A new food for use in typhoid and other fevers / by J.W. Springthorpe.

With Dr. Springthorpe's Compliments.

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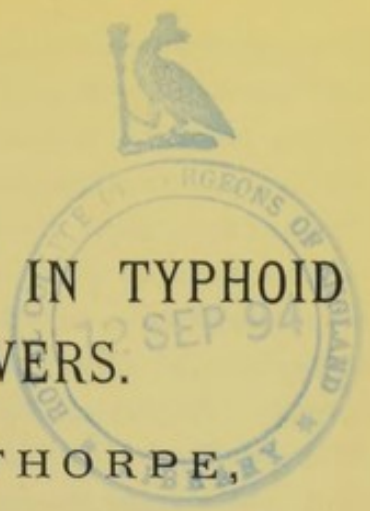

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Confusion of Diseases.

Although this paper is essentially a therapeutic one, there are certain general considerations as to the antecedent question of diagnosis that seem not inappropriate by way of introduction. I have long been forced to the conclusion, and for years have ventured to bring it under the notice of my hospital students, that the work of differentiation begun by Jenner in the separation of typhus from typhoid fever was only the initial step, and that there still remain, grouped under the latter heading, a variety of fevers which agree in being continued in type, and prevailing at certain seasons of the year. And, as many of you are no doubt aware, I am very far from being alone in such belief. Thus, a large number of American physicians hold strongly the opinion that there is a form of continued fever prevalent in the Southern States different from, yet resembling, both typhoid fever and malarial fever, and which they prefer to call typho-malaria (*vide* "Sajous' Annual," 1890, Vol. I, H. 40; also 1891, Vol. I, H. 44; also 1893, Vol. I, H. 92). Again, certain Continental authorities of repute have advocated the separation of another distinct subclass, to which they would give the name of "spleno-typhoid" (*vide* Eiselt, at the Berlin Medical Congress, August 1890; and Chantemesse, *Gazette Hebd. de Med. et de Chir.*, Paris, June 1891). It is of some interest to me also to find that, at the very time when

Chantemesse was writing that changes in Peyer's patches should not be taken as an indispensable criterion of typhoid fever, I was saying precisely the same thing here in the discussion on M. de Bavay's paper on the Saccharomyces and their Relation to Typhoid Bacilli (*Australian Medical Journal*, July 1891).

And when, in addition, we remember the doubtful position of many cases of so-called "abortive" typhoid, and the continued separation of others under the agnostic titles of "continued fever," "febricula," and the like, we have good reason, with Wynter Blyth (*British Medical Journal*, January 24, 1891), to hold that several distinct forms of disease are included under the heading of typhoid fever, and that ulceration of Peyer's patches must no longer be considered pathognomonic of one specific disease.

Lest any should consider that these diagnostic discrepancies have no local bearing, let me briefly summarise my own Hospital experience during the past seven years :—

(1) Mistakes have arisen, and do arise, in reference to the exact diagnosis of even non-intestinal fevers. Thus, like many other hospital physicians, I have had cases sent into the hospital as typhoidal, which have been diagnosed inside as cases of acute tuberculosis, and the latter diagnosis confirmed post-mortem. Again, I have recently had under treatment a case which was not unnaturally called typhoidal outside, with pulmonary complication, in which pneumonic phthisis followed, and in which even now the question of typhoid implication remains uncertain. At present, also, we have in Ward XII a little girl, who came in with the diagnosis "typhoid," and in whom the only certain pathological condition has been that of an ill-defined broncho-pneumonia. It is almost certain, also, that many cases occur in ordinary practice, which are cases of "febricula" and "continued fever," rather than typhoidal, but it is rare for such to be severe enough, or sufficiently prolonged to require hospital treatment.

(2) Not unfrequently, the outside and tentative diagnosis of "typhoid" is altered inside the hospital, after further examination and extended observation, into "gastro-enteritis"—the probable cause being chill, indigesta, various micro-organisms, ptomaines, &c. With our variable climate, insanitary surroundings, and frequent pollution of food and drink supply, cases of this kind must always be common, and that (owing largely to the necessity of giving an early and "satisfactory" diagnosis) such are, during the typhoid season, frequently diagnosed as typhoid is, I think, beyond dispute.

