

THIRTY-THIRD SCIENTIFIC MEETING—EIGHTEENTH ENGLISH MEETING

LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE,
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NUTRITIONAL EXPERIENCES IN PRISONER OF WAR AND INTERNMENT CAMPS IN THE FAR EAST

Chairman, Dr. P. S. SELWYN-CLARKE

Dr. P. S. Selwyn-Clarke (Government Medical Department, Hong Kong): I am very grateful to The Nutrition Society for the invitation to take the chair at this Conference.

At this juncture I think it would be difficult to name a more important or a more pressing problem than that of nutrition. Hardly a day passes without some reference to the subject in the lay and scientific press. Thanks very largely to the activities of this Society and to the unceasing activities of the Medical Research Council, under the distinguished leadership of Sir Edward Mellanby, this country enjoyed a planned economy during the war years. From evidence in possession of the Ministry of Health, I refer to an interesting series of lectures given by Dr. Magee at the Royal College of Physicians early this year, it would appear that an actual improvement in the general standard of nutrition in Great Britain during the difficult period took place, particularly amongst children (Magee, 1946). The same amazing and very gratifying result was not achieved in other parts of the world, notably the Colonies where, as you know, many millions suffer from various degrees of disordered nutrition extending to the most aggravated form or to actual starvation.

You may recall that a few weeks ago President Truman hinted at the possibility of 150 million people dying this summer of starvation and, in his broadcast last night, Mr. Hoover, who has just made a survey round Europe, intimated that some 300 million people would be on the sub-standard dietary of 900 Calories or less, which amounts to death by slow starvation. Under-nutrition will be the cause in central and southern Europe of a degree of unrest which may seriously hamper post-war reconstruction.

The contribution that this country is making at the present moment to ease the problem of nutrition, necessitating personal sacrifices by the people of Great Britain, including, as you may have seen from the papers, another 200 thousand tons of cereals given up from our pipeline, makes one proud of one's citizenship.

The problem of nutrition is so complex, involving production, consumption, distribution, economic and many other factors, that one arrives at the stage of feeling rather hesitant in putting forward any solution whatever. Despite the havoc of world war, the world's peoples continue to increase at a rapid rate. Unhappily production and distribution do not keep pace with this increase, and we are left with a still greater problem. In fact, as you know, cultivable areas tend to decrease owing principally to soil erosion.

You are all doubtless aware that the seriousness of the situation has been fully appreciated by the Secretary of State for the Colonies for many years past. On the advice of the Chairman of the Colonial Medical Research Committee, nutrition research committees were established in many Colonies, and nutrition surveys have been fostered, for example, the one carried out with such distinction by Dr. B. S. Platt and others. I have been authorized by the Chief Medical Officer to the Secretary of State to inform you that it is proposed shortly to bring into being a Colonial Nutrition Research Committee to advise the Colonial Secretary.

Today's meeting may, I think, be regarded as a Regional Conference. It will afford an opportunity to pool the experiences of first-hand observers in the south west Pacific during the second world war, with particular reference to Malaya, Hong Kong, Formosa and Japan. It should enable us to compare findings and possibly arrive at conclusions which may assist towards a solution of local nutritional problems.

Apart altogether from the individual's purchasing capacity and the economic resources of governments, it will be agreed that the shortage of shipping is one of the chief limiting factors at the present time. For this reason, and in order to be able to alleviate hunger and suffering in various parts of the world, particularly the Colonial Empire, it is important, I think, that colonial governments should be in possession of the very best possible advice as to the nutritional requirements of the people for whom they are trustees.

The fact that, geographically speaking, the material in the papers to be read this afternoon is derived principally from the sub-tropics and tropics will naturally influence our findings, but the closer approximation between air and body temperatures, the quality and quantity of food available, particularly under blockade conditions, all have some bearing on the issues presenting themselves. Demographically, the groups concerned were prisoners of war and interned civilians, most of them, I think, adult European males in the age groups 20 to 50. It should not prove difficult to produce a body of evidence to support the hypothesis that the nutritional deficiencies in the camps which will be described to you did, indeed, serve as a rough index of conditions in the surrounding territory. It is not possible to draw any very close correlation between one camp and another because of the great differences between them in age, sex and race of the occupants.

In so far as concerns the time period, I think it would be fair to assume that it was covered by the interval of forty-four months from December 1941, when the Japanese launched their attack against the Far Eastern possessions of Great Britain, the United States and Holland, and August 1945, when the Allied Forces brought Japan's domination in the Pacific to an end.

Climate, general hygienic conditions, housing, clothing, water supplies, sanitary, washing and cooking arrangements, recreational and horticultural facilities and compulsory labour all differed in various camps. These differences may possibly account for the difference in incidence of nutritional diseases about which you are to hear.

The influence of Red Cross parcels and of supplies sent in by voluntary welfare agencies or by friends in the surrounding community was appreciable. In Singapore the Red Cross was not permitted to function openly

at any time. On the other hand, in Hong Kong, after an interval of about a year, the Japanese permitted the Red Cross to take over relief work which had been carried out hitherto by a welfare committee. These additions to the rations given by the Japanese, although restricted in quantity and received at very irregular intervals, were indeed well described as "life savers".

Despite underground arrangements for supplying the military camps with nutrients, vitamins, drugs and so on, there can be no doubt to my mind that the civilians were more fortunate and enjoyed a far better dietary than it was possible to enjoy in military camps. The military camps had far fewer contacts amongst the local population and the non-interned neutrals who could send in parcels. The camps for civilians also benefited, in Hong Kong at least, from the fact that they were supervised by the Japanese Foreign Office, whereas the military camps were under the control of ill educated and often brutish soldiery.

The age and sex of the population of the military camps would, other factors being equal, have given rise to lower morbidity and mortality rates, but the reverse was the case in spite of the fact that civilian camps had, of course, a large number of children and elderly people.

There are one or two points on which it has been suggested it might be worth while to dwell. It is thought that it might prove interesting, and would certainly prove profitable, if some efforts were made to relate accounts of syndromes to conditions met with in general medicine. This might help in the elucidation of problems not normally regarded as being connected with nutritional diseases. Perhaps if I give one or two examples of what I mean my point will be clearer.

In a small internment camp on the Kowloon Peninsula to which I was sent after my release from prison and where, for several months, I was the only doctor, a number of cases came under observation suffering from Paterson's syndrome but without koilonychia and occasionally without any obvious hypochromic anaemia, although, as you know, this condition is usually attributed to lack of iron.

