THE TREATMENT AND MANAGEMENT OF DISEASES DUE TO DEFICIENCY OF DIET:

SCURVY AND BERI-BERI.*

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AMONG the many fascinating and interesting medical problems which presented themselves during the campaign in Mesopotamia those connected with scurvy and beri-beri occupied the foremost place. These two deficiency diseases occurred to a greater extent in Mesopotamia than in any theatre of war.

The enormous wastage caused by scurvy in that campaign can be realized from the statistics available; thus, 11,445 cases occurred in the last six months of 1916. These cases were almost all evacuated to India, since they were quite unfit to undergo the hardships of active service in the field.

The careful investigations made in connexion with these diseases in Mesopotamia, and the results of the management—that is, the scientific rationing—of the troops, have most conclusively established that both scurvy and beri-beri are essentially deficiency diseases and are due to a deficiency in the respective vitamins in the dietary associated with their causation.

From the beginning of May, 1916, until the end of January, 1919, as senior consulting physician to the Mesopotamian Expeditionary Force, I made a special study of scurvy and beri-beri from their clinical aspects and from the point of view of prevention and treatment, and acted as special adviser with regard to deficiency diseases. I would take this opportunity of expressing my thanks to the Directors of the Medical Service, Major-General Sir Francis Treherne, K.C.M.G., and Major-General A. P. Blenkinsop, C.B., C.M.G., for the help and encouragement always given me in this work.

In order to understand clearly the problems which presented themselves in the Mesopotamian campaign in connexion with the management of scurvy and beri-beri it is necessary to pass in review the circumstances which effected the rationing of the troops in so far as they related to the occurrence of scurvy and beri-beri.

The Mesopotamian campaign commenced on November 6th, 1914, when troops under General Delamain landed at Fao; on November 22nd, 1914, when General Sir Arthur Barrett was in command, Basrah was occupied. The force pushed its way up the Tigris, and after a series of brilliant military successes Kut was captured on September 28th, 1915.

From the beginning of the operations until 1916 the Mesopotamian Force was under the control of the Indian Government, and the system of rationing troops was based on the field service scale of rations laid down in War Establishments, India.†

It may be stated now that scurvy in Mesopotamia was practically limited to Indian troops. A few isolated cases occurred amongst British troops; their causation could be traced to inadequate dietary owing to some other diseases occurring in the individual patient.

TABLE I.—Field Ration of British Troops.

Bread	1 lb.	Sugar	2½ oz.
Fresh meat	1 lb.	Salt	1 oz.
Bacon	3 oz.	Pepper	½ oz.
Potatoes	1 lb.	Fuel	3 lb.
Tea	1 oz.		

TABLE II.—Field Ration of Indian Troops and Followers.

Atta	1½ lb.	Ginger	½ oz.
Fresh meat	4 oz.	Chillies	½ oz.
Dhall	4 oz.	Turmeric	½ oz.
Ghi	2 oz.	Garlic	½ oz.
Gur	1 oz.	Salt	½ oz.
Potatoes	2 oz.	Fuel	1½ lb.
Tea	½ oz.		

Beri-beri, on the other hand, was limited to British troops; practically no cases occurred amongst Indians.

Some cases occurred amongst the Chinese Labour Corps at Basrah in 1918, and also amongst the crews on board ships arriving at Basrah. Both of these epidemics were traceable to polished rice as the etiological factor.

A review of the ration scales shows that as regards deficiency disease the ration for British troops was fairly satisfactory. Attention will be called later to the deficiency as regards the anti-beri-beri factor under the conditions of service at the front. For Indian troops the field service ration was very deficient as regards anti-scorbutic vitamins, the only anti-scorbutics being 2 oz. of potatoes and 4 oz. of fresh meat. This deficiency became much accentuated owing to the conditions of service at the front.

The great cause of the wastage in the Indian troops of the Mesopotamian force up to the end of 1916 was scurvy. To understand this thoroughly it is necessary to explain the system of rationing of Indian troops in India prior to 1917. An allowance was made to each soldier equivalent to the cost of the items in the field service ration. He bought his ration from the bunniah or food contractor of his unit. The Indian has the instinct of saving money for his family very firmly implanted in his mind, and under the old system of rationing Indian troops in India there was no guarantee that the Indian soldier bought and consumed even the field service ration. He no doubt often starved himself to save a few annas.

