we should endeavour by all the means in our power to obtain a supply of sterile cow's milk, and that until this object can be attained—

X. Germs must be killed by some method. The handiest and most generally used being heat.

STERILIZATION.

Cow's milk, though sterile when drawn, soon becomes infected, and as delivered is full of micro-organisms. One authority states that London milk contains more organisms per c.cm. than its sewage.

The aim should be to deliver milk as nearly sterile as possible. Much we may hope will be accomplished in this direction in the future. Cattle should be kept in well built, drained and ventilated stalls. They should be as carefully groomed as a horse, and should be examined by the veterinary surgeon each month, any suspicious animals being at once isolated. The milkers should be made to wear overalls and to thoroughly cleanse their hands before milking; any sickness being immediately reported to a medical man. The water supply must be beyond suspicion and must be regularly analysed, and every care must be taken with the cleansing of all vessels used.

The milk should be cooled as soon as it is withdrawn. Most of the better dairies make some attempt to carry out these requirements, and by compensating freely for illness to man or beast make it advantageous to report anything of the sort. The limit to these precautions is at present the price of milk. We must take things as we find them, and acknowledging the probable presence of large numbers of organisms in any milk we are dealing with, do our best to destroy them. This process we have called sterilization, and to be effective, necessitates boiling for a prolonged period, at least one hour. This was the time adopted by Soxhlet, who introduced boiled milk. He noticed the following disadvantages following its use.

1. That some spores are not destroyed, even by such boiling, and that they may subsequently develop in such numbers as to make the milk dangerous.
2. That the taste becomes unpleasant.
3. Causes constipation.
4. That the soluble albumen (lactalbumen) coagulates at about 160° F., and is lost if removed.
5. That casein is rendered less digestible and is acted on more slowly by pepsin and trypsin.
6. That a harmful change results in the calcium salts.
7. That milk boiled has lost its antiscorbutic properties, and babies fed on it may develop scurvy. Cheadle, who is strongly in favour of boiling milk, admits that many such cases have come under his care and knowledge.
8. It is found that fat is less digestible in boiled than in unboiled milk.

Boiling milk, therefore, as a means of sterilization may not in every case be effective, and frequently does produce untoward effects. The question now naturally presents itself—Have we any alternative? We recognize that milk contains numbers of organisms; that these are injurious and must be got rid of or killed.

To sterilize milk completely and certainly it must be boiled more than once for at least an hour. Such prolonged boiling has many serious disadvantages, but in practical feeding we may strike a mean combining as many advantages with as few disadvantages as possible. This mean is generally accepted to be 70° C. (158° F.), kept up for thirty minutes, the process being known as pasteurization. Pasteurization is a loose term, both as regards time and temperature, and in writing a milk prescription in giving directions these should be specified:—Holt considers it to be 167° F.; Freeman considers it to be 155° F.; Leeds considers it to be 157° F.; Vincent considers it to be 150° F.

The advantages of pasteurization are: (1) That micro-organisms are destroyed and rendered harmless; (2) fermentation is stopped; (3) lactalbumen is not coagulated; commences at 161° F.; (4) chemically the milk is little changed; (5) the risks of transmission of disease are reduced to a minimum; (6) it is not so likely to produce scurvy, though Holt says the feeding on milk raised to 167° F. for thirty minutes has done so. Rapid cooling is part of this system, and little chemical change in the milk is said to result.

To our previous conclusions we may add the following, therefore:

1. That some attempt must be made to kill germs always present in large quantities in milk.
2. That boiling does this most effectually and rapidly, is much the easier method, and, in the hands of the poor, often

the only method available, but that certain injurious changes result, to be avoided if possible.

3. That these changes can best be avoided at 70° C. (158° F.) for half an hour (pasteurization).

4. That all infants' food should therefore undergo this process when possible.

THE INCREASE IN THE CONSUMPTION OF ANIMAL FOOD:

A SURVEY OF THE PAST FIFTY YEARS.