Also, Major Harrison, who is the medical specialist at the military hospital, Hong Kong, in a private communication to me, mentioned that he saw a number of cases resembling sub-acute combined degeneration of the cord but without extensor plantar response. I think most neurologists will agree that this sign is invariably present at some stage during the disease. Possibly the distinguished physiologist who is to address us today will be able to tell us whether in any of the cases he encountered in his camp fractional test meals were given or whether, in fatal cases, histological sections of the cord showed involvement of the posterior and lateral columns.

Mention of syndromes in which anaemia is an important feature recalls another problem. What relation does pellagra bear to nutritional macrocytic anaemia which resembles pernicious anaemia, except for the absence of achlorhydria, and presence of Castle's intrinsic factor? The recent discovery of the curative effects of folic acid is likely to revolutionize the treatment of this type of anaemia.

I wonder if anyone here can throw any light on the curious ability which was noticed in Hong Kong of the interned European young women to metabolize rice? Of course, I refer to those who enjoyed normal health

and in whose case there was no question of hypoproteinaemia or thyroid deficiency. With young boys in their teens, on the other hand, the deterioration on the inadequate diet was much more prolonged and serious than in the case of adults or children.

Dr. Smith, who made such an outstanding contribution to the nutritional problem in Hong Kong internment camp, will probably recall the pains we took to try and convince our Japanese captors that Europeans could not live on a rice diet, but had to have a modicum of bread and flour in addition.

What is the nature of the deficiency in patients with amblyopia complicating a frank vitamin B₁ neuropathy when the eye condition failed to react to massive doses of vitamin B₁ but often cleared up when treated with the vitamin B₂ complex? It was not a lack of riboflavin or of nicotinic acid. I mention this condition in order to get one of the members of your Society, of whom I have been a humble disciple for many years, to give us some views on the point. Dr. Stannus described this condition in about 1910 when he was in East Africa. Later a colleague of mine in Nigeria in the early 30's described it and attributed the cure to riboflavin and nicotinic acid (Moore, 1930, 1932, 1939). Incidentally, I notice that Dr. Fitzgerald Moore is here this afternoon, and I hope he will not mind if I mention the fact that he earned the reputation of being the most expensive medical officer in the Service because he treated his patients with one or two oz. of marmite daily, with excellent results.

Some of those affected with this condition showed the rather curious visual hallucination that, when they attempted to read, they saw colours at the violet end of the spectrum. These particular patients recovered very satisfactorily when given a diet including eggs, green leafy vegetables, or yeast grown on soya bean residue but not on sugar or potatoes.

I think it will be generally agreed that many of our preconceived ideas as to powers of adjustment and ability to survive on a sub-standard diet over a long period had to be given up during internment. In spite of this, I am inclined to adhere to my own views in relation to the importance of variety and palatability in a dietary. It is possible that some of you may have read the very interesting experimental study on rationing recently issued by the Medical Research Council (McCance and Widdowson, 1946). It is there maintained that variety and palatability are not necessary provided the dietary is well balanced in nutrients.

In conclusion may I invite those who are taking part in the discussion to suggest some practical measures which can be taken in connexion with the nutritional problems in the Far East as a result of the data placed before you?

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Nutritional Conditions in Army Prison Camps in the Far East

Lieutenant Colonel J. Bennet, R.A.M.C. (Military Hospital, Cowglen, Glasgow)

The policy of dispersal of prisoners of war, adopted by the Japanese, makes difficult in some cases a correlation between the diet and the deficiency states which occurred. Although in certain areas the conditions approximated to those of a controlled experiment in that the quantity, quality and ingredients of the diet were fairly constant over periods of many months, conditions of environmental stress, such as the compulsion to hard labour, other adverse hygienic conditions, and the high incidence of disease due to infection, often inadequately treated, were such that it is difficult to assess the state of health compatible with the diet under more favourable conditions. Appalling conditions of transport by sea contributed largely to a highly complex picture of ill health seen in certain groups on arrival at their destination, and the effects of this were reflected for a considerable time in the lack of well being among those who survived.

On dietary considerations we can subdivide the Far Eastern prisoner of war camps into two groups, southern and northern, the latter including those in Formosa, Japan and Manchuria. This is justified by the fact that in the northern areas rice issued was either unpolished or, if polished, was reinforced with a varying admixture of barley, millet and soya beans. Fresh vegetables were issued in reasonable quantity but were often of poor nutritive quality on account of coarse texture. I shall confine my remarks to conditions arising in association with this diet, taking the diet in Formosa as representative. In Table 1 is shown the standard of diet issued in working camps, and in Table 2 an analysis of its nutritive value, for which I am indebted to Major A. M. Thomson, late D.A.D.M.S., A.M.D.5, the War Office.

Incidence of malaria was high in Formosan camps. Many cases of bacillary dysentery were imported from Malaya but, after subsidence of cases attributed to this source, further cases were not numerous when it is considered that general hygienic conditions, including prevalence of flies, were extremely favourable to the spread of the disease. Prophylactic inoculation of prisoners of war was practised by the Japanese. Great shortage of dressings, coupled with the fact that members of working parties had little time for personal hygiene or for washing and repair of their clothing, led to a heavy incidence of skin lesions, and many forms of pyoderma were prevalent. The chief of these were tropical pemphigus, infected scabies, boils and carbuncles and a low grade inflammation of an erysipelatous nature. Diphtheritic infections of skin lesions were numerous in some camps, and many cases of polyneuritis, mild and severe, occurred.

Nutritional Oedema

In working camps in Formosa nutritional oedema overshadowed and complicated almost every other condition. Factors conducive to its incidence, and the severity of its manifestations, arose mainly from the

harsh standards of fitness for work enforced by the Japanese, and the prevalence of diarrhoea. It occurred, however, independently of these factors, its onset being determined in some cases by febrile illness. Some fairly severe cases followed closely upon an attack of acute gastritis. A few originated apparently spontaneously. A localized form was frequently excessive and persistent following infection, burns and insect bites. Severe febrile illnesses were occasionally complicated in oedematous cases by rapid extension of the oedema; this was confined to the legs as long as the subject was up and about, but spread to dependent portions of the trunk, the face and hands and, terminally, the lungs, when he was prone.

For a period of three to four months after a change in policy by the Japanese, an opportunity arose to observe the progress of cases of oedema under conditions of a diet restricted to the amounts, for an officer, of rice and vegetables shown in Table 2. The group was relieved of work. The cases did not deteriorate; the tendency was rather the reverse, and an outbreak of moderately severe influenza produced few fresh cases.