As a consequence of this system the Indian troops arriving from India in Mesopotamia in many cases showed a considerable percentage of men anaemic and debilitated, and suffering from pyorrhoea; they had little balance in the bank, so to say, against the onset of the deficiency disease scurvy, and their latent period would be short were dietetic hardships imposed on them. My colleague the late Colonel H. C. Melville, I.M.S., paid special attention to the examination of Indian troops arriving from India during the latter half of 1916, and he found at this time a considerable percentage of men on arrival to be anaemic, debilitated, and suffering from pyorrhoea. These men were not actually suffering from scurvy, but they were in a condition which strongly predisposed them to it.

The British soldier, on the other hand, came out to Mesopotamia well nourished and with a good balance in his bank against deficiency disease, and if he developed this his latent period would be a long one.

A glance at the map of Mesopotamia shows the military situation up to February 23rd, 1917, when the Tigris was crossed at Shumram and the Turks retreated towards Baghdad. From December 11th, 1915, down to this date the operations of the Mesopotamian Force were directed towards the relief of Kut and the advance onwards to Baghdad.

Basrah and Amara were centres of local production of fresh fruit and vegetables and the incidence of scurvy was very slight amongst the troops stationed there. Beyond Amara there were no centres of local production of fruit or vegetables and troops had to rely entirely on the river transport for supplies of these articles.

Attempts were made by the army to grow vegetables for the troops, but it was impossible to do this in sufficient quantity since in Mesopotamia irrigation is essential for cultivation and a scheme for growing vegetables for the army on a large scale would have taken a very long time to carry out. To grow fruit and vegetables successfully involved a long and intimate experience of local conditions, and it was found that this could be much more economically and satisfactorily carried out by the native Arabs under our supervision; the produce was purchased from them by the army.

During 1915 and 1916 the river transport was taxed to its utmost in conveying troops and supplies and in carrying sick and wounded downstream. No special provision for the transport of fresh fruit or vegetables or fresh meat was available until towards the end of 1916. The climatic conditions of Mesopotamia were such that vegetables and fruit sent by river from Basrah arrived generally in a damaged condition unsuitable for issue.

It is thus obvious that the troops in the front area from December, 1915, to February, 1917, obtained few supplies of fresh vegetables or fruit; this explains the fact that up to February, 1917, there was an enormous incidence of scurvy amongst Indian troops in the front area in Mesopotamia.

* A paper read before the Section of Therapeutics and Pharmacology of the Royal Society of Medicine.

† Pages 10 and 11: Table 1, British rations; Table 2, Indian rations.

Alterations of Rations.

The incidence and causation of deficiency diseases in Mesopotamia was thoroughly appreciated, and steps were taken to put the ration scales on a scientific basis in this respect. The army commander, Sir Percy Lake, in 1916 with this object sanctioned the ration scales of July 4th, 1916, which were a great improvement as regards the protection from deficiency diseases.

TABLE III.—RATIONS, JULY 4TH, 1916.

A. Field Rations of British Troops.			
Bread	1 lb.	Condensed milk	2 oz.
Fresh meat	2 lb.	Salt	1 oz.
Bacon	3 oz.	Pepper	3 oz.
Potatoes	1 lb.	Wood	3 lb.
Tea	1 oz.	Oatmeal	4 oz.
Sugar	2½ oz.	Condensed milk	2 oz.
Cheese	3 oz.	Tobacco (weekly)	2 oz.
Rice	3 oz.	Matches (boxes weekly)	2
Jam	3 oz.		
Extras.			
Chocolate	1 oz.	Dates	4 oz.
Bread	4 oz.	Fresh fruit	4 oz.
Lime juice	½ fl. oz.	Dry lentils	2 oz.
Sugar	½ oz.	Curry powder	½ oz.
Rum	4 fl. oz.	Limes (per man)	3
B. Field Rations of Indian Troops.			
Atta	1½ lb.	Tea	½ oz.
Fresh meat	4 oz.	Ginger	½ oz.
Dhall	4 oz.	Chillies	½ oz.
Ghi	2 oz.	Turmeric	½ oz.
Gur	2 oz.	Garlic	½ oz.
Potatoes	2 oz.	Salt	½ oz.
Fresh fruit	2 oz.	Fuel	1½ lb.
Tobacco (weekly)	2 oz.	(Substitutes same as per British troops.)	
Matches (boxes weekly)	2		
Condensed milk	2 oz.		
Extras.			
Atta	½ lb.	Fresh fruit	4 oz.
Ghi, 1 oz., or Gur	2 oz.	Tamarind	2 oz.
Fresh meat	2 oz.	Rum (25 per cent. under proof)	2 fl. oz.
Fresh vegetables	4 oz.		