Naturally also, if anything occurs to increase the usual duration of such febrile attacks, the diagnosis (typhoid) is accepted as accurate. It is, of course, only the adult cases of this class that receive treatment in the Melbourne Hospital, and as a rule, their recovery leaves the matter still one of opinion. In several exceptional cases, however, sent in as typhoid, the lesions found post-mortem have proved to be those of ulcerative or membranous entero-colitis. One, from one of the village settlements, had an attack which we diagnosed as gastro-enteritis, with a (?) typhoid. A few weeks later she died of a second similar attack, without any satisfactory signs of antecedent typhoid being found in the intestine.

(3) So far back as 1889 ("Transactions of the Intercolonial Congress," p. 174), I pointed out the confusion that, it seemed to me, was then being made between typhoid fever and gastro-intestinal influenza. I well remember the more than incredulity with which that observation was received. It is doubly satisfactory, therefore, to find that the necessity for the differentiation and the danger of its omission, have now for some time been generally recognised amongst us. It is interesting also to find that a similar experience has been reported during the later spread of influenza in Germany, France, Austria, England and the United States. Fortunately, of late years, the discovery of the influenza germ by Pfeiffer has enabled us to place the matter beyond all doubt, and on at least three occasions we have turned the probability into a certainty, by finding the influenza germ in the blood of patients who had been certified outside as suffering from typhoid fever. We have had indeed several cases sent in this year as influenzal, in which the influenzal germ could not be found, and which were really enteric, and one at least in which an attack of typhoid, with a relapse, supervened immediately upon an attack of influenza.

(4) So much is perhaps admitted, but my experience leads me a step further. In cases evidently of intestinal fever, and not now at least to be included in any of the foregoing divisions, we have long noticed fundamental differences in mode of onset, state of stools, spleen, relative implication of head and abdomen, &c. It has become almost a commonplace to say that, if we are to include what we are asked to call typhoid under that heading, we must re-write the classical descriptions of the disease. It is easy of course to widen the definition; it is not difficult to attribute the alteration to alterations in the persons attacked, but the further

question, "is there not a difference in the cause," must also be answered. Clinically, the cases are separable into at least two very different divisions. Pathologically, the old reasoning in a circle (the bacillus of Eberth, or its congener, produces ulceration of Peyer's patches, &c., and the finding of such ulceration, &c., is proof of the presence of such bacillus) must be replaced by a sceptical compilation of actual results, and an exhaustive analysis of their meaning. From the little that I have myself seen, I would raise the question whether there is not a form of enteric fever (using the term in its widest sense) separable pathologically from the classical, by its wider implication of solitary glands and large intestine, its (?) smallness of spleen, and even by its somewhat different affection of the membrane and patches themselves? Bacteriologically, also, the case against the unity of so-called typhoid fever seems conclusive. M. de Bavay, whose work in this direction is well known to most of you, has isolated from fresh (?) typhoid spleens pure cultures of at least three germs—the bacillus of Eberth, a bacillus, so far as I know, discovered by himself, and the bacillus of malignant œdema. As I hope shortly to bring this question of the further differentiation of typhoid fever specially before you, I will for the present content myself with now adding, that bacteriological examination of the blood shows it to be at times sterile, at others invaded by various organisms, amongst which a certain diplococcus, apparently independent of any ordinary complication, has so far possessed a fatal significance.

Disadvantages of Milk as a Food.

Leaving now the question of diagnosis, the point to which this paper draws special attention is, the dietetic treatment of these intestinal fevers. Since the time when Liebig's views were discarded, milk in some form or other has been almost universally recognised as the most suitable food for typhoid patients. There is no need for me, therefore, to dwell upon the advantages of a milk diet; they are known to us all. But its disadvantages deserve summarising, especially in such a paper as the present.

Thus (1), it but imperfectly fulfils the requirements of a fever food. Voit has shown us how three and a half pints of milk of good quality (8–10 per cent. cream), though satisfying a healthy idle adult, are deficient in the albumen required, and while containing twice the fat, are wanting in carbo-hydrates to the extent of two-thirds. If, with many good authorities, we hold

that a fever diet should contain more carbo-hydrates, and less albumen than a non-fever diet, and be free from fat, we see how, even with the addition of some form of animal broth, the quantity of milk recommended by the best clinicians must fail to meet the requirements of a continued fever. To this imperfection, indeed, we must ascribe some at least of the wasting found in such fevers.