In some camps the prevailing oedema was classified as beriberi, but this diagnosis disregarded the outstanding features of its soft, pitting character, and its distribution determined by posture. I do not propose to discuss this matter further, except to say that the incidence of neuritis in the latter years of captivity fostered the view of a vitamin B₁ deficiency. This condition, however, bore features very different from those seen as an integral part of the picture of beriberi. There was much spontaneous pain in the form of severe aching in the bones and joints, and cramping sensations in the feet. The nerve cords were often thickened and tender. The condition was frequently precipitated by an attack of malaria and seemed to indicate an enhanced vulnerability of the peripheral nerves. The recognition of this neuritis of infective or mixed origin is important as it assists in the proper delimitation of the symptoms of beriberi and burning feet.

Diarrhoea

The simplest explanation of the diarrhoea which so greatly undermined health was that it was due primarily to mechanical irritation of the stomach by the excess of cellulose in the poor quality vegetables supplied and by the unpolished rice the pellicle of which was difficult to masticate if the rice was served dry. A deep elemental fear of starvation caused the prisoner of war to disregard his condition and eat at all costs. As a rule his appetite was little impaired, but the prevalence of gastric irritation was reflected in the number of cases of acute gastro-enteritis which followed the infrequent opportunities to partake freely of sapid food.

It seemed unlikely that a nutritional deficiency entered primarily into the cause of the diarrhoea. Nicotinic acid was present in the food in moderate amount and, in some camps, medicinal yeast was on sale in the canteens and regularly consumed. In some relapse cases of diarrhoea, however, with a previous history of features pointing to gastric irritation, or infection, a picture suggestive of sprue presented with early changes in the tongue. In others the emergence of these factors was not preceded by any intermission of symptoms. A definite interrelationship between diarrhoea, changes in the tongue and oedema could not be established in

TABLE 1
 RATIONS ISSUED IN NO. 1 PRISONER OF WAR CAMP, TAIWAN
 (g. per man daily)

Year and month	Strength		Rice*	Barley	Flour	Rice flour	Veget-ables†	Meat	Fish	Dried fish	Oil	Beans	Bean paste	Bean sauce	Salt	Sugar	Tea	
	Fit	Sick																
1943 (mean)	360	160	410	135	—	—	217	0.09	—	4.8	0.6	1.3	4.16	1.5	8.2	3.85	0.4	
1944																		
1	710	75	625	40	9.2	13.2	217	17.2	1.1	12	1.8	9.0	21.6	16.3	20.0	18.0	0.34	
2	706	76	645	—	5.8	26.4		14.4	1.3	8.8	4.9	17.6	16.3	16.3	10.5	23.2	11.0	0.37
3	702	80	645	—	9.0	22.6		9.4	1.25	0.02	3.7	3.7	19.0	21.5	14.8	15.6	11.0	0.42
4	699	82	650	—	11.2	43.0		26.8	3.2	3.2	2.1	4.2	17.8	24.0	11.2	14.0	9.5	0.68
5	698	82	650	—	7.7	49.0		32.2	—	—	2.7	4.5	10.0	20.2	16.6	18.3	11.3	0.40
6	682	96	690	—	7.6	47.5		24.0	0.08	0.08	1.9	0.78	11.1	27.0	17.5	17.2	10.5	0.11
7	663	113	600	—	13.7	98.0		12.2	—	—	2.4	0.76	9.4	24.6	15.0	12.1	8.7	0.05
8	639	123	600	—	10.2	50.5		25.7	0.04	0.04	0.84	2.27	9.3	22.7	15.6	15.5	9.4	0.06
9	632	133	575	—	7.6	77.5		22.6	—	—	0.4	1.52	9.2	21.9	13.3	16.3	9.0	0.04
10	596	153	585	—	3.5	25.5		4.25	1.27	—	—	2.7	3.6	25.3	13.0	12.5	9.6	0.195
11	546	163	585	—	2.9	54.0		32.1	—	—	0.22	2.45	—	15.2	13.0	15.0	10.2	0.14
12	507	185	590	—	3.0	55.0		37.9	1.57	1.57	2.2	3.32	1.8	17.9	12.1	22.7	13.9	0.19

* Latterly fixed at 718 g. for a fit man; 350 g. for a sick man; 390 g. for officers.

† Vegetables included cabbage, onions, yams, pumpkin, *makuma*, *brinjol*, bamboo, marrow, cucumber, potatoes, *taikon*, *gobi* and tomatoes.

TABLE 2
AVERAGE NUTRITIVE VALUE PER HEAD DAILY (RAW FOOD) OF RATIONS IN NO. 1 PRISONER OF WAR CAMP, TAIWAN

Year and month	Calories	Protein g.	Animal protein g.	Carbohydrate g.	Fat g.	Calcium g.	Iron mg.	NaCl g.	Vitamin A I.U.	Vitamin B ₁ mg.	Riboflavin mg.	Nicotinic acid mg.	Ascorbic acid mg.
1943 (mean)	1938	42.9	0.5	437.3	5.2	0.12	14.5	8.78	405	1.12	0.34	11.5	24
1944													
1	2698	61.9	2.5	574.6	14.1	0.20	22.5	20.89	427	1.75	0.51	15.0	24
2	2665	61.3	1.9	566.1	16.4	0.20	23.2	24.03	430	1.76	0.51	14.4	24
3	2670	61.8	0.8	566.8	14.8	0.21	23.6	16.30	435	1.78	0.51	14.6	24
4	2813	66.4	2.5	585.3	20.1	0.22	24.4	14.76	437	1.91	0.55	15.2	24
5	2801	63.2	2.6	585.5	20.5	0.20	23.4	19.07	427	1.84	0.54	15.6	24
6	3001	66.4	2.0	616.0	15.3	0.22	25.1	18.00	432	1.91	0.56	16.2	24
7	2733	63.2	1.2	587.2	11.7	0.20	22.7	12.86	430	1.71	0.51	14.1	24
8	2608	59.6	1.9	549.6	16.4	0.19	22.1	16.17	428	1.73	0.51	14.2	24
9	2595	60.3	1.7	539.0	15.7	0.21	23.2	16.96	432	1.71	0.51	14.4	24
10	2363	53.3	0.3	508.5	10.3	0.18	21.1	13.10	425	1.52	0.45	12.7	24
11	2482	53.0	2.3	526.7	15.4	0.15	22.3	15.65	412	1.56	0.47	13.8	24
12	2565	55.9	3.1	538.3	18.6	0.17	20.8	23.40	418	1.65	0.49	14.4	24
1944.12													
Fit man	3025	64.9	3.1	639.3	19.0	0.18	24.5	23.52	418	1.91	0.56	16.6	24
Sick man	1733	39.1	3.1	349.3	17.7	0.14	14.0	23.20	418	1.18	0.37	10.2	24
Officer	1771	41.9	3.1	380.3	17.9	0.14	15.2	23.23	418	1.26	0.39	10.9	24