Later the rations were further improved, and the army commander, General Sir Stanley Maude, who took a very great interest in the prevention of scurvy and beri-beri, sanctioned the ration scales of October 31st, 1916.

TABLE IV.—RATIONS, OCTOBER 31ST, 1916.

A. British Troops.	
Daily:	Weekly:
Bread	Pepper
Or biscuit when bread not available	Mustard
Fresh meat	Tobacco
Or preserved when fresh not available	Or cigarettes No. 40, or sweets
Pickles when preserved meat is issued	Matches (boxes)
Bacon	Twice weekly:
Potatoes or fresh vegetables	Marmite (Monday and Thursdays; not in summer)
Or dried vegetables when fresh not available	Thrice weekly:
Tea	Oatmeal (Mondays, Wednesdays and Fridays)
Cheese (not in summer)	Tinned milk (Mondays, Wednesdays and Fridays)
Sugar	Rice (Tuesdays, Thursdays, and Saturdays)
Jam or golden syrup	Curry powder (Tuesdays, Thursdays, and Saturdays)
Tinned milk	Butter (Mondays, Wednesdays, Fridays; not in summer)
Salt	Lime juice (Tuesdays, Thursdays, Saturdays; not in winter)
Fresh fruit	
Or tinned fruit 2 oz., or dried fruit 1 oz., when fresh fruit not available	
Soup or oxo (not in summer)	
Fuel (coal 1 lb., wood 1 lb.)	
B. Indian Troops.	
Daily:	Daily (cont.):
Atta or rice	Condiments (ginger, chillies, garlic, turmeric)
Fresh meat	Salt
Gur when fresh meat not available	Tamarind or cocum
Dhall	Fuel (wood)
Gur	Thrice weekly:
Ghi	Ghi (Mondays, Wednesdays, Fridays)
Potatoes or fresh vegetables	Lime juice (Tuesdays, Thursdays and Saturdays; not in winter)
Dried vegetables when fresh not available	Weekly:
Fresh fruit	Tobacco (Sundays)
Tinned fruit 2 oz., or dried fruit 1 oz., when fresh fruit not available	Or cigarettes No. 40, or sweets
Tea	Matches (boxes)
Milk, tinned	

Reviewing the ration scales of October 31st, 1916, we find that as regards protection against scurvy the Indian ration contained:

Potatoes or fresh vegetables—for example, onions	6 oz.
Fresh fruit (limes, etc.)	2 oz.
Fresh meat	6 oz.
Tamarind or cocum	2 oz.
Lime juice (three times a week)	½ oz.

The only difficulty was to convey this ration to the troops. The fierce heat of Mesopotamia rendered it impossible to carry perishable articles, such as vegetables, fruit, and fresh meat, up the 300 mile journey on the Tigris without special provision as regards transport. Down to the later part of 1916 transport was inadequate both on river and land to cope with this great problem. Towards the end of 1916 the transport was much improved, and the refrigerator barges which arrived, with cold storage chambers for fresh meat, were of great value.

Major-General Sir G. MacMunn, K.C.B., Inspector-General of Communications, took a great interest in the problem of conveying antiscorbutics to the troops on the front, and devised crates for the carrying of fresh vegetables and fruit which were of great value in protecting them from damage during transport.

Fresh Meat.

The evidence from the Mesopotamian campaign proved that fresh meat has important antiscorbutic value. During 1916, when the troops at the front, both British and Indian, were unable to get fresh vegetables or fruit for long periods, the only protection that the British had above that of the Indians was the fresh meat allowance of 1 lb. daily. Usually two or three issues were obtained from local supplies of Arab sheep; on other days tinned beef was issued. The Indian troops did not care for meat, and usually had only one or two rations of 6 oz. a week. On other days, owing to their class prejudices, tinned meat could not be issued.

