and examined, and their free and total acidity determined in terms of a decinormal soda solution, and charted. The presence of pepsin, mucus, bile, and blood, the time of their appearance and disappearance, and the time of emptying of the stomach can be recorded.⁴

If it is desired to investigate the stomach bacteriologically the fasting content can be examined in films and by culture. Cases comprised under Group II least often, and those under Group III most often, disclose positive results.

To examine the duodenal contents the patient lies on the right side as soon as the tube has entered the fasting stomach, and in due course the tube will enter the duodenum, which can be established by the fluid becoming alkaline and by x-ray examination. Also a certain grip is felt when the tube is in the duodenum.

The normal stomach shows on average a maximum free acidity of 30 (0.109) and a total acidity of 50 (0.182). In contrast with this a duodenal ulcer may give a free acidity of 70 or more, and a total acidity of 80 or 90; an acidity which is associated with rapid emptying—say in an hour—is less sustained than an acidity which is associated with emptying in two and a half hours. On the other hand, there is the absence of free acid and the low total acidity (10 to 30) found in malignant growths, pernicious anaemia, and other conditions.

MALIGNANT DISEASE OF THE STOMACH.

When it is recalled how large a proportion of cancers arise in the stomach (according to some authorities 50 per cent.), and when it is realized that operative treatment of stomach cancer in its early stage is followed by encouraging results, the importance of the recognition of this condition is patent.

In its early stages the manifestations are vague, and there may be an entire absence of symptom or sign till the disease has advanced so considerably as to be incapable of effective treatment. It follows, therefore, that close attention needs to be paid to ill-defined dyspeptic symptoms, and especially in people whose digestions have hitherto been strong. Constant watch and systematic investigation should be the rule. And in patients whose general health is deteriorating a systematic search for the cause should include an investigation of the stomach even though gastric manifestations may be absent.

Well-defined pain is seldom an early feature, and here is a distinction from ulcer. There are often distension and discomfort, but not often pain. Even later there may be a considerable infiltration of the stomach with growth, and yet but little pain.

Vomiting is seldom an early sign, though it may be one of the first signs of a pyloric cancer. Haematemesis may be the first intimation that anything is wrong, though in such cases the growth is seldom found to be early. A tumour that can be clinically detected must never be expected.

A dilated stomach may be the first though not an early sign. Loss of appetite is valuable evidence, and sometimes occurs early, though in other cases a good appetite endures till late in the disease.

Anaemia may attract attention and be a feature of vaguely declining health, and the similarity between the manifestations of malignant disease of the stomach and those of pernicious anaemia are well known. There is often, too, a depression and gloominess of outlook which are suggestive.

A physician rightly puts reliance on his intuition in these doubtful cases, and is thus prompted to proceed to further investigation. The examination of fasting contents, of a test meal in the manner already referred to, the search for occult blood, will afford evidence of value.

As already stated, radiography must not be expected to yield positive assistance in the diagnosis of early stages of malignant growth, unless the latter begins as an ulcer. Perhaps when it becomes practicable to study radiograms serially at short intervals, earlier detection may become possible. If, however, an early growth is situated at the pylorus, radiography may afford evidence of its effects. At a later stage growth near the pylorus may cause a defect in the filling of bismuth. The defect may be annular in shape and appearance, or the growth may cause a "biting out" of the bismuth and an irregularity of its outline.

In this kind of investigation bismuth is better than barium because it stays for a longer time in the stomach and is not stimulating to the movements of the latter.

If the results of the foregoing investigations, carefully considered, lead to the conclusion or even the suspicion that malignant disease may be present exploration should be advised, and although this line of action sometimes will lead

to negative results and unnecessary operations, this is of far less importance than the missing of an early carcinoma in a situation where removal can offer favourable prospects.

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EFFECTS OF CHRONIC STARVATION DURING THE SIEGE OF KUT.