Notes on analysis

- All values calculated on a raw food basis less average allowance for wastage.
- Values for all foodstuffs except soya bean taken from *Field Service Hygiene Notes, India* (Anonymous, 1945). Soya bean values from tables of the nutritive value of foodstuffs (War Office, 1945).
- Rice taken as undermilled rice.
Flour taken as white flour, similar to Indian millings.
Rice flour calculated as polished rice.
Meat calculated as pork, including bone.
Fish, fresh assumed to be cleaned, but not filleted; dried, calculated as smoked haddock.
Vegetables average daily intake per head assumed to be 8 oz.
Soya bean, bean paste, amounts added together and the result analyzed as dry soya bean.
Bean sauce omitted from the calculation, no values being available; mineral values might be thereby affected.

the mild to moderately severe oedematous cases. Uncontrolled diarrhoea ascribed to gastric irritation tended to produce emaciation, without deficiency signs in the tongue if the patient was rested, but caused oedema and emaciation with occasional signs of mild glossitis if he had to continue to work. Changes in the tongue were infrequent in association with oedema apparently conditioned by other factors or arising spontaneously. In severe and persistent cases of oedema both diarrhoea and tongue changes were often also present. The diarrhoea in these cases was often intermittent, occurring as explosive evacuations in the early morning, painless and self-limited, and heralded by hypogastric, flatulent discomfort. Some remission of the oedema temporarily followed such outbursts.

The Sprue Syndrome

The complete picture of the syndrome of sprue was a rarity. I personally saw in Formosa only one case which warranted the diagnosis on all counts except the features of the stool due, in more favourable nutritional circumstances, to the ingestion of fat which was practically absent in the diet when the case came under observation. Severe emaciation was the main feature which called for placing the case in a category of its own. There had been several attacks of inadequately treated malaria during the period of evolution of the disease. In the younger individuals suffering from diarrhoea with sprue-like features and early changes in the tongue, a reasonable state of health could be maintained by strict attention to matters of dietetic hygiene and by giving a diet within the resources of the camp, supplemented with more of the yeast preparations or with the Red Cross mixed vitamin preparations. In the older members of the group cases of severe asthenia and hypotension were occasionally seen with or without changes in the tongue.

State of the Skin

The skin of the inmates of the camp tended to be dry and to scale easily on exposed parts. On the body the shining, tanned skin of many outdoor workers was healthy. In a personal communication Capt. J. A. Glover has described how patients returning to work after treatment indoors often developed a dark brown, almost black, pigmentation of the scrotum, margins of the axillae and groins, rough and lustreless in contrast with the smooth light brown skin of their healthier comrades. Occasionally, after a severe illness, a sequence of changes was observed like those seen in the development of a pellagrous dermatitis. Such cases were few and cleared up as health was regained. I treated a case of blackwater fever in which, during convalescence, severe oedema developed, followed by a typical pellagrous rash on the dorsum of the feet. The same individual at a later date, when mild oral manifestations of riboflavin deficiency were prevalent, showed the only magenta tongue I have ever seen. Thin, atrophied pigmented skin was occasionally seen on the legs of men with long standing oedema who were able to take outdoor exercise.

The scrotal dermatitis and angular stomatitis with which many left Singapore almost entirely disappeared in Formosa; the former especially was very rarely seen. Occasionally mild oral manifestations of riboflavin deficiency were seen. This occurred in a group of senior officers when extra rice was issued on account of work being done. Otherwise,

manifestations of this syndrome were confined to individuals in whom some conditioning factor was present, such as the occurrence of *herpes labialis* in association with malaria.

Burning Feet

Symptoms of burning feet contracted in the southern areas persisted for some time after arrival in the north. In a group I examined, symptoms had started on board ship and disappeared about a month after arrival in Formosa. More severe manifestations were reported from Japan and Manchuria, but the tendency seems to have been for the condition to disappear.

Ocular Manifestations

Disturbances of vision attributable to retrobulbar neuropathy were commonly encountered in Formosa during the earlier months of 1943. I saw a few in a senior officers' camp at a time when labour was enforced and the diet limited to rice and vegetables as shown under the scale for officers in Table 2. Oedema was prevalent but was not seen in association with these cases. They became apparently normal with the advent of rest from work and arrival of Red Cross stores. Captain Lewis, R.A.M.C., informed me that the diet in working camps in Formosa deteriorated during 1945 to a daily scale of 380 g. of unpolished rice, some cabbage and such other edible green leaves as could be found. The incidence of nutritional oedema rose but no cases of retrobulbar neuropathy were seen. It is a matter of some interest that such mild cases as occurred in Formosa were reported at about the same time as that at which incidence was at its maximum in Singapore and Hong Kong. I did not see any of the other ocular manifestations of deficiency disease in Formosa.

Only one case of severe macrocytic anaemia came under my observation. Even in the apparently fit, blood blisters about the size of a small cherry were not infrequently seen in the mouth, often on the mucosa of the infero-lateral surface of the tongue.

As to the standards of health compatible with the diet provided, the impression was formed that, in the absence of the conditioning factors mentioned, a reasonable state might have been maintained. It was significant that the features I have discussed were rarely seen in groups of men who were rested. They did not occur, for example, in a number of cases of pulmonary tuberculosis or in suspects of this condition of whom I had charge. Satisfactory recovery within the normal time for such cases, on the camp diet reinforced by yeast preparations, was observed in cases of diphtheritic polyneuritis, some of them severe. My own personal observations were made in an officers' camp where conditions were better than in the men's working camps though the caloric value of the ration was less; no cases of the degree of severity manifest as ascites, and effusions into other serous membranes, occurred among them, but the men's working camps in Formosa contributed their quota of bloated, bladder-like individuals, and living skeletons to the list of deaths from captivity.

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Nutritional Conditions and Diseases in the Civilian Internment Camp, Hong Kong

Dr. D. A. Smith (Government Medical Department, Hong Kong)

In the civilian camp in Hong Kong a considerable variety of nutritional diseases was seen. It is clearly impossible in a short time to describe them all in detail. In this brief paper emphasis will be laid on the incidence of the main nutritional diseases in relation to dietary deficiency and on the results of such measures of treatment and prevention as it was possible to apply, rather than on detailed descriptions of the various clinical syndromes.

Little need be said by way of introduction except that the population did not vary widely from a total of 2500, of whom about 1300 were men, 900 women, and 300 children under 16 years. All age groups up to the eighties were represented. As may be imagined, laboratory investigations were impossible and many elementary necessities for treatment were absent or very scarce.