Further evidence of the value of fresh meat was obtained by investigations carried out by Major Marjoribanks, I.M.S., on Indian patients suffering from scurvy, in 1916, at Nos. 9 and 10 Indian General Hospitals. Two parallel groups of scurvy cases were treated on identical lines as regards diet, except that one group was given a daily ration of fresh meat juice; they improved much more rapidly than the other patients. I saw these patients several times in consultation, and can testify to the striking antiscorbutic value of raw meat juice.

The climatic condition of Mesopotamia and the risk of parasitic infection prohibited the general use of raw meat juice in the treatment and prophylaxis of scurvy, but in the treatment of cases of scurvy in hospital the beneficial effect of a liberal allowance of fresh meat was very striking.

Tamarind.

In all probability the tamarind has antiscorbutic properties. It was taken by the Indian troops either as a chutney with stewed meat or, as an infusion with sugar, formed a palatable acid drink. Cocum is a sort of dried plum, which appeared to have no antiscorbutic value. It has had a reputation in India as an antiscorbutic, but it was not liked by the Indian troops, and was little used in Mesopotamia.

Lime Juice.

The ration lime juice up to the end of 1916 had no antiscorbutic value, and produced no beneficial effect on patients suffering from scurvy. It usually arrived in Mesopotamia after a long journey overseas, and was probably six months or more old before issued. At my suggestion, in August, 1916, fresh lime juice was prepared in India from fresh limes, a small quantity of alcohol (5 per cent.) and salicylic acid (2 grains to the pint) being added as a preservative. This was sent to Mesopotamia in special casks with the date of preparation marked on it, and gave better results as regards antiscorbutic properties; it was used in the treatment of patients suffering from scurvy as well as for issue to troops.

Lime juice as a prophylactic against scurvy is of uncertain value, since it is difficult to ensure its delivery to an army in the field within three months of its preparation, and after that time much of its antiscorbutic value is lost. Undoubtedly when fresh it has important antiscorbutic properties, as I saw demonstrated on many occasions in patients suffering from scurvy. After the occupation of

Chart showing admission rate to hospital per mille of Indian strength. Upper curve = 1917. Lower curve = 1918.

Baghdad lime juice was prepared from limes and bitter oranges obtained locally; preservative was added as above described. It was issued to troops with as little delay as possible, and had undoubted value as an antiscorbutic. The recent work of Miss Chick and Miss Hume showing the superior value of lemon juice to lime juice is of great value and interest.

During the deficiency of fresh vegetables and fruit in 1916, owing to the great incidence of scurvy among Indian troops, an order was issued that they should have the first call on the fresh vegetables and fruit available.

Beri-beri in Relation to the Ration Scales.

Indian.—This ration is highly protective as regards antiscorbutic vitamins. Atta, the usual issue to Indian troops, although rice was an alternative, is a wheat flour containing the germ and some of the aleurone layer of the grain, so that it is rich in anti-beri-beri vitamins. Dhall contains the coat and germ of the lentil, and is also rich in anti-beri-beri vitamins.

British.—In 1915 over 300 cases of beri-beri occurred amongst British troops. The India field service British ration was protective against beri-beri, but owing to the inadequacy of transport and the long distances from the base, fresh meat and vegetables were not available for the troops at the front, so that the basis of the ration was tinned beef, bread or biscuits, jam and tea. The British bread and biscuits were made of white flour from which the germ and aleurone layer had been removed, thus depriving them entirely of anti-beri-beri vitamins. The British soldier as regards this became liable to beri-beri, and in many cases became a victim to the disease.

In the July, 1916, ration, oatmeal 4 oz. and dhall 2 oz. were added to the British ration to supplement the British vitamin deficiency. In October, 1916, marmite $\frac{1}{4}$ oz. three times weekly was added to the ration.

Beri-beri cases occurred in the Dardanelles; I saw practically all of them, and at the suggestion of Colonel C. J. Martin advised the treatment with yeast, which gave satisfactory results.

In February, 1916,¹ I suggested to the Sanitary Committee of the War Office the advisability of an extract of yeast being issued to the troops as a prophylactic against beri-beri. Experiments instituted by Major-General Sir William Horrocks, K.C.M.G., were carried out by Professor Starling, F.R.S., Dr. S. M. Copeman, and their co-workers, who showed that extract of yeast was a prophylactic against beri-beri, and a preparation known as marmite was issued to British troops in Mesopotamia in October, 1916. Marmite can be mixed with warm water and taken like bovril or be added to a stew after cooking. It was undoubtedly of great value as a prophylactic against beri-beri in Mesopotamia, and it was a valuable remedy in the treatment of cases that occurred. It kept well in Mesopotamia, and no difficulty was experienced in its issue as a ration to troops.