BY

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THE siege of Kut lasted 148 days, from December 4th, 1915, to April 29th, 1916. The besieged garrison consisted of the 6th (Poona) Division, supplemented by various details. The strength on December 8th, 1915, was 14,586; this included British officers 218, British rank and file 2,534, Indian officers 175, Indian rank and file 8,117, followers 3,542. Of this number 1,508 were sick and wounded in hospital.

The following notes were prepared with the view to placing on record the state of nutrition and general health of the Kut force during the penultimate week of the siege—April 11th to 18th, 1916; they were completed and submitted to the G.O.C., Major-General Sir Charles Townshend, K.C.B., D.S.O., on April 28th, the day before the capitulation. They are published now for the first time. As may be understood I was not in a condition of health and strength to take full advantage of the material at my disposal; even this meagre record called for some effort of will. The siege afforded opportunities for studying the morbid state of the body brought about by long-continued deprivation of an adequate quantity of suitable food which seldom present themselves; it would have been almost criminal to have disregarded them.

During 1915 the 6th (Poona) Division experienced severe hot weather and an epidemic of malaria in Lower Mesopotamia, and immediately before the siege underwent great physical strain and exceptional hardships on the march to the battle of Ctesiphon, during the battle (November 22nd to 24th, 1915), and in the retirement from Ctesiphon to Kut, where they arrived in a worn-out state on December 3rd, 1915. During the early days of the siege the preparation of the defence works threw a considerable amount of labour on the troops. It was in the circumstances considered advisable to let them build up part of their tissue losses for a week or so before beginning to reduce their rations; this reduction was then made gradually. Most of the garrison were in trenches and dug-outs; the remainder were billeted in huts or bivouacked, or were in tents with the floors sunk several feet.

Meteorological Conditions.—During the months of December and January and the first half of February it was decidedly cold; from January 15th to February 8th it froze every night. The ill effects of the cold were intensified by high winds and rain storms. From January 17th to 20th the trenches were flooded with ice-cold water. On January 20th twenty-four Indians were brought out of the front trenches collapsed from the cold, and were resuscitated with much difficulty; five others were found to be dead—cold and stiff. After the middle of February warmer weather set in.

The Rations of the Kut Garrison.

To grasp the state of nutrition of the garrison towards the end of the siege it would be well to bear in mind the usual classification of foodstuffs, the physiological bases upon which rations for bodies of men such as soldiers are formulated, and the functions carried out by each class. The rations of the British soldier in Mesopotamia before the siege had a heat equivalent of 3,600 calories, that of the Indian 3,100 calories.

The Protein Factor.—British troops did comparatively well as regards their protein ration during the siege. When fresh beef and bouilli were exhausted they were given 1 lb. of horse-flesh, which was increased to 1½ lb., next to 1½ lb., and then to 1½ lb., but finally reduced to 1½ lb. again. While the ration of bread was not below 10 oz. and the butter and bacon continued, this amount of horseflesh prevented any rapid loss

of weight and stamina, but when the loaf was reduced to 8 oz. and all butter and bacon ceased, they began to lose flesh and condition rapidly—the oxidizable material in the bread and horseflesh combined was insufficient, and they started using part of the protein of their muscles for the production of force and maintenance of the temperature of the body. In Indians, except those who had eaten horseflesh from the beginning, the muscles began to waste rapidly as soon as *ghi* underwent a serious reduction, and in all except those who were highly developed physically at the beginning of the siege the muscles dwindled considerably.