Again (2), though a fluid food in the mouth, milk becomes a more or less solid food in the stomach. No doubt curdling may be diminished by appropriate dilution and admixture, but it is questionable whether it is ever entirely prevented, and it may be safely asserted that, in practice, curdling very frequently occurs. The evil results are at least twofold. The undigested curd represents so much loss of albumen, and increased nutritive deficiency, whilst the curds themselves are a frequent cause of rise of temperature, restlessness, diarrhœa, and other aggravation of an already serious if not dangerous condition.

Thirdly, milk is a food very apt to ferment ; hence distension, and all the discomforts and dangers which follow therefrom.

Again (4), difficulties often surround its successful administration. To a certain number it is distinctly distasteful, whilst it disagrees more or less with the majority of the large class of hepatic temperament. Hence, the practical disadvantage arises of having to dilute it with alkaline waters, which favour the growth of the specific cause of the disease, or with effervescing waters, which aggravate the distension, or peptonise it, a procedure which is often difficult and frequently obnoxious.

Further (5), its purity is often so suspicious, that it has to be prepared for use by boiling ; it often turns sour ; and its condition, prior to administration, can seldom be termed aseptic ; whilst its composition, and hence its nutritive value, vary within wide limits.

In addition (6), though compared with ordinary diet, milk may, as has recently been asserted, lessen the number of micro-organisms in the intestine, still the fact remains, as shown by M. de Bavay's experiments, that the bacillus of Eberth can and does grow in even sterilised milk with the production of large bacilli, whilst ordinary milk is generally recognised as a very suitable pabulum for its growth.

Lastly (7), being incompatible with acids, its ordinary administration hampers, if it does not entirely prevent, the use of acid medication.

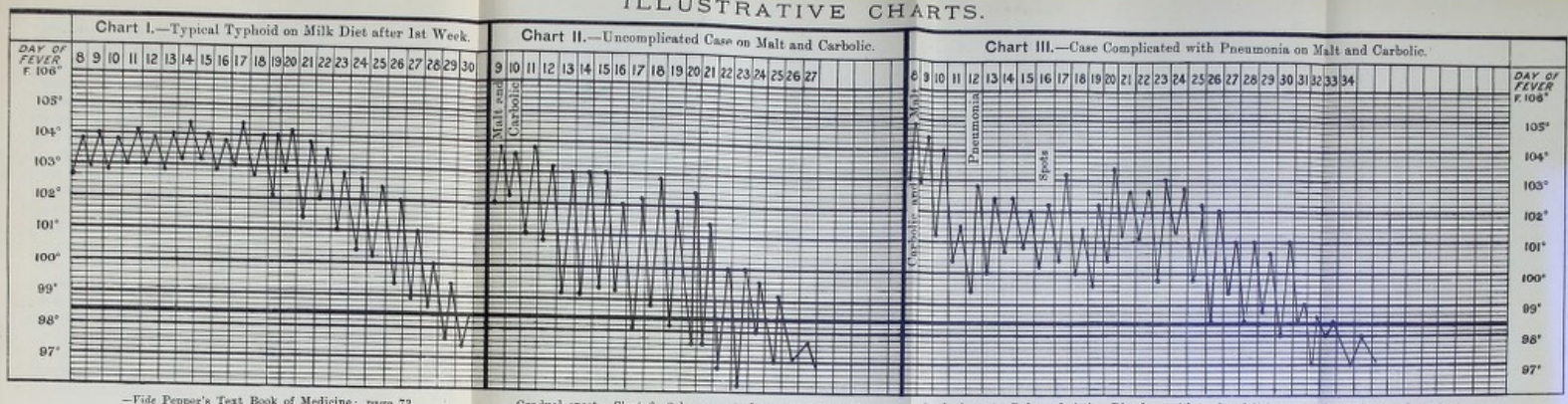
A Probable Substitute.