The Diet

The staple diet was rice. That supplied was highly milled, "white" rice of poor quality of which most samples were heavily infested with weevils and so grossly dirty as to necessitate washing. The inevitable but unmeasurable loss by insect infestation and removal of gross dirt and foreign bodies makes it probable that the food values calculated for the rations are over- rather than under-estimated. Water-buffalo beef was included in the rations in 1942, and was replaced by small quantities of fresh fish in 1943 but, in the last two years, the only animal food was salt dried fish which was supplied about every other month. Edible oil, mostly groundnut, in quantities varying between $\frac{1}{8}$ and $\frac{2}{3}$ oz., and $\frac{1}{4}$ to $\frac{1}{2}$ oz. salt were regular issues, the remainder of the rations being made up of vegetables, coarse greens, Chinese cabbage, water spinach, chrysanthemum and sweet potato tops, gourds and relatively small amounts of sweet potatoes, yam and taro in season. Table 1 shows the

TABLE 1
YEARLY AVERAGES OF THE NUTRITIVE VALUE OF THE DAILY RATIONS PER HEAD

Dietary constituent	1942	1943	1944	1945
Calories* ..	1689	1596	1566	1679
Protein g. ..	50.4	45.1	37.5	37.1
Fat ..	30.5	20.2	22.7	21.7
Carbohydrate ..	304.5	298.4	300.6	333.2
Carotene I.U. ..	10,307	10,347	6910	5998
Vitamin B ₁ mg. ..	0.48	0.40	0.30	0.33
Riboflavin ..	0.71	0.78	0.68	0.61
Nicotinic acid ..	9.0	8.9	8.0	6.9
Vitamin C ..	55.5	73.0	64.0	63.0
Calcium g. ..	0.237	0.257	0.317	0.335
Phosphorus ..	0.527	0.512	0.576	0.577
Iron ..	0.0118	0.0127	0.0115	0.0108

* The Calories per person per day ranged from a low level of 1180 in Jan. 1942 to one of 1986 in July 1942.

value of these rations calculated from the Tables of Platt (1945), Sherman (1937), Read, Lee and Cheng (1937), and Fixsen and Roscoe (1940), from which it will be seen that they were deficient in all factors except carotene, vitamin C and iron.

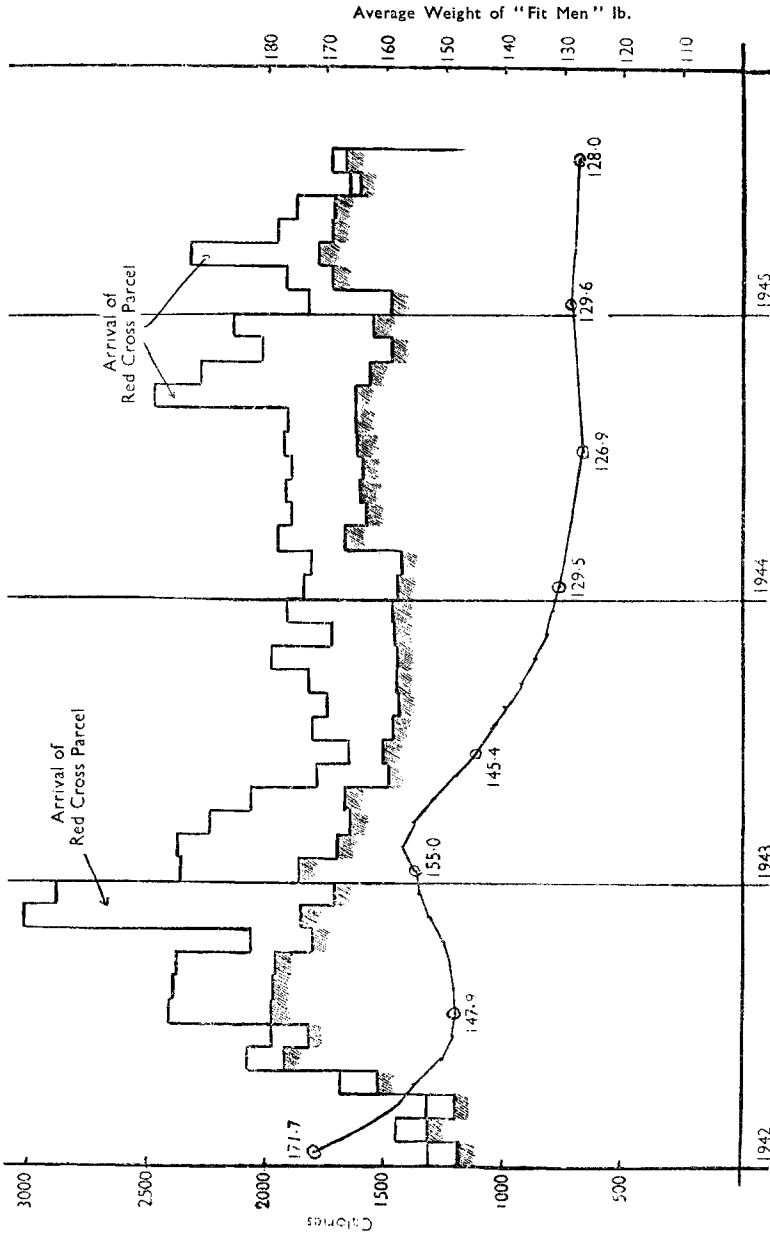


FIGURE I.
 THE RELATION OF CALORIE INTAKE TO BODYWEIGHT.
 Total Calories are indicated by a plain line; those received from rations by a shaded line; bodyweight by a plain line with circles.

Food, however, was fortunately obtained at times from other sources, the main ones being (a) the local Red Cross Organization, through which supplies of soya beans, wheat bran and rice polishings reached the camp in the last two years, (b) International Red Cross comfort parcels, of which the Japanese permitted delivery on three occasions, and (c) produce of camp gardens, which was only of significant amount in the last year of internment. Figure 1 shows the value of the rations in each month and the contribution of these other sources of food, in terms of Calories per person per day.

The first and most obvious evidence of under-nourishment was loss of bodyweight, the average weight of men consuming the rations being shown also in Figure 1. This curve was made by taking the average weights of 100 men, a stratified sample as regards age groups but selected at random within the age groups, who weighed themselves monthly for this purpose. In addition, weight surveys of all men were done every six months. The rapid fall in the first six months and the response to the improved diet in the winter of 1942-43 are striking. The lowest average weight attained in July 1944, represents a loss of 26.1 per cent. of pre-war weight. Adjustment to new circumstances and the establishment of equilibrium at a lower metabolic level are well indicated. The smallest changes were shown in the age-groups 25 to 29 and 30 to 34 years, falls being progressively greater in the higher age groups, the over 65 age group having, for instance, an average weight of 114.5 lb. in August 1945, as against an overall average of 128 lb.