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THE question of physical inefficiency or physical deterioration is one which is occupying a prominent place in the minds of medical men at the present time. This subject has recently been investigated by a Departmental Commission, which arrived at the general conclusion that the available facts hardly warrant a definite statement as to the existence of a progressive deterioration in the physique of the nation. The only definite conclusion arrived at was the existence of a deterioration in the teeth of the younger generation. With regard to the general question, there is probably a widespread opinion among medical men that any deterioration which may be proved to exist has a direct relation to the alterations in the dietetic habits of the country in the present and past generations. This point was suggested to the Commission in the remit from the Royal College of Physicians of London, who, in their reply to the official invitation to take part in the investigation, pointed out that, among other factors demanding investigation, the question of the altered diet of the country took a prominent place. This subject does not, however, appear to have been very particularly investigated. The only evidence bearing directly on it was led by Drs. Haig and Hutchison. Dr. Haig pointed out that there had been a great increase in the consumption of meat in recent years, and expressed the opinion that the influence of this increase had been unfavourable to the race. Dr. Hutchison, on the other hand, expressed the opinion that the deficient use of nitrogenous foods at the growing periods of life—especially 10 to 15 years of age—was an important factor in the general malnutrition. It does not appear that any facts were elicited in favour of either view. A study of the available data proves conclusively that in the last fifty years there has been an enormous increase in the consumption of animal food (meat). This is proved by the following figures taken from the Blue Books. By way of introduction, a few words may be said on a cognate subject—namely, the geographical distribution of disease.

The difficulties attendant on the collection of reliable statistics on the geographical distribution of disease almost preclude any definite statement on this point. We have, for the most part, to be content with the general impressions of medical practitioners who have had extensive experience of disease in countries in which the dietetic habits are profoundly different from those prevailing in this country. To illustrate. The writer has been told by more than one practitioner of large experience in medical work in India that appendicitis is almost unknown among the natives of those districts in which the staple article of food is rice; similarly, that chlorosis is extremely rare.

On the other hand, some diseases which are comparatively rare in this country, are much more prevalent in that part of the world, for example, osteomalacia and diabetes. A short time ago a friend of the writer informed him that, as the result of six years' work as a medical missionary, she must have seen and treated over a hundred cases of the former disease; and for the prevalence of diabetes we have the authority of Dr. Crombie, who has suggested that diabetes might appropriately be called the gout of India. These facts are suggestive. They constitute strong evidence in favour of the importance of an experimental inquiry adapted to prove the existence or non-existence of an important relationship between the diet of a country and its prevalent diseases. If it could be shown that there is an important relationship between the diet of the natives of India and the diseases referred to, it is reasonable to think that diet may play an important part in the incidence of other diseases of a more acute nature. In this connexion it is of interest to note that a recent writer in the *Lancet* has suggested that the relative immunity to typhoid fever in the Japanese army may partly

be accounted for by the nature of the Japanese dietary. If it be proved that there is an important relationship between the diet of a country and the prevalence of certain diseases we might safely conclude that, in a country in which an important alteration in diet is taking place, there must of necessity be a concurrent evolution in disease. As already stated, my main object in this paper is to submit evidence which proves that a very remarkable change has taken place in the dietetic habits of the people of the British Isles in the past fifty years. In a later paper I hope to submit some highly-suggestive facts bearing on the question of evolution in disease.

THE AMOUNT OF ANIMAL FOOD (MEAT) CONSUMED PER HEAD PER ANNUM.

A study of the Blue Books shows that there have been several important changes in the diet of the country in the

TABLE I.—Meat Imports in the Last Fifty Years.

	1853.	1863.	1873.	1883.	1893.	1903.
Bacon and Hams	Cwts. 205,667	Cwts. 1,877,813	Cwts. 2,987,229	Cwts. 3,695,997	Cwts. 4,187,298	Cwts. 6,298,320
Beef	183,285	288,369	260,554	1,094,008	2,008,565	4,805,913
Fish	200,455	238,713	718,174	1,295,754	2,319,838	2,161,462
Meat, Salted or Fresh	—	—	79,841	272,849	*2,149,009	663,261
Preserved, other than Salted	—	—	260,749	610,400	590,800	245,794
Mutton	—	—	—	—	—	4,065,776
Pork	152,731	170,751	289,695	376,899	368,992	943,418
Totals, Cwts....	742,138	2,575,646	4,596,242	7,345,902	11,624,502	19,183,944
Population (Millions)...	27.5	29.3	32.1	35.4	38.4	42.3

* This figure presumably includes mutton.

past fifty years. The two most striking are, in order, an increase in the consumption of meat and an increase in the food-stuffs classified under the heading—confectionery and

Chart 1.—Showing the amount of imported meat consumed per head per annum (see Imports, *Statistical Abstracts of United Kingdom*).

succades. Attention is here more particularly directed to the consumption of animal foods.