The Hydrocarbon Factor.—From a physiological point of view the most serious deprivation suffered by British troops was the absence of hydrocarbons. Bacon and butter failed at a comparatively early stage of the siege. In ordinary circumstances this would have been to some extent compensated for by the large ration of horseflesh allowed, and at the beginning this was so, but during the last ten weeks of the siege the animals themselves were in such a state of starvation that no fat remained in their tissues. They could not go out to graze, as we were within gun and rifle range of the enemy on three sides. From about the end of March British troops were definitely in a state of partial starvation, and were losing ground daily; they were lacking in energy, debilitated, and incapable of any serious strain. The Indian troops received a progressively reduced ration of *ghi*, which was only 1 oz. daily from March 11th, and ceased altogether early in April. Until the second week in April only about one-ninth of the Indians were eating horseflesh, so that the small amount of fat obtained from this source is almost negligible. Indian troops had by that time reached an advanced stage of chronic starvation; their energies were markedly reduced, they were debilitated, less capable than the British of any severe physical strain, and they possessed little resistance to disease.

The early stage of the siege at which the fats and carbohydrates of the rations of British troops and Indians had to be reduced soon led to a loss in body weight, which was naturally to a large extent at the expense of the adipose tissue of the body. There were some men who began the siege in a highly muscular state and with a fair covering of fat, who did not show any serious signs of diminution in bulk, but in the vast majority it may be stated that a large part of their body fat had been burnt up by April 15th; many British troops were decidedly attenuated, especially among the younger men, while about 10 per cent. of Indian troops and followers were really emaciated.

The Carbohydrate Factor.—The greatly reduced ration of the garrison in carbohydrates (the average reduction of bread in British troops during the five months of the siege was 50 per cent., and of the *atta* of Indian troops 66 per cent.; during the last six weeks neither sugar, *gur*, butter, nor *ghi* was available) led to the removal of nearly all glycogen from the liver and muscles, so that the amount of stored material readily assimilable in the tissues for energy and heat production during the penultimate fortnight of the siege was at a minimum. This fact was demonstrated by the case with which the men became fatigued, their inclination to remain at complete rest whenever opportunity offered, and the speed with which they collapsed, with a marked sub-normal temperature, when they had the misfortune to get an attack of diarrhoea or any other malady causing a drain on the system. It likewise helped to explain how difficult it was to restore the heat of the body once it was lost. British troops especially felt the want of more bread, which forms a large part of their food normally; they also had urgent cravings for fats and sugar; there was a very marked yearning for tea. In the same way Indians had a great longing for more *chupatties* and *gur*.

Inorganic Salts.—Shortage of salt in the rations of both British and Indian troops and followers began about the middle of the siege, after which time the salt issue underwent great reduction, the troops receiving only about one-eighth the normal ration. Early in April it ceased altogether except for a small issue made for a few days from some bags of salt that were dropped into Kut by aeroplanes. I was not able to gauge satisfactorily the extent to which this deprivation affected the nutrition and health of the troops. It is possible that some of the cases of diarrhoea and gastro-intestinal disturbance that prevailed during the last two months of the siege were partly attributable to a want of sufficient salt in the food.

It is well to bear in mind the very important differences between acute starvation, in which there is complete and

sudden deprivation of all food, and chronic starvation such as we went through, in which there is continuous use of an insufficient supply of food of a kind unsuitable to maintain the normal standard of nutrition. In acute starvation until death actually happens it is possible to restore the victim to health and strength once more by an appropriate regimen; in chronic starvation a stage is eventually reached, sometimes weeks before death, from which recovery is impossible.

The following lists give the quantities of the various articles of diet used by the Kut garrison, and show the progressive reduction of some and disappearance of most of them from the rations in the penultimate and final stages of the siege.

Tables of Rations issued during the Siege.

On January 22nd, 1916, and for some weeks after, the rations consisted of:

British Troops.		Indian Troops and Followers.	
Bread, white	12 oz.	Atta	8 oz.
Meat	8 "	Rice	8 "
Butter or cheese	3 "	Gur	2 "
Potato meal	2 "	Ghi	2 "
Pickles	1 "	Ginger	3 "
Jam	3 "	Dhall (lentils)	2 "
Dates	2 "	Chillies	3 "
Tea	3 "	Garlic	3 "
Sugar	3 "	Dates	3 "
Salt	3 "	Potato meal	2 "
Ginger	3 "	Salt	2 "
Fuel	2 lb.	Fuel	1 lb.