With this fall in weight were associated hypotension, 100 unselected men in June 1942 showing an average blood pressure of 95/68 mm. Hg., bradycardia, and a number of subjective symptoms including weakness, undue fatigability, fainting, dizzy spells and a generally poor vasomotor response to change of posture. Amenorrhoea was present in 58 per cent. of women between 15 and 45 years of age with normal menstrual histories.

Deficiency Diseases

Beriberi

The first specific vitamin deficiency to make its appearance was subacute wet beriberi, of which the first case was seen on March 18th 1942, 87 days after the Japanese occupation (*cf.* Fraser and Stanton, 1909). There was nothing unusual about the clinical picture of these cases, in which there was oedema with neurological manifestations, except that serious cardiac involvement was not common. The onset followed acute bacillary dysentery in 55 per cent. of the dysentery cases (*cf.* Najjar and Holt, 1943).

The incidence of beriberi rose steeply as is shown in Figure 2 and, since crystalline vitamin B₁ had been brought into camp with us, and was available at that time, an attempt was made to stop the outbreak by general administration of a prophylactic dose. No response in five weeks followed a dose of 10 mg. once a week, but the administration of 3 mg. every other day to the entire population was rapidly followed by a fall in incidence and no further new cases were seen while the supplies allowed this dosage to be maintained.

The response of established cases of this type of beriberi to treatment with synthetic vitamin B₁ was uniformly satisfactory. At first a most

extravagant oral dosage of 10 mg. daily was used, and the average time for cure was 2.6 weeks; subsequently a dose of 5 to 10 mg. was given by intramuscular injection daily, and cure was achieved in an average of 10 days with a considerable saving of material.

Coincident with this first outbreak of wet beriberi there occurred a number of other cases of oedema, which showed no neurological manifestations and which did not respond to treatment with vitamin B₁. There were 338 such cases during the summer months of 1942; we considered

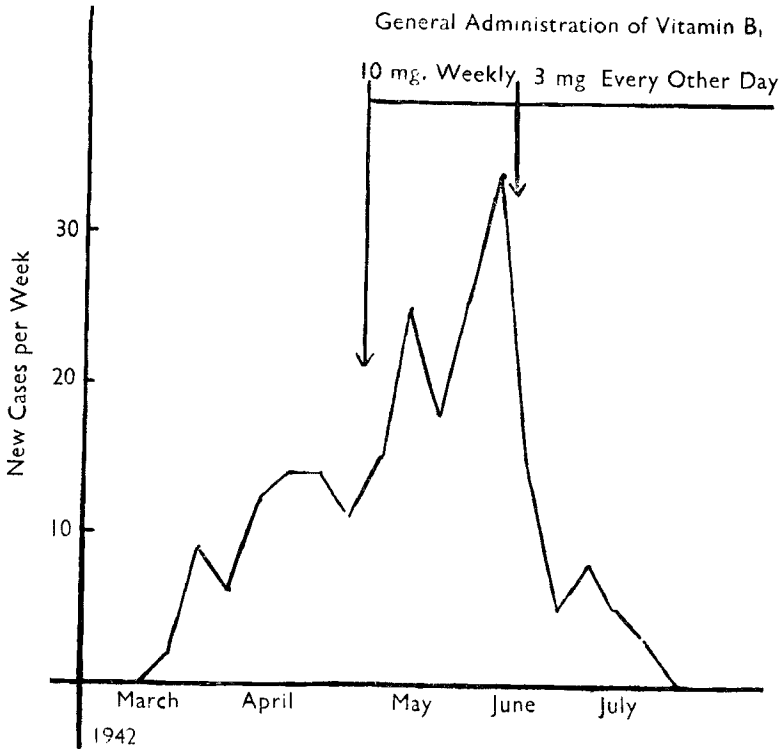


FIGURE 2.
INCIDENCE OF OEDEMATOUS BERIBERI.

them at the time to be cases of famine oedema, though we had no means of estimating their plasma protein. Of these 338, 120 were given a dietary addition of 4 oz. bully beef daily, and all showed great improvement or complete recovery within a week; there was not sufficient beef to treat more.

In 1943, the regular general administration of vitamin B₁ had to be discontinued owing to shortage of supplies, and cases of wet beriberi reappeared. In all there were 844. Figure 3 shows their incidence plotted against the vitamin B₁ : carbohydrate ratio, and a fairly clear negative correlation is discernible. From 1943 onwards the ratio was not the same for the whole population, heavy manual workers receiving a

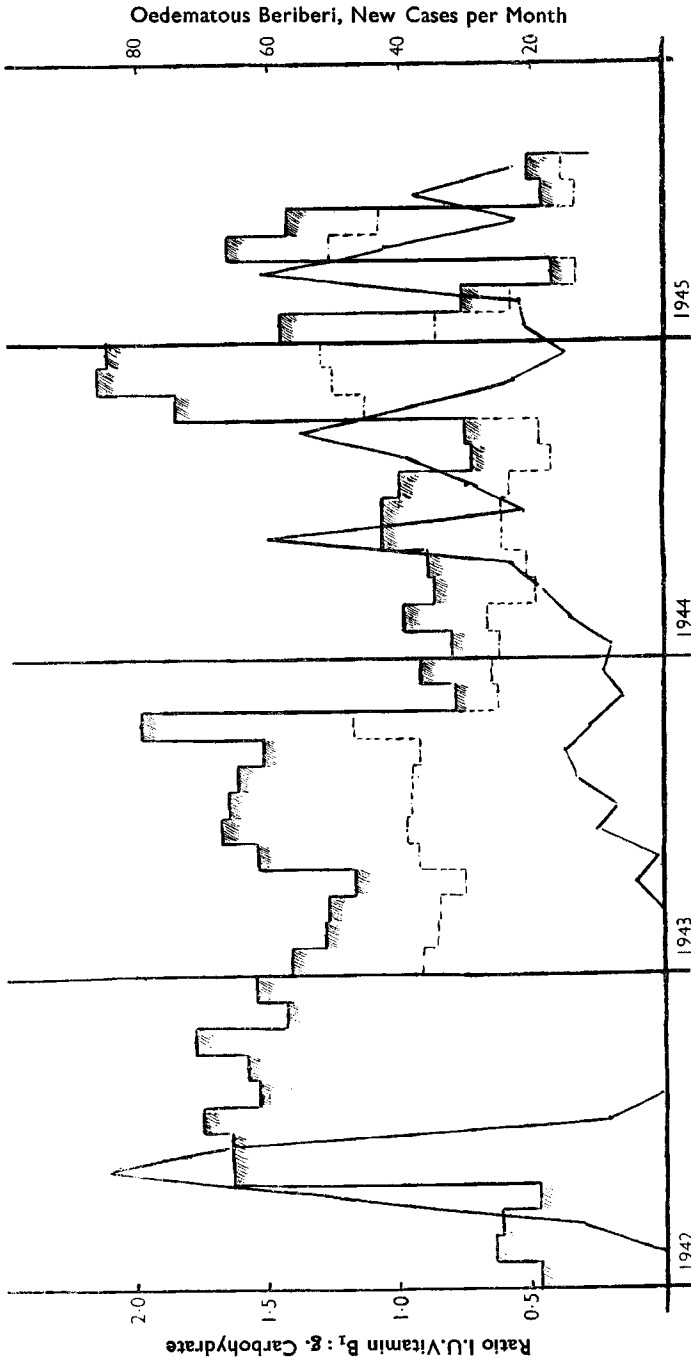


FIGURE 3.
RELATION BETWEEN THE RATIO OF VITAMIN B₁ INTAKE (I.U.) TO CARBOHYDRATE INTAKE (g.) AND THE INCIDENCE OF OEDEMATOUS BERIBERI.