It thus becomes a matter of great therapeutic importance to see if we can find a food possessing the advantages of milk, yet free from some, at least, of its disadvantages. During a comparative testing of the suitability of various food stuffs for the growth of the bacillus of Eberth, M. de Bavay (*vive supra*) discovered that a sterilised hopped malt extract was superior to either broth or milk in its resisting power, there being absolutely no growth whatever when typhoid bacilli were introduced into it. The next point was to compare its composition with that of milk. Analysis showed that it consisted of soluble carbo-hydrates, peptones, para-peptones, and amides, a small proportion of ash, rich in phosphoric and lactic acid, and the extract of the hop. The carbo-hydrates are represented by maltose, dextrose, lævulose, and dextrin, the proportion of the first three to dextrin, being as three to one. In all, the solid extract amounted to 15 per cent., much the same as good cow's milk. The ash is ·25, and the average acidity as lactic acid is ·18. It was estimated that there were from eight to twelve grains of lupulin in three pints of the extract. The foregoing analysis, though not exhaustive, sufficed to suggest that in this hopped malt extract we had a food, probably superior to milk in nutritive value, sterilised, with all its active principles predigested, capable of administration with acids, and containing within its dialetic limits, a not excessive dose of a recognised sedative. The mode of its preparation is given in appendix, and now that its value has been established, its exact analysis will be shortly determined.

Tested Clinically.

There remained still the crucial test, that of its use in place of milk in a series of cases of fever, and to this test the malt extract has been submitted during the recent epidemic. As you are aware, our hospital cases include few of the milder, and many of the severer cases. This year, the type of disease has been a severe one, and I fancy that the average Victorian death-rate has not been less than 10 per cent., whilst the hospital death-rate has been between 11 and 12. To give practically nothing but the malt extract, therefore, as I have done to some forty consecutive cases during the past six months, has been to submit the new food to a fairly rigorous testing. Fortunately, perhaps, for the continuance of the experiment, our first dozen cases were admitted about the

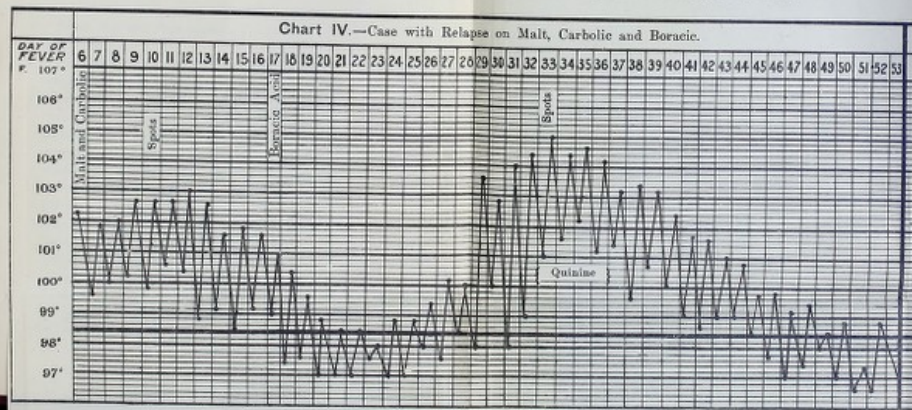
ILLUSTRATIVE CHARTS.



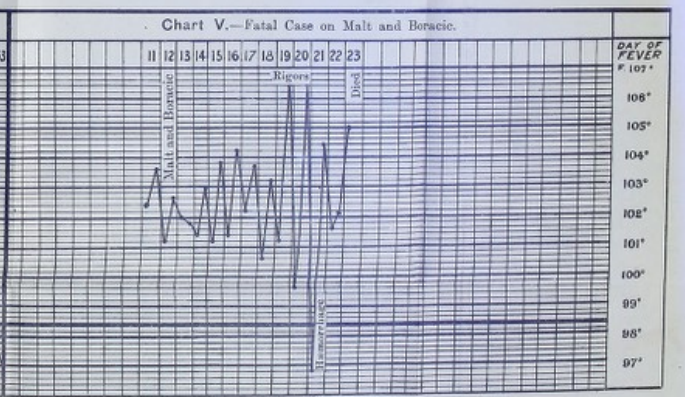
—Vide Pepper's Text Book of Medicine; page 73.

Gradual onset: Slept 6—8 hours; stools occasionally acid; passed curds with peptonised milk.