On March 11th, and for some weeks afterwards, the rations consisted of:

British Troops.		Indian Troops and Followers.	
Brown bread	10 oz.	Barley flour	10 oz.
Horseflesh	1½ lb.	Barley, unhusked	4 "
Jam	1 oz.	Ghi	1 "
Salt	1 "	Salt	1 "
Oatmeal	2 "	Horseflesh (to those who eat it)	8 "

This British diet is equivalent to 1,975 and the Indian to 1,550 calories. Up to April 12th the heat equivalent of the Indian rations in non-meat eaters was:

Barley flour	10 oz.	700 calories.
Barley, unhusked and parched	4 "	240 "
Ghi	1 "	65 "
Herbs (grass, etc.) as vegetables	4 "	40 "
Total		1,045 calories.

The rations from April 12th onwards with their heat equivalents were:

British Troops.		Indian Troops and Followers.	
Brown bread	6 oz.	Coarse barley flour	5 oz.
Lean horseflesh	24 "	Lean horseflesh	12 "
Green stuff, herbs, and grass	2 "	Green stuff, herbs, and grass	4 "
Total		Total	
	390 calories.		350 calories.
	1,440 "		720 "
	20 "		40 "
	1,850 calories.		1,110 calories.

Up to April 8th only about 1,000 out of over 10,000 Indians were eating horseflesh; on April 14th 9,239 Indians were consuming it.

In British troops, after the first fortnight of the siege, the bread ration was reduced to 12 oz., six weeks later to 10 oz., then to 8, and in the last weeks to 6 oz. For about four weeks fresh beef was issued, then bouilli beef or mutton for three weeks, then fresh beef of battery bullocks, after which horseflesh was commenced. Fresh vegetables, potatoes, and onions ceased early in February, but a ration of potato meal was continued for about a fortnight later. Butter and bacon were reduced at an early stage and ceased about the middle of February. The jam ration was very gradually lessened and ceased at the end of March. Tea and sugar were exhausted after the second week in February, then dates replaced the sugar for a fortnight.

In Indians who ate it the fresh meat ration was cut down to 6 oz. after the first week of the siege, later to 4 oz. At the end of the first week the *atta* (coarse wheat flour) was reduced to 1½ lb., then to 1 lb. with 6 oz. of parched unhusked barley; later to 8 oz. *atta* and 8 oz. rice, then to barley flour 10 oz. and 4 oz. parched barley, and finally to 5 oz. barley flour only. During the first week of the siege the full ration of 2 oz. of *ghi* (clarified butter) was given, then for a month 1½ oz., for another month 1 oz., for two months 1/2 oz., and during the last two weeks none. For the first week of the siege the full ration of 4 oz. *dhall* (lentils) was given, then it was reduced successively to 2 oz. and 1 oz., the issue ceasing at the beginning of March. *Gur* (jaggery or unrefined sugar) ceased about the middle of March, when its place for a fortnight was taken by an issue of dates.

During the first ten weeks of the siege the billeted part of the garrison was able to supplement the rations issued by purchase of barley cakes fried in fat sold by Arab confectioners, also small quantities of *atta*, barley flour, *dhall*, sweetmeats, and dates. These gradually disappeared from the market, and for the last six weeks only negligible quantities of eatables were purchasable. The heat equivalents of these fortuitous foods were not estimated.

as nothing approaching accuracy could have been obtained. These supplementary additions, however, were of significant value to the garrison.

On April 25th I noted: "On an average fifteen men are dying daily; of these, five a day are dying from the direct effects of chronic starvation, and ten from chronic starvation with diarrhoea, bronchitis, or some other simple malady supervening. The present condition of nutrition and health of the average man of the garrison is physiologically highly unsatisfactory. His stamina is greatly lowered, his resistance to disease-causes considerably reduced, and should he suffer from any disease, such as pneumonia or bronchitis, fever from any cause, dysentery, or severe diarrhoea, it will greatly tax his vital powers."