The statistical abstracts of the United Kingdom give a clear statement of the amount of animal food imported into this country in the past fifty years. The entries include bacon and hams, beef, fish of various kinds, meat salted and preserved, mutton, and pork. These are given in Table I, which also gives the population of the United Kingdom for each year. A glance at the table shows the remarkable nature of the increase, which is perhaps better indicated in the form of a chart (see Chart 1). These show that, whereas in the year 1853 the amount of meat imported was 3 lb. per head per annum, in 1903 this had increased to 50 lb. per head per annum. Further, the significance of this increase is enhanced by the facts given in Chart 2, which shows that in the past

Chart 2.—Showing the increase in the amount of land under pasture in the past thirty years. Plain line = permanent pasture; Dotted line = corn crops.

thirty years an increasing amount of land (24 per cent.) has been permanently devoted to pasture for rearing cattle for home consumption. These facts appear to be conclusive. They are certainly striking.

Chart 3.—Showing consumption of tea and coffee per head per annum. Plain line = tea; dotted line = coffee.

For purposes of comparison it is of interest to refer to the facts *re* the consumption of tea and coffee, the former of which is commonly regarded as much increased in amount. The chart (Chart 3) shows that in the past fifty years there has been a considerable increase in the consumption of tea; this increase, however, is very much less striking than in the case of meat. The figures bring out the interesting point that in the past twenty years there has been no considerable increase in the consumption of tea. With regard to coffee, the table indicates that in the past thirty years there has been a striking decrease in the consumption of that beverage.

A CLINICAL METHOD FOR THE QUANTITATIVE ESTIMATION OF URIC ACID IN URINE.

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VARIOUS methods for the estimation of uric acid in urine have been devised which are, however, only useful for laboratory workers, and require the use of several reagents and considerable technical skill. From amongst all the methods the simplest and fairly accurate one is the Gowland-Hopkins method; however, even this requires about 50 to 100 c.cm. of urine and various chemicals, and the result cannot be obtained within three to four hours at the earliest.

The following method, which I have found to work satisfactorily for over three years, will, I hope, recommend itself to others on account of its simplicity and fair amount of accuracy. For this method 5 to 10 c.cm. of urine is quite sufficient, and the only reagent required is a couple of tiny drops of pure hydrochloric acid; the drops must be so small that 50 such equal 1 c.cm. of the acid. This can be easily managed by using a capillary tube, drawn out in a blowpipe like the ordinary glass bristle used for bacteriological purposes.

THE METHOD.

Five c.cm. of the urine are placed in a percentage centrifugal tube and two drops of pure HCl mixed with it. This tube is now immersed in a freezing mixture of salt and ice for about fifteen to twenty minutes. This freezes the urine, and the urates and uric acid are deposited in a dense opaque mass along with other salts.

Even at this stage one can see whether the uric acid is scanty or not, as the frozen urine appears translucent when the urates are scanty, while it is milky, curdy, opaque even when the amount of uric acid is normal.

Now this tube is removed from the freezing mixture and rapidly centrifugalized till the whole of the mass is liquefied.

It must then be allowed to rest till it approaches the normal temperature of the room, then the percentage of the deposit is to be read off. This percentage is less than 0.5 per cent. when the amount of uric acid is less than 0.04 per cent. as estimated by Fokker's or Gowland-Hopkins's method.

In case there is much pus or albumen or any other deposit is present, it must be removed by boiling 10 c.cm. of the urine acidulated with a tiny drop of glacial acetic acid, and 5 c.cm. of the filtered urine is to be treated as above. The temperature of the freezing mixture is about 12° C. in a room at 25° C.

Some samples of urine contain a deposit of urates and uric acid; in such cases, especially when crystals of uric acid are in abundance, it is necessary to dissolve these by the help of caustic soda and heat. About 10 c.cm. of the urine (after mixing it thoroughly) is treated with strong caustic soda solution till red litmus paper just shows a faint blue tinge, then this is to be boiled. The phosphates are precipitated by the procedure, but it is of no importance, and it is not necessary to remove them by filtration, as the subsequent addition of HCl dissolves them. Take 5 c.cm. of this boiled urine and treat as above.