Gradual onset: Before admission, Diarrhœa, with curds; delirium; sleeping 1½ hours. On Malt slept 6—7½ hours; stools at times acid; passed curds on peptonised milk.



Gradual onset: Slept 6—10 hours; rapid convalescence; daughter also ill with Typhoid.



Gradual onset: Walked into hospital; Hæmorrhage very severe; Coccus in blood.
Post Mortem—Large intestine full of blood; deep ulcers there, more than in ileum.

fifth day of the fever, instead of the 9th—12th, which is our usual average, and the results were so striking and satisfactory, that we were encouraged to continue even in cases of the gravest nature. Indeed, such became our confidence that, when later on there was a temporary dearth of the malt extract, it was the worst cases that were kept on the malt, and the milder that were put back upon milk.

The method of administration was as follows :—After sterilising, the bottles were kept on their sides until opened, and no bottle was used that had been open twenty-four hours. The patient was given five ounces of the malt every two hours. In addition, he had ice, iced filtered water, and O ss—j of the potus acid phosph. (acid phosph. dil. ʒ jss ad. O j). As an antipyretic, quinine was used when sponging, &c., had failed ; nepenthe (Ferris) when a sedative seemed advisable ; and alcohol, the diffusible stimulants, and digitalis according to indications, complications being treated on familiar lines. In addition to the acid of the food and of the potus, some internal antisepsis was attempted by carbolic or boracic acid. The first twenty cases were treated with the carbolic, the pure acid being given in pills of 1½ gr. every four hours. The latter cases were treated with boracic acid, 2½ gr. in an ounce of distilled water, with each dose of the malt.

Results.

From the test thus applied, I venture to draw the following conclusions :—

(1) We have in this sterilised hopped malt extract a food which can replace milk in the treatment of "typhoid" fever. Here is a series of some forty cases, which had practically no other food during the weeks that they were under treatment in the hospital. As the accompanying charts show, in twenty cases the fever ran a course of about four weeks, and in four the fever lasted over six weeks. In six, there was pneumonia as a complication ; in five, intestinal hæmorrhage ; in one, pleural effusion ; and in another, phlebitis. In six there was a typical, and in one, a doubtful relapse. It cannot be said, therefore, that the cases thus treated were of less than average severity.

(2) This new food has many advantages over milk. Thus, its composition may be made definite ; it is easy to keep and to administer ; there is no risk of souring ; no need of peptonising, or of adding alkalies or effervescents ; and it goes naturally with acids.

(3) In many ways it meets the requirements of the case better than milk. Thus, the active principles are pre-digested, the carbohydrates predominate, fat is absent. Again, with its use, there is no such thing as curdling. Throughout the series, the motions were apparently intestinal secretion, tinged with malt; there is no loss of albumen, and no irritation of the intestine. And it is noteworthy that, on several occasions, when a few doses of peptonised milk had to be substituted for the malt, some patients at once passed curds with their stools. Further, the food remains unfermented throughout the intestine. It was partly to assist this, and partly from its own merits in typhoid antisepsis, that boracic acid was given with the malt. As a matter of fact, in no single case did we have any distension—an occurrence without parallel in my experience of the previous six epidemics, and one too good almost to expect always in the future. Again, some influence was exerted upon the reaction of the stools, and hence, in all probability, upon the reaction of the intestinal contents also. Thus, though we were unable to obtain permanent acidity, the stools became actually acid on four occasions, when the bowels were open several times in rapid succession, and in a large number of cases the reaction was altered from alkaline to neutral. No doubt the addition to the food produced much of this change, still, the food helped.