Loss of Weight in Chronic Starvation.—During the nineteenth week of the siege I had the weight of 400 healthy British and 800 healthy Indian troops at duty taken with the view to ascertaining the average loss during the siege. The weights were taken on the same scales, at the same time in relation to meals, and in the same kind of clothes. British troops on an average lost 12.5 lb. per man and Indian troops 17 lb., which was, roughly, a loss of 10 per cent. in weight in the former and 14 per cent. in the latter. Personally I started the siege weighing 10 st. 6 lb., and at the end of it weighed 8 st. 11 lb.; my normal weight is 10 st. 12½ lb. The loss of weight reached its maximum in officers and men who began the siege with a superabundance of fat, and it may be remarked that they stood the loss well. The average loss of weight given above was that which occurred during the siege. It may not appear excessive, but, as stated in the introduction, the force had immediately antecedent to the siege lost a certain undetermined amount of weight from hardships and privations. The average weight in one platoon of Rajpoots on April 16th was 7 st. 12 lb., and in one of Jats 7 st. 10½ lb., as compared with their normal weights of 9 st. 3 lb. and 9 st. 1 lb. respectively.

Lowering of Body Temperature in Chronic Starvation.—In chronic starvation the temperature tends to fall very gradually. The temperature of healthy British and Indian troops during the three days April 17th, 18th, and 19th, 1916, was lower than normal. The average morning temperature in 200 British troops was 96.13° F., and in 260 Indian troops 95.84°. The average evening temperatures in the same men were: British 97.41°, Indians 97.03°. These observations were accurately made and the usual precautions to eliminate error adopted. In some cases in hospital the temperature was less than 90° F. just before death. We had Indians going about at duty with temperatures between 94° and 95°. My own temperature was never above 97° for the last six weeks of the siege, and during the last fortnight it varied from 96° to 96.8°. I was seemingly in good health, bar the effects of short commons. We did not meet with the great diurnal variations or fluctuations of body temperature that have been recorded in some cases of acute and chronic starvation.

On April 17th I wrote: "The present condition of the average officer and fighting man who began the siege in fair physique and with a normal deposit of adipose tissue, and who has not suffered from any disease nor been able to supplement his rations from any exceptional sources, may be described as follows: He has lost weight, in particular his muscles have materially decreased in size and about 80 per cent. of his adipose tissue has disappeared; he is much below par in stamina, and, without feeling any decided weakness, he is incapable of doing anything approaching the normal amount of physical or mental work; in moving about his lower limbs feel a trifle heavy; he tires comparatively soon and welcomes a rest after an outing, walk, or short spell of fatigue duty. During work he is disposed to be affected by a temporary giddiness, especially on bending down or after an effort demanding some physical strain, and he perspires more readily than usual. Whilst he does not suffer in any way, he has the usual sensation of emptiness felt about the epigastrium, which is temporarily alleviated by a meal, especially a warm one. His temperature is a few degrees below normal, and his pulse rate from 8 to 10 beats per minute slower than normal. He sleeps well, completely digests what he eats, his bowels are regular; in practically every one there has been an occasional attack of simple diarrhoea which is evanescent. This latter may be connected with the coarse bread or *chuppatties*, and use of such extraneous articles of food as the green herbs and grass collected from the plain as substitutes for vegetables. On the ration now being issued the garrison could continue for some time, but at the end of another fortnight we should be very reduced in weight and unfit for any work calling for much physical exertion. A certain undefinable proportion of the garrison will reach this latter stage long before a month's time; some have reached it already, and a progressively increasing number will reach it from now onwards."