In February, 1917, at my request experiments were carried out at Amara to determine the practicability of issuing to British troops bread made with a certain proportion of atta in the flour. Loaves were made with flour containing 100 per cent., 75 per cent., 50 per cent., and 25 per cent. respectively of atta. The bread was very palatable, but the addition of much atta caused some difficulty in the rising of the dough so that the bread was somewhat heavy. Bread made with 25 per cent. of atta

was quite as palatable, and differed little except in the slightly brownish colour from ordinary bread. It was issued to several units at Amara with satisfactory results, and later on a general issue to the army on three days a week was sanctioned by the General Officer Commanding in Chief. The issue to British troops of bread rich in anti-beri-beri vitamins was undoubtedly an important factor in the reduction of beri-beri among them.

Rice.

As a causal factor of beri-beri amongst the troops rice did not attract much attention, because atta was almost entirely issued in its place to Indian troops. But in 1918 a Chinese Labour Corps arrived at Basrah, and the men of this unit refused to eat any rice except the polished variety; in consequence a number of cases of beri-beri occurred amongst them. The difficulty was overcome by the issue of atta in place of a portion of the rice ration; the outbreak of beri-beri then subsided.

After the occupation of Baghdad on March 11th, 1917, local supplies of fresh vegetables and fruit and fresh meat became available in ample quantity. General Dickson, C.M.G., C.B.E., Director of the Department of Local Resources, took the greatest pains in ensuring the issue of these articles to the troops throughout the advanced area. It was owing to the adequate supply of fresh vegetables, fruit, and fresh meat that deficiency diseases were stamped out from the Mesopotamian Expeditionary Force after March, 1917.

Statistics.

Scurvy in Indian troops and beri-beri in British troops were very prevalent up to July 1st, 1916, but correct statistics were not available. From July 1st, 1916, scurvy and beri-beri were made notifiable diseases in the army. From July 1st to December 31st, 1916, 11,445 cases of scurvy occurred in Indian troops. In 1917, 2,199 cases occurred, and in 1918 only 825, although the force in 1917 and 1918 had been largely increased.

TABLE V.—Scurvy in Indian Troops, and Beri-beri in British Troops.

Year.	Scurvy (Indians).	Beri-beri (British).
1916 (July 1st to December 31st) ...	11,445	104
1917	2,199	84
1918	825	51

The chart shows for 1917 and 1918 the incidence of scurvy, the maximum being in May and June.

As regards beri-beri, records are available showing that 335 cases occurred among British troops to the end of February, 1916, and 104 in the last six months of 1916. In 1917 only 84 cases occurred, and in 1918 only 51 occurred.

ETIOLOGY.

Undoubtedly the prime causes of scurvy and beri-beri are vitamin deficiencies; other factors, however, play a part as predisposing causes.

The Climatic Influences.

The maximum incidence of scurvy was in the hot months of May, June, and July, while beri-beri attained its maximum in November and December.

Mental Depression.

This is mentioned by Osler as a predisposing cause in scurvy, and undoubtedly in Mesopotamia the depressing influences associated with the campaign in 1916 were factors in the causation of the high incidence.

Intercurrent Diseases.

Patients suffering from such diseases as dysentery, those of the enteric group, and epidemic jaundice, which required careful dieting, would rapidly develop scurvy unless care were taken that antiscorbutics formed a part of the dietary. It was remarkable how quickly scorbutic symptoms would develop in Mesopotamia in patients on a dietary devoid of antiscorbutics. I have seen several cases develop typical scorbutic gums within six weeks of admission to hospital. It became a rule, therefore, to add to the diet of all patients in hospital a sufficiency of antiscorbutics—for example, lemons, limes, oranges, etc.—to prevent the development of scurvy.

In the Dardanelles campaign I called attention to the occurrence of beri-beri in patients recovering from an attack of epidemic jaundice. The absence of anti-beri-beri vitamins in the dietary prescribed for the jaundice was undoubtedly the cause.