(4) It exerts upon the disease a beneficial influence, which is not found in the case of milk. Thus, its influence upon the nervous system was very marked. Sleep was undoubtedly promoted. Instead of insomnia, requiring the use of dubious sedatives, most of our patients slept in a manner and degree which was as gratifying as it was surprising. The average slept over seven hours; many slept nine hours and over; one very severe case slept twelve hours. No doubt most of this benefit must be ascribed to the lupulin, and its usefulness is so suggested, that M. de Bavay has isolated for me the alkaloid (hitherto unused clinically) for further testing. Still, some at least of the good may be due to the better feeding of the case by the new food. Again, a beneficial influence was seen in our temperature curves, thirty-eight of which are are exhibited this evening for your further study. Not that there is any noticeable shortening of their duration (as well expect a runner to give a competitor fifty yards' start in a hundred, as shorten the last three weeks' temperature of a disease which has had three weeks' start). In all, however, you will notice that the remissions began at once, no matter what the stage of the disease, and, except in the fatal cases, they continued throughout. I am

told also that our curves were, on the whole, noticeably below those of other patients in the hospital during the same time, and on milk diet. It is, of course, impossible to append all these charts to the present copy of my paper, but instances are selected which illustrate the points referred to. Of course it must not be understood that all were equally influenced; still all were apparently influenced, and many quite as much as those here shown. The reports of the Sisters in charge of the nursing arrangements are also favourable to the malt extract. Not unnaturally, the change from milk to malt was at first viewed with something more than suspicion, but before the end of the epidemic, the nursing report was that, without any doubt, it was much easier to nurse the cases on the malt, and much easier also to keep them clean. And, generally, from a careful watching and comparison, my own conviction is that, taken as a whole, the patients on the malt seemed stronger during the illness, were less wasted, and convalesced better than similar patients under the milk *régime*. It will require, however, further evidence before this can be regarded as definitely proven.

The death-rate needs a special paragraph. It goes without saying, that statistics based on such a small number of cases, even when compared with the general hospital death-rate during the same period, are of little practical value. As a matter of fact, however, the death-rate under the malt was much under the hospital average. In our forty cases, we had three deaths. All three had severe hæmorrhage, and the diplococcus already referred to was found in their blood *ante-mortem*. Amongst our recoveries were a number of very severe cases, which nothing but a well grounded confidence would have justified us in placing upon the malt. Four were specially pointed out by our worthy Hospital Superintendent, Dr. Molloy, as likely to test it to the utmost; all did remarkably well; one other was the severest case that I have ever seen recover, and he convalesced splendidly.

In addition to this hospital testing, the malt extract has been tried outside by different practitioners in some twenty other cases of enteric fever, and their experience supports the conclusions already adduced.

Further, I have myself tested the malt extract in cases of pneumonic phthisis (?) complicating enteric fever, ulcerative entero-colitis with relapse, malignant stricture of the rectum, typhlitis, paralytic distension of the intestines, &c., and have found it more satisfactory than milk. I intend also testing it in cases

of acute pneumonia and other intestinal, renal, and general disorders, for which milk and farinaceous foods are at present so largely prescribed, supplementing it, of course, as occasion demands.

Objections.

The question may now be faced—Are there any objections to its use? Not unnaturally, being a fluid food like milk, and deficient in proteids, it lacks satisfying power to those who are accustomed to, or are craving for a more solid and stimulating diet; but I have not found that it is, in this respect, less satisfying than milk. If anything, the contrary is the case. Its sweet taste, however, is disliked by some, but this dislike is not so common as with milk, and may generally be easily overcome by washing the mouth with an acid solution, or sucking a small piece of ice. In enteric cases, also, there is a theoretical objection that such a food may drive germs from bowel contents on to intestinal tissue; but though certain of the charts show a fall of temperature, followed by a somewhat suggestive rise, the meaning of which requires further consideration, the general results show that there is nothing serious in the objection.

Suggested Improvements.

It would be too much to expect that a food, not primarily prepared for the purpose, should prove the best possible, or that by simple alterations in quantity, we will be able best to meet the varying conditions of different cases.

(1) The question arises, whether it would not be an improvement to retain more of the albuminous matters removed for brewing purposes. Certainly, in several very bad cases, benefit seemed to follow the addition of egg albumen to the diet, and in such cases at least, I should feel inclined to recommend such addition. Of course it will be possible to retain the original albumen, though the question has still to be settled as to whether this is generally advisable, and if so, to what extent.

(2) The proportion of lupulin best suited to meet ordinary requirements still remains unsettled. As at present prepared, the quantity of lupulin is not fixed, and I am inclined to think that the maximum has been more useful than the minimum. Future experiment alone will decide if such a happy mean can be obtained as will give the best results in average cases, supplementing this with varying amounts of the alkaloid in more severe cases, or relying, as at present, upon some preparation of opium.