During the last month of the siege men at fatigues, such as trench-digging, after ten minutes' work had to rest a while and go at it again; men on sentry-go would drop down from syncope (the spell of this duty had to be reduced to one hour instead of two); those carrying loads would rest every hundred

yards or so. In many instances Indians returning in the evening after lining the trenches all day, seemingly with nothing the matter with them, would be found dead, cold, and stiff in the morning, death being due to exhaustion of the vital processes resulting from starvation. I saw one dead man lying on his back with a *chuppattie* in his hand near his mouth. It was natural that men in such a low state of health and vitality could stand little in the shape of illness—an attack of simple diarrhoea, for instance, that would have been got rid of in a day or so at the beginning of the siege in March and April often ended fatally; all recuperative and rallying power had gone. Personally up to the middle of March I could make a complete round of the front line trenches and fort (about five miles) in the morning; I had then to halve it, and at the end of April while doing the half I had to take it very quietly, and even then rest every 200 yards or so; practically all officers were in a similar condition of physical incapacity.

Inclination to Sleep in Chronic Starvation.—During the last days of the siege there was an increased tendency to sleep, a greater lowering of temperature, and a still slower pulse rate. If any disease (such as severe diarrhoea) intervened, these phenomena were exaggerated and death rapidly ensued. During the later periods of slow starvation there is practically no actual suffering even when such a disease as dysentery is present. In fatal cases so imperceptibly does life ebb away that it is sometimes not easy to say whether the man is really dead or not.

Reduction of Pulse Rate in Chronic Starvation.—It is sometimes stated that the rate of the pulse continues practically normal until a few days before death from chronic starvation. This is not the case. In the nineteenth week of the siege the average pulse rate in 200 odd cases in whom observations were continued thrice daily for a week was nine beats less per minute than normal. After the middle of April in many men the pulse rate was suddenly increased on the occurrence of impending danger, during an attack by the enemy or an exceptionally severe strafing from aerial bombs or even small-arm fire. The same occurred during severe exercise. A very slow pulse rate, from 30 to 40 per minute, was met with in many cases, both in hospital and at duty.

Mental Attitude of Garrison during the Siege.—During the first two months of the siege both British and Indian troops were moderately cheerful; for the next six weeks or so they were more subdued. For the last month without being depressed or melancholy they became somewhat cheerless, and during the last fortnight manifestations of mirth and vivacity had disappeared. Personally I was astonished at the patience and fortitude with which the garrison endured the terrible hardships they went through. I was amongst the men practically every day from the beginning to the end of the siege, and write from intimate knowledge of the conditions. The grit shown by our British and Indian soldiers was beyond all praise. "The behaviour of the men in meeting the unfortunate circumstances in which they are placed is heroic" (Diary, April 25th, 1916).

CHIEF DISEASES DURING THE SIEGE.

Diarrhoea.—This was by far the most prevalent disorder met with during the siege. On April 16th I entered in my diary:

"During the last two months there has been a high incidence of diarrhoea. In March this disorder was of a mild type and the vast majority of cases were treated regimentally, a few days' rest and medicine rectifying the disturbance. Early in April we began getting cases of very watery and severe diarrhoea with vomiting, cramps in the legs and abdomen, profound prostration, subnormal temperature, pulselessness, suppression of urine, and collapse. The majority of these cases rallied, but many of them became intensely collapsed and died on the second, third, or fourth day, some after a feeble attempt at reaction, most of them without manifesting any disposition to recover. I have seen practically all these cases; they were not true Asiatic cholera, though clinically very like it. It is not infectious; none of the attendants so far have been affected, and it occurs scattered in platoons and not in groups. The stools have not the well-known rice-water characters of cholera; they always contain a certain amount of bile; there is not the same degree of shrinking of the features, nor the change in the voice met with in cholera, and the mortality is much lower than in that disease. In a large number of instances the stools were examined by a bacteriologist expert, Captain H. H. King, I.M.S., and in none were cholera spirilla discovered."