A few cases of scurvy occurred among British troops in Mesopotamia in men with very carious teeth, who, on account of the difficulty of mastication, avoided eating any fresh fruit or vegetables. I saw one case in a man who had an intense dislike to fruit or vegetables of any kind.

Starvation *per se* does not cause scurvy or beri-beri. In May, 1916, I examined a large number of sick who had been in Kut during the period of its siege (December 11th, 1915, to April 29th, 1917). Many of them showed signs of acute starvation, but symptoms of beri-beri and scurvy were not usually manifest.

TREATMENT.

In order to obtain effective control of the diseases special hospitals for scurvy and beri-beri were established in June, 1917, at Baghdad, Amara, and Basrah—an Indian hospital for scurvy and a British hospital for beri-beri. A special medical officer was attached to each of these hospitals, and special registers were kept in which all the cases of scurvy and beri-beri were fully recorded. In this way the occurrence of either in any unit was at once recognized, and moreover uniformity of diagnosis and treatment was ensured.

Scurvy.

The symptoms of scurvy exhibited by the individual called for special lines of treatment. Anaemia and debility were the early symptoms.

Mouth.—The hyperplastic condition of the gums with characteristic red buds between the teeth, often shown best on the buccal aspect, was the most common symptom. In some cases the gums were so swollen as to present an appearance resembling a new growth. Pyorrhoea, which is quite a distinct disease from scurvy, often accompanied it, and no doubt by its presence tended to accentuate the symptoms of scurvy. Petechiae or patches of haemorrhage occurred in the soft and hard palate; if old they had a pigmented appearance, also a characteristic dark crimson or purplish area of discoloration commonly extended from the inner aspect of the molar teeth upwards towards the palate. This sign was very common, and a very valuable early indication of scurvy. The palate itself was usually pale, owing to the marked anaemia present.

Muscle haemorrhages occurred in about 30 per cent. of the cases, usually in the calf or thigh muscles or around the popliteal spaces or anterior tibial region, forming a hard brawny swelling hot to the touch and tender on pressure.

Oedema.—Scorbutic oedema of a firm brawny type occurred in the legs and feet and around the tendo Achillis; it was of quite a different type from cardiac or renal dropsy, and was often tender. It was too firm to pit readily.

Subperiosteal swellings—for example, along the ulna or tibia—were fairly common.

Effusion into the joints of a haemorrhagic type sometimes occurred.

Skin.—In Indians skin manifestations were very difficult to determine owing to the natural pigmentation of the skin. In white races purpuric patches were very common, and frequently the skin had a general earthy or bluish appearance.

Subconjunctival haemorrhages occurred in a few cases.

Haemorrhagic pleural effusion was seen by me in six cases.

Bowel.—In some cases haemorrhage from the bowel required careful differentiation from dysentery.

Dilatation of the heart, usually accompanied by haemic murmurs, was generally present in severe cases, and was an important indication for a period of rest in bed.

Rules for Treatment of Scurvy.

Captain A. J. Stevenson, M.C., R.A.M.C., who was appointed M.O. in charge of the scurvy wards in the special scurvy hospital at Baghdad, did valuable work. The following scheme of treatment for scurvy in Indians was drawn up by us:

Rest in bed was essential as long as the anaemia or cardiac dilatation persisted; also the presence of muscle haemorrhage, oedema, periosteal or joint haemorrhages, or other severe haemorrhagic symptoms, demanded complete rest in bed.

Local Treatment of the Mouth and Gums.—A solution of 1 per cent. salicylic acid in alcohol was applied to the gums twice daily. A mouth wash of alum and carbolic acid was used frequently; also dental treatment, such as scraping the teeth to remove tartar and removal of carious teeth, was carried out.

Anaemia.—A mixture of iron and arsenic was given for this in addition to the other measures.

Diet.—The diet table was:

6 a.m.	Tea and biscuits and 2 oz. fruit.
8 a.m.	$\frac{1}{2}$ oz. fresh lime juice.
10.30 a.m.	Chappatis or rice with 8 oz. vegetables and two pints fresh milk.
12 a.m.	$\frac{1}{2}$ oz. fresh lime juice.
2 p.m.	10 oz. fresh fruit.
7 p.m.	Meat 14 oz., vegetables 8 oz.

Tomatoes, cucumbers, and onions were given raw; other vegetables were boiled for twenty minutes.