The shaded line indicates the basic ration; the dotted line, the incidence of beriberi.

ration supplement. This supplement was mostly rice and, without additional vitamin B₁, lowered the ratio considerably below that of the general community. During 1943 more than two-thirds of the cases of beriberi occurred in this group.

On two further occasions it was possible to carry out general prophylaxis, from October to December 1944 and in March and April 1945, and on both occasions there was a satisfactory fall in incidence.

On the basis of these findings, represented in Figure 3, it is even possible to suggest quantitative relationships, applicable to this type of population and diet pattern. When the ratio of vitamin B₁ to carbohydrate was 0.56 I.U. per g. carbohydrate (0.42 mg. per 1000 carbohydrate Calories) or less, there was a rapid and increasing incidence of cases of wet beriberi. On the other hand, when the ratio rose above 0.9 to 1.0 I.U. per g. carbohydrate (0.7 mg. per 1000 carbohydrate Calories) the incidence fell steeply and no new cases occurred. For these circumstances the true minimum requirement must lie between these two figures. Its value has been placed as high as 0.6 mg. per 1000 total Calories by Williams, Mason and Wilder (1943) and as low as 0.23 mg. per 1000 total Calories by Keys, Henschel, Mickelsen and Brozek (1943). These different estimates of the vitamin requirement may be accounted for by differences in age, sex and race of the experimental subjects, in duration of the experiment, in level of total calorie intake, and, above all, by individual differences in the extent of biosynthesis by the bacterial flora of the intestine. Until quantitative data concerning the latter phenomenon are available, complete interpretation of vitamin requirements is impossible.

In describing the incidence of wet beriberi in relation to season it has often been said to be highest when the average temperature is rising. Figure 4 shows the incidence, plotted against mean effective and dry bulb temperature. If the periods are discounted during which outside factors were at work, in particular our attempts at general prophylaxis, it must be admitted that the incidence showed minima when the temperature was lowest and rose each year during the spring and early summer months.

In contrast with wet beriberi, cases of what is regarded among the Chinese as typical chronic dry beriberi were very few, only six in number. They were characterized by flaccid paraplegia with wasting, anaesthesia and absence of reflexes, and responded slowly to vitamin B₁ therapy.

Burning Feet

In July 1942 there appeared the first of over seven hundred cases of polyneuropathy in which pain and sensory disturbances, particularly connected with temperature, predominated to such an extent that the syndrome earned the title of "electric feet" or "burning feet". The recent vivid description by Jackson (1946) applies entirely to our cases except in one important feature. In no case, in spite of intolerable sensations of burning or freezing, could we ever find evidence of actual change in skin temperature or of vascular or vasomotor change. The incidence of these cases is shown in Figure 4 and, even if there was a considerable lag in the effect, it is not easy to correlate it with the intake of vitamin B₁.

The response of these "sensory neuropathy" cases to treatment with vitamin B₁ was also disappointing. Only 17 per cent. of cases were cured

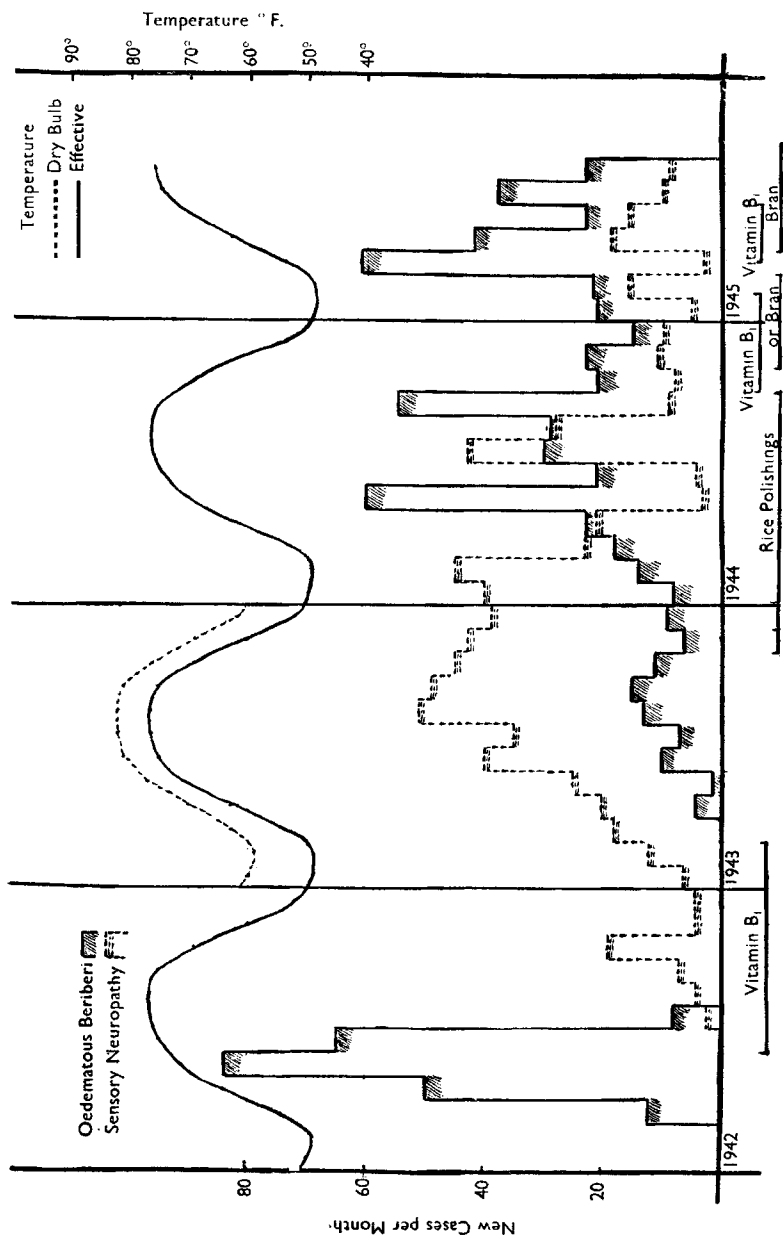


FIGURE 4.
 RELATION BETWEEN EFFECTIVE TEMPERATURE AND THE INCIDENCE OF OEDEMATOUS BERIBERI AND OF SENSORY NEUROPATHY.