(3) In cases in which the taste is an obstacle, and the objection is not met by the means already mentioned, it may be of advantage to flavour the extract with vegetable juices, &c., to suit differences or even variations in taste.

(4) Bound up with the question, at any-rate in the case of the intestinal fevers, is the problem of intestinal antisepsis, and this problem we certainly have not yet solved. How far indeed such medication can be carried, and what actual results are attainable, are still unsettled matters. Turning to the two antiseptics used during these experiments, I believe with M. de Bavay that the quantity of boracic acid added, is sufficient to keep the malt extract sterile in the intestine, and is valuable to that extent; but it may be questioned whether it is sufficiently aggressive against the specific cause of the disease. On the other hand, the carbolic acid seemed more powerful (yet it must be remembered that it was used in milder and earlier cases). There is also an objection to administering anything in pill form, and in one fatal case treated before the malt was tried, a carbolic pill was found in the small intestine. It is conceivable that such a pill might dehisce, so to speak, on to an ulcerated Peyer's patch, and even promote a perforation. It was partly from this reason that we did not attempt to coat our pills with keratin. The carbolic also always wants watching; even with our dosage, three cases showed carbolic acid in the urine. On the whole, therefore, I feel inclined to try some other soluble antiseptic, and, *cæteris paribus*, Burney Yeo's mixture of quinine and chlorine, seems the most promising.

Such, however, have been the results with the sterilised hopped malt extract up to date, that I am hopeful that when these and similar questions are settled by experience, we shall find in it, what we certainly do not find in milk, a practically perfect fever food. And with the necessary modifications or additions, I am hopeful that we shall find it superior to milk in those non-febrile disorders, also in which we require a sufficient digestible and non-fermentable food.

Pending these further experiments and probable improvements, I venture with considerable confidence to bring this new food, even as at present prepared, under the notice of the profession, and to ask my medical brethren to test it for themselves. It can be procured from the Victoria Brewery, Victoria Parade, East Melbourne, and if the bottles are laid on their sides, the extract will keep for any length of time. The price is only 5d. per bottle.

Thus the cost of feeding a typhoid patient on the malt extract is considerably under 1s. per day.

I cannot conclude this paper without an expression of my indebtedness to my Resident Medical Officers, Drs. Pabst and Officer, for their continued watchfulness and accurate reporting during our months of testing, and to Sisters Bentley, Ivey, and Brissendon, who had nursing charge of the patients, for the wholly satisfactory manner in which they aided our investigation. Without their kindly and persistent co-operation, it would have been almost impossible to have carried our experiment to a successful issue.

Appendix.

The sterilised hopped malt extract is prepared as follows:— Infuse crushed English barley malt with twice its weight of water at 165° for two hours. The mash produced should be at 151°. After draining, the sweet wort is run off, and "sparged" with water at 170°, until the malt is perfectly extracted. It is then collected in the copper, and when saccharification is complete, saccharose sugar is added to bring about inversion into dextrose and lævulose by the diastase of the malt. The contents of the copper are now brought to the boiling point, and after boiling for half an hour to precipitate the albuminoids thus removable, hops are added, and the boiling continued for one and a half hours. The tannin of the hops precipitates a further portion of the crude albuminoids. This wort is then run over a large quantity of raw hops to extract therefrom an additional quantity of the essential oil and other volatile constituents of the lupulin. In all, twelve pounds of hops, and one and a half cwt. of sugar are used to each quarter of malt. The extract is then bottled, corked, and put into a steam bath at 212°, and kept at that temperature for two hours. As soon as the bottles are lukewarm after removal, they are laid on their sides. If this had been done before, the vacuum formed during cooling would have given rise to an explosion. If good corks are used, the filtration through them is sufficient to sterilise the entrant air, and if left on their sides, contamination does not occur. The bottles are now ready for use. On keeping, a further precipitate is produced by the oxidation of the albuminoids, but this can be easily separated, if desired, by filtering the last portion before use. The composition of the hops is—hop oil 0, lupulin 11, tannin ½–2, gum 5–6, and cellulose 63–70. Assuming that only one-half the principle is extracted, there are eight and a half grains of lupulin in three pints of the extract.

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