The essential cause in all these cases was chronic starvation. The men had got into such a state of debility and wasting from shortage of food that any added strain on the economy, such as diarrhoea, was sufficient to lead to speedy dissolution. The disease continued epidemically after we got to the prisoners' camp, Shamran, where during May we had

over 1,500 cases and about 200 deaths from it. I was of opinion that the vast majority of these were ordinary cases of diarrhoea in men whose resistance had disappeared, whose stamina was greatly lowered, and whose heat-generating powers were so reduced that once a drain of any kind occurred from the body they were incapable of rallying; the low state of vitality, and especially the absence of any fuel in the system, rendered resuscitation impossible or highly improbable. The condition is one of the common accompaniments of every lasting famine in India, and has during these famines been repeatedly mistaken for genuine cholera. In the terrible and widespread famine of 1877-78 in India this form of diarrhoea was responsible for the death of most of the famine-stricken.

Dysentery.—A large number of diarrhoea cases merged into a form of dysentery that might pathologically be called catarrhal. The total number admitted into hospital with the clinical symptoms of dysentery was 684. There was besides a large number of slight cases treated regimentally; it might indeed be stated that it attacked a very high percentage of all ranks of the garrison at one time or another during the siege. It was relatively more frequent in Indian than British troops, and was of less severity and associated with a lower mortality and more amenable to treatment in the latter. Pathologically it varied in its intensity from a mild catarrhal inflammation to widespread destruction of the large bowel, and even of the lower part of the small intestine. In the penultimate and final stages of the siege medical officers were unanimously of opinion that the disease did not yield to treatment as satisfactorily as in the earlier stages. The symptoms and course of the disease were something like those of bacillary dysentery, but its real bacteriological relations, if any existed, were not determined. This condition was a particularly fatal terminal complication of scurvy.

Chronic Starvation Debility.—There are reasons for considering that there is a definite pathological state with a fairly well defined clinical course in chronic starvation debility. A general weakness without any assignable cause except the defects in the rations was naturally the commonest condition met with in the siege, and finally affected the entire garrison. It assumed graver forms in Indians than in Europeans. We noticed in hundreds of Indians that there is a stage in the downward path in chronic starvation from which recuperation cannot take place, that after the effects of starvation had reached a stage that is difficult to define, recovery was hopeless, as no possible measures appeared to have the power of restoring the victim. It is a condition of inanition in which it might reasonably be declared that all capacity to assimilate food has permanently disappeared; the glands and tissues engaged in the digestion and assimilation of food have wasted so much as to cease to function, the atrophy of these glands and tissues arising from their disintegration in helping to keep life going. This stage may or may not be associated with the diarrhoea or dysentery alluded to above; in many cases it passes almost imperceptibly into death. When soldiers doing their ordinary duties during a siege are living on less than a mere subsistence diet changes are occurring in their assimilative organs and tissues which, if continued, will lead inevitably to death. The pathological processes in operation in chronic starvation indicate that if relief is to be of service to the victims it should be commenced before the stage under reference has been reached. Enough has been said to indicate that advanced chronic starvation is necessarily associated with a very high mortality.

Scurvy.—Indian troops went through a serious outbreak of scurvy; during the siege it caused 1,050 admissions. A few cases appeared early in January; the incidence gradually rose, and in the middle of January we had 140 cases in hospital; at the end of March there were 597 cases under treatment, after which time it gradually declined. These do not include the incipient undeveloped cases which for military reasons were obliged to keep at duty, nor the latent cases. With the exception of chronic starvation itself nothing undermined the stamina of the Indian troops more than scurvy.

The essential differences between the diet of British and Indian troops were that British ate horseflesh and Indians until near the capitulation did not; Indian troops used *dhall* and British did not; British used white flour or biscuits made of it for a large part of the time, Indians used *atta* or coarse barley flour. The British got beri-beri and no scurvy, the Indians got scurvy and no beri-beri.