The accompanying tables show the selection of fruit and vegetables obtainable in the Baghdad area.

TABLE VI.—Vegetables obtainable in Baghdad Area.

A. Summer planting commencing from the month of February.		B. Winter planting commencing from the month of September.	
Onions	Tomatoes	Cabbage	Turnips
French beans	Cucumber	Beans	Radish
Haricot beans	Pumpkin	Spinach	Cauliflower
Brinjals	Melons	Beetroot	Lettuce
Lady's finger	Water melons	Carrots	Furze

TABLE VII.—Fresh Fruits obtainable in the Baghdad Area.

A. Fruit produced during the summer locally.		B. Fruit produced during the winter locally.	
Apricots	Figs	Oranges	Limes
Apples	Dates	Tangerine	Quince
Peaches	Pears	oranges	Pomegranates
Plums	Mulberry	Sour oranges	Citron
Grapes		Lemons	

One of the most effectual remedies for scurvy is a salad made by cutting raw potatoes into very fine slices, and adding slices of onion and a little vinegar. Captain A. L. Shepherd, I.M.S., at my suggestion tested this in 1916 on cases in the scurvy camp at the front area. He found that it gave a better result than any of the antiscorbutics he was then using.

Physical exercises were given for twenty minutes twice a day to those patients who were sufficiently well.

In a few isolated cases the muscle haemorrhages suppurated and required surgical treatment, incision, etc. The cases of scorbutic haemothorax required treatment by aspiration, in addition to the other treatment of scurvy.

Germinated Dhall.—The discovery in 1917 by Miss Chick and Miss Hume of the value of germinated dhall as an antiscorbutic gives to forces in the field where no fresh vegetables or fruit are available a very valuable antiscorbutic prophylactic. Unfortunately during the trying periods of 1915 and 1916 in Mesopotamia, when antiscorbutics were not available for the troops at the front, this discovery had not been made. After May, 1917, germinated dhall was used in outlying districts in Mesopotamia as a ration when fresh vegetables or fruit could not be supplied. It was used also in hospitals for the treatment of scurvy, but it had no advantage over the use

of fresh fruit and vegetables, and was less palatable. The great value of germinated dhal is that it can be used as a good substitute for fresh fruit and vegetables when these are not available; it is not meant to take their place.

Beri-beri.

In a country like Mesopotamia where toxic influences causing multiple neuritis were present most careful examination was necessary to exclude such causes of multiple neuritis as dysentery, enteric or paratyphoid fever, heat, malaria, sand-fly fever, and diphtheria.

The early signs of beri-beri were those of cardiac weakness accompanied by symptoms of multiple neuritis. A valuable early diagnostic test for troops was the squatting test which I described in 1916.² In Mesopotamia the cases were treated on similar lines to those described, the only difference being that marmite was used in place of yeast; it was given thrice a day.

CONCLUSION.

The experiences of the war, specially in distant countries such as Mesopotamia, called for special attention to the scientific rationing of troops. The old idea of sufficiency of calories, or of proteins, fat, and carbohydrates, is quite inadequate. A dietary to be satisfactory must contain proteins, fat, and carbohydrates in the proper amount, and must satisfy the calorie requirements, but it is essential that, in addition, it should be adequate as regards vitamin content—for example, it must be protective against scurvy, beri-beri, and other deficiency diseases.

Too often financial considerations predominate, and I cannot let this opportunity pass without calling attention to the action of the Indian Government in the matter of the rationing of the Indian soldiers serving in India. On February 17th, 1917, a ration was sanctioned by the Indian Government for Indian troops in India. This ration repeats the field service ration which was responsible for the enormous outbreak of scurvy in the Indian troops in Mesopotamia; and, indeed, it is inferior as regards antiscorbutic value, for it entirely lacks any fresh meat allowance. Under a ration of this kind scurvy is likely to be prevalent amongst Indian troops in India, and if at any time they are called upon for active service there is bound to be a great wastage owing to the incidence of scurvy. Rationing of this kind may appear to those without special knowledge economical, but to those who have studied the subject it is a false economy. It seems incomprehensible that after the tragic experiences of Mesopotamia the same mistakes should be repeated.