Some people pass urine which deposits uric acid crystals very rapidly, although there is no increase of uric acid. (See cases No. 5, 5a, 9 of Table B.)

Again, in cases where there is actual increase of uric acid, the method of freezing it as described above does not give a proportionate amount of deposit, unless the urine is alkalized and boiled as described above. (See cases No. 11, 12, 12a, 13, 13a of Table C.)

Even after centrifugalizing the urine it is advisable to leave the tube in the freezing mixture for about eight hours, as much of the uric acid will crystallize out by that time, and thus one can distinguish between the deposit due to the uric acid and the amorphous mass of coagulated albumin or pus cells which may have passed through the filter paper by accident. (See No. 11, Table B.)

With this limitation to the usefulness of the method, the centrifugal method is fairly accurate, and the result is obtained within half an hour.

Although oxalates are soluble in HCl, the trace added is not enough to dissolve the crystals when they are in abundance, and a few of these are deposited in the tube, along with the uric acid, but they are so few that they do not appreciably interfere with the volume of the deposit of urates and uric acid.

I have noticed in most of the cases, when the oxalates are increased in the urine, that the supernatant fluid after centrifugalizing the tube remains slightly turbid, but it clears up as the temperature of the tube comes up to about 25° C. This happens even though there is neither pus nor albumin in the urine. In fact, in such cases one can with confidence expect the oxalates to be increased, and subsequent examination with the microscope, or with the chemical method, has confirmed the surmise. So this method helps in forming an opinion about the quantity of oxalates in the urine also.

Tests of Accuracy.

To test the accuracy of this method I have compared the results obtained by it with actual uric-acid estimation by Fokker's method in 54 cases.

Urine, when cooled to 15° C. for about six hours, gives a slightly reddish, copious, curdy deposit of amorphous urates in case there is an increase of uric acid. Phosphates and oxalates, when in excess, are also deposited, but the uratic deposit is much more dense and reddish-tinged, while that of phosphates and oxalates is cloudy in appearance. However, this deposit of urates does not take place in all cases, even though the amount be increased. Thus, in cases of feebly-acid urine, and when crystals of uric acid are present, no such deposit is formed, although the uric acid may be in excess.

Thus in Table C, 15 out of 31 cases did not give a deposit on simple cooling, although the uric acid was in excess. The acidity of some of these samples was determined by a decinormal solution of caustic soda, with phenolphthalein as an indicator, and in most of the cases where no deposit was obtained by simply lowering the temperature, it was found that about 1 to 2 c.cm. of the caustic-soda solution was required to neutralize 5 c.cm. of the sample of urine.

But this is not the only factor which determines the deposit of urates. Thus in samples Nos. 25 and 26 of Table C of one and the same case, although urates, phosphates, and oxalates were in excess, and the acidity was even high, only a scanty deposit was obtained in one sample, while the other gave a copious deposit. In fact the sample with slightly higher acidity failed to give the deposit. Again, the phosphates were more in the sample with scanty deposit as compared with the other.

The phosphates were estimated by the magnesia mixture method, and the deposit read off after twelve hours. The temperature at which the deposit was looked for was 7° C.

The only other difference between the two samples was an excess of indican in one, which gave a copious deposit of urates. At least, the high acidity failed to produce a copious deposit in one of the samples.

The method of freezing after adding HCl gave a deposit in both cases of about 2 per cent.; thus it is essential to add HCl before freezing the urine.

Again, as has been stated further on, in cases No. 11, 12, 12a, 13, and 13a of Table C, the deposit was of uric acid, and the amount appeared scanty, although the acidity in such cases was high.

Tests with Artificial Urine.

In order to test the accuracy of the method, artificial urine was prepared containing the following constituents: Urea, uric acid, acid phosphate of soda, sodium chloride, and sulphate of soda, dissolved in distilled water by the aid of gentle heat and decinormal solution of sodium hydrate.

The various constituents were in the normal proportions that are found in urine; 5 c.cm. of this were treated with HCl and frozen. Simple addition of HCl brought down some of the uric acid without freezing the mixture, while freezing