beings, we may clear the ground somewhat by pointing out that the problem really resolves itself into the supply of fat soluble A for infants and growing children. Both the water soluble B and the antiscorbutic C are sufficiently widely distributed in foods to give us no anxiety in ordinary diet, and adults do not require vitamins to such an extent, as, the necessity for providing growth does not develop after childhood. Moreover, the diet of grown-up people is much more varied. So we will pass to the question of fat soluble A in children, with the note that if infants are to be fed on dried or otherwise prepared milk, the antiscorbutic vitamin must be supplied—as it usually is—by some fresh fruit juice.

Let us then consider fat soluble A for children, more closely. Do they always get it? If they can command a sufficient quantity of fresh milk or of butter they do not suffer, but is this always possible? For artificially fed infants, milk is sometimes boiled, which may easily destroy the factor altogether. In dried milks, while it is possible to preserve the fat soluble A, there is considerable doubt whether this is always done. It depends on the degree and duration of the heat to which it is subjected, and so far as my information goes both these factors vary considerably. From what I learn from physicians and others who have a large experience of infant feeding, it seems to be agreed that a baby does not thrive on dried milk alone. When we pass the age of infancy, and poverty exists, milk and butter become prohibitive. How many poor children get even half a pint of fresh milk a day, or any butter or eggs at all? They eat margarine instead.

Until recently the manufacturers were compelled to add a proportion of animal fat to their margarine, but—unhappily—that proviso has been withdrawn. Inasmuch as animal fat is much more costly than vegetable oils, I leave it to your imagination whether a commercial undertaking will continue to use it!

But there is another factor. Formerly it was impossible to use low grade vegetable oil, because the resulting margarine was not sufficiently firm, and the taste and smell of the oil survived. Nowadays, however, it is possible to make margarine out of almost any oil by subjecting it to a high temperature and forcing hydrogen through it under pressure, which not

only removes all taste and smell, but makes the finished product firm and white. Consequently, people who formerly disliked margarine now consume it with avidity. From the point of view of the production of heat and energy this is satisfactory, but it can contain no fat soluble A whatever, and in practice does not. So if a child gets little butter and milk or none at all, we must add fresh animal fat in some form or other to its diet. Lightly boiled eggs are useful, but how many poor children get eggs?

Now let us consider the result of this deficiency of fat soluble A; firstly, the children cannot grow properly: that means a stunted race. Then we have the question of rickets. In a recent inspection of London County Council school children it was found that no less than 80 per cent. showed signs of that disease, and I show you photographic slides of a puppy fed on a diet containing vegetable oil as its source of fat, and showing marked bending of the bones, which is visible not only in the direct view of the whole animal, but also in the X-ray photographs of its legs. When cod liver oil was substituted for the vegetable oil the rickets was cured. This must not be taken, incidentally, to mean that cod liver oil is necessarily suitable for children. Many cannot digest it at all, and it is therefore useless and cruel to give it. Secondly their resistance to infectious disease is concerned, and this hits not only the individual, but is responsible for much of the extent and severity of microbic diseases—not only the infective fevers be it noted, but tuberculosis also. Examples are within the experience of all of you. The recent epidemic of influenza took a heavy toll in death and invalidism, and the children's hospitals get more tuberculosis than ever they did, especially, as I am told, tubercular peritonitis.

How does the fat soluble A increase the resistance to infection? Personally, I think, by raising the nutrition and numbers of the white blood corpuscles. I do not wish to lay undue stress on this point, because the experimental work is not yet completed, but I may, perhaps, show you two photographs from preparations of my own. The first is one microscopic field of the blood of a rather weakly rat, not on a deficiency diet, but just a puny animal. You will notice that it contains only one white blood cell. To the diet a proportion of Virol—which was taken as the most convenient and most easily digestible source of fat soluble A, was added. The physique of the rat improved markedly and three weeks later its blood was again photographed, and you will see that the same type of field now contains six healthy

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