Since the rationing of troops or of a civil population is carried out usually by the laity not possessing special medical knowledge, the education of the lay mind in the scientific principles which form the basis of a sound dietary is of the utmost importance. For this purpose in Mesopotamia the "Official Memoranda" on scurvy and beri-beri which had been carefully drawn up were circulated not only to all the medical units, but to the commanding officers of all combatant units in the force. The education of the fighting forces in the principles of rationing as regards protection from the deficiency diseases—scurvy and beri-beri—was of great value, for the commanding officers took the greatest care to see that their troops received those articles of dietary which were essential for their protection.

REFERENCES.

- ¹ *Lancet*, March 11th, 1916. ² *Ibid*.

THE Board of Education has issued a new edition of the *Syllabus of Physical Training*. The general suitability of the syllabus issued in 1909 has been established, but experience has shown that certain modifications and developments are desirable. They have been made on the advice of a committee, after hearing suggestions made by a number of experienced gymnastic teachers. The syllabus has been made less formal; the arrangement of the lessons has been retained, but a considerable amount of free movement has been introduced and "breaks," rather than rests, between the exercises have been recommended, and also that half the lessons should be given to general activity exercises, including games. The exercises and games are classified according to age, and there are appendices dealing with school dress, general activity exercises and games, dancing and swimming.

THE AIMS AND METHODS OF GRADUATE STUDY.*

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The universal process of reconstruction has led to much discussion on medical education, as the writings of Sir Clifford Allbutt, Dr. Fortescue-Brickdale, Sir James Mackenzie, Sir George Makins, Mr. Thelwall Thomas, Sir George Newman, and others testify, and the present moment affords an opportunity to review some of the problems in connexion with graduate, usually and perhaps unnecessarily called post-graduate, education and teaching.

It is often said, especially in introductory addresses, that we remain students all our days, and this of course should be true; but, in assuming that we are industrious students, possibly some of us flatter ourselves—as an unconscious compensation for the apparently modest admission—for in the face of many distractions it is not so easy to carry this ideal into practical effect as it may seem at first sight. It is natural, by glancing at the weekly journals, to keep more or less in the fashion, so as to be familiar with new names and thus avoid being too obviously out of date, but more than this may be difficult for want of a definite stimulus; the bogey of examination has been safely left behind, and it is only in the naval and military services that the earlier steps of promotion are accompanied by study leave and an examination test. Without some such incentive it is only too easy to stagnate in a gradually narrowing groove, and to remain satisfied with the same outlook and the methods that held the field at the time of qualification, but have become obsolete. The advance of medical science is so rapid that without knowing it—and he seldom does—a man easily becomes a medical Rip Van Winkle. In 1911 the late Dr. J. B. Murphy⁴ of Chicago suggested that the licence to practise should be granted only for a certain number of years, five or ten, and that at the expiration of this period practitioners should be required to pass an examination or take a prescribed course of study. The idea of a temporary diploma with a renewal contingent on an examination is not likely to meet with an enthusiastic reception.

But a less drastic step towards the same end would be the grant of some kind of a higher diploma, or even of a degree after a series of yearly courses or after a single prolonged course. This addition would perhaps be analogous to the bar to the D.S.O. or the Military Cross. It might be suggested that whereas an M.B. degree is the crown of undergraduate work, the M.D. now awarded for a thesis or by examination should be given after proof of graduate education. If such a scheme were general the habit of graduate education would in time become almost obligatory instead of optional, and would enable the graduate course to be standardized just as that demanded for qualification has long been. At first sight this may seem a revolutionary proposal, but the principle has long been acted upon in the diplomas in public health and other special branches; and in America certificates, which vary in their value and the standard required, because many post-graduate institutions are proprietary, are given after a course. Certificates were, indeed, given after the Emergency Post-graduate Course of the Fellowship of Medicine. At Harvard, where the minimum time qualifying for a certificate is four months of work occupying the whole day, the question of these degrees was under discussion as long ago as 1913; and though the matter was postponed, the personal opinion of the Dean of the Graduate School¹ was in favour of their ultimate establishment, and to the effect that a systematic course of at least eight months should be required.

Immediate Need of Organization.

The need for organization of graduate teaching on a large scale is urgent because, owing to the reluctance of English-speaking nations and their allies to go to Berlin, Vienna, Munich, and other medical centres of the Central Empires, there is a great opening for efficient and complete

* The opening address of the session at the North-East London Post-Graduate College, Prince of Wales's Hospital, Tottenham.