Beri-beri.—This disease gave rise to 155 admissions in Kut, all in British troops. These cases were the continuation of an alarming outbreak that began at Aziziyeh (a post about

half-way between Kut and Baghdad) in October, 1915. There were besides many undeveloped or incipient cases that continued at duty. Short of producing obvious clinical beri-beri a diet deficient in special directions brings on gradually a condition of lowered stamina and vital energy and of inefficiency. This is a change to be watched for—a danger signal.

TREATMENT OF CHRONIC STARVATION.

It is essentially necessary after long periods of partial starvation to exercise the greatest caution and discretion in returning to ordinary food. Death frequently occurs in those who after forced abstinence of some duration suddenly and completely gratify the natural cravings of hunger. The whole digestive apparatus is in a weakened state, and the various glands in and around the intestines that take part in the process of digestion have undergone atrophy, and their functioning power has to be restored before they can resume work normally. The activities of the digestive organs and metabolic processes have necessarily been sluggish, and any sudden demands made upon these functions are liable to be followed by a breakdown in the machinery. The main indications in attempting to restore those in advanced starvation are—maintenance of the warmth of the body and the administration of readily assimilated warm liquid nourishment. Rest and the application of warmth (if the weather requires it) are very comforting.

When circumstances allow of it only the most digestible substances should be sparingly partaken of at short intervals—milk (which is the great standby), beef-tea, meat juices, broths, prepared farinaceous and partially digested liquid animal foods, white of egg, etc., solid food being eschewed for some days, then beginning with white fish, rice, bread, butter, and fatty food, meats, and vegetables in gradually increasing quantities, the normal amount not being administered for some months. Digestibility and nutritive capacity are the main points in the foods given. Solid food of any kind is at first quite inadmissible; any attempt made to consume ordinary solid food, no matter how urgent the cravings for it may be, is likely to be followed by serious reaction. Everyone who went through the siege of Kut required to be taken into hospital, nursed, and treated on the lines indicated above if the consequences of their chronic starvation were to be averted. Instead of that the garrison was, on capitulation, put on the coarse rations of the Turks at once, and within three weeks sent on a 1,000-mile march, much of it through an arid desert *en route* to various places in Asia Minor. We had published in division orders during the last week of the siege a warning as to the dangers associated with returning to normal diet after long-continued partial starvation. There being no suitable food available, and human nature being what it is, as soon as the Turks' rations were issued, especially the coarse, hard, brown rye bread and biscuits, which caused intense irritation in the stomach and intestines, a large number of British and Indian troops and followers gorged themselves with it. The immediate result was the occurrence of a violent epidemic of a disease that had all the clinical characters of cholera as already described.

During the last two months of the siege the energies of the garrison were carefully husbanded; only the most indispensable fatigues were ordered, guards and outpost duty were reduced to the lowest possible minimum compatible with the military situation, and when men began fainting on "sentry-go" at the beginning of April the two hours' spell was reduced to one hour.

It was a long time before those who went through the siege of Kut regained their normal weight; in my own case it was about one and a half years. This appears to be in accordance with the experience of all long sieges of which we have record. The digestive glands of the stomach and intestines, the pancreas, and liver, have undergone considerable atrophy, and are long in recovering their normal functional activity. It was about two years before I personally could comfortably consume a normal meal as regards quantity; earlier than that any attempt to eat the amount of food I had been accustomed to before the siege was at once followed by unpleasant effects, which, however, caused only temporary inconvenience.

I have often been asked what rations remained at the time of the surrender. On April 29th, 1916, the only food left was twenty-nine emaciated artillery horses; on that date there was not a pound of flour, *atta*, barley, or any other foodstuff available. As the Turks failed to provide any food until April 31st, the sick and wounded in hospital (about 2,500) got no rations at all on April 30th. The troops at duty marched to Shamran on April 29th, the Turks occupying Kut the same day.