by daily injections for one month, and 55 per cent. of cases showed no improvement whatever after three months. A number of cases actually received daily, and at times twice daily, treatment with injections of vitamin B₁ by every possible route, including even the intrathecal, in

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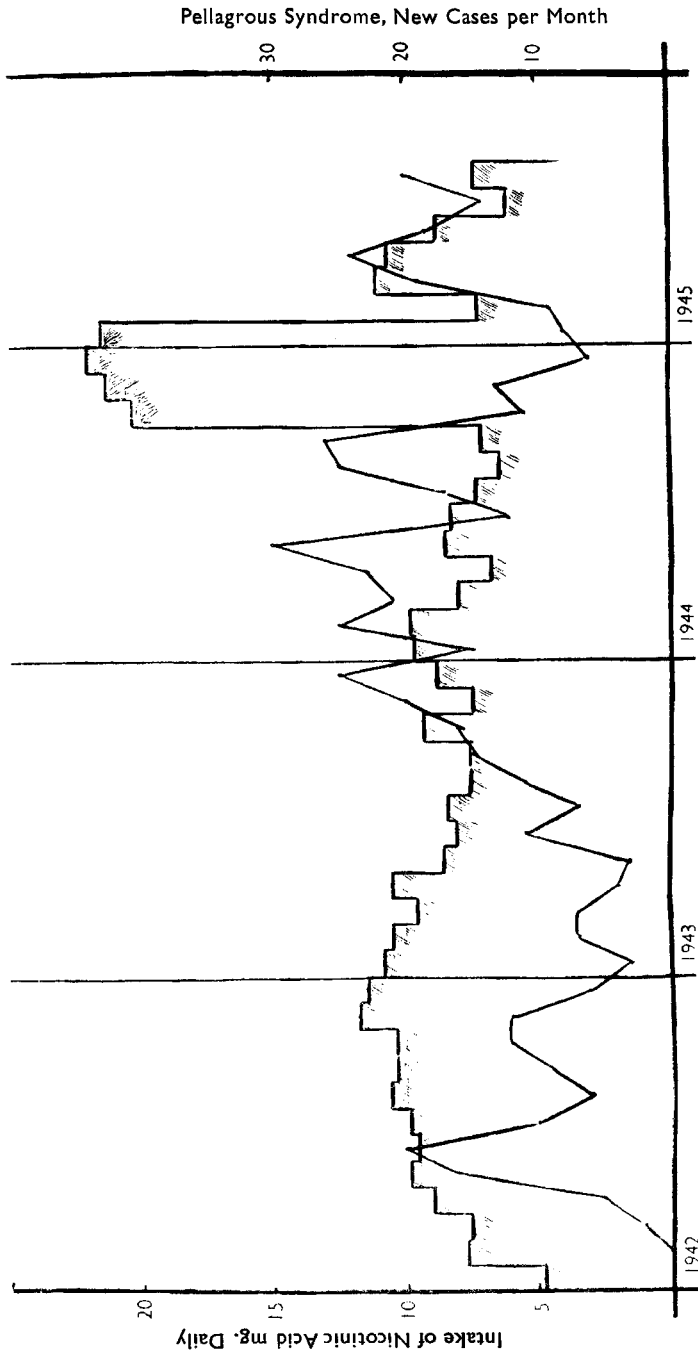


FIGURE 5.
RELATION BETWEEN THE INTAKE OF NICOTINIC ACID AND THE INCIDENCE OF PELLAGROUS SYNDROME.
Shaded line, nicotinic acid intake; plain line, pellagrous cases per month.

doses varying from 2 to 200 mg., for a period of a year without improvement. In January 1944 supplies of vitamin B₁ were so low that treatment of this group of men had to be stopped but, in the following few months, it was possible to supplement their diet with beans, wheat bran and rice polishings; in all but three cases there was a slow but steady improvement, to such an extent that heavy labour was possible for all of them within six to eight months, by which time they were free of symptoms, though areas of anaesthesia and diminished reflexes could be detected for at least another year.

The supply of bran and rice polishings which made this treatment possible was sufficient also for a general small issue of $\frac{1}{4}$ to $\frac{3}{4}$ oz. daily, which was maintained with few intervals for the remainder of internment. I think it is possible to say that the incidence of this condition showed at least a tendency to decline during the period of this dietary addition.

Pellagrous Syndrome

Manifestations of deficiency of other factors of the vitamin B complex were numerous, the first to arise being pellagrous in character. The lesions were fairly characteristic except that, possibly because of the high atmospheric humidity, the typical skin condition was much less common than the fiery red glossitis and the buccal ulceration. These shallow buccal ulcers which rapidly showed heavy secondary infection were seen in some cases also in the pharynx and nose, and spread even to the larynx. Blood blisters under the buccal mucosa were common and appeared, from their incidence and response to treatment, to be of pellagrous origin. There were five mental cases. The so-called oro-genital syndrome, ascribed to riboflavin deficiency, and characterized mainly by cheilosis, angular stomatitis, a large, pale, indented tongue, maceration of the buccal mucosa and genital dermatitis, followed a few months later and subsequently, in the vast majority of cases, was co-existent with the nicotinic acid deficiency. It was possible in most cases to say which was predominant but in considering Figures 5 and 6, it must be remembered that most were cases of mixed deficiencies. The test of Beckh, Ellinger and Spies (1937) for porphyrin-like substances in the urine in the pellagroid cases was of value in differentiation and in determining whether nicotinic acid was likely to be effective in treatment.

Figure 5 shows the incidence of the predominantly pellagrous cases, of which there were in all 557, plotted against the nicotinic acid content of the rations. Some degree of negative correlation is discernible, especially during 1943 and after the intake was greatly augmented by the vitamin capsules which arrived in the first consignment of Red Cross supplies and were sufficient for general administration for the last three months of 1944. When nicotinic acid was used for treatment, it produced dramatic results in the dermatitis cases but was slower in its effect upon mouth lesions. Local treatment was necessary for buccal ulcers when there was heavy secondary infection.

Riboflavin Deficiency

The correlation between riboflavin intake and the incidence of the oro-genital syndrome was not so apparent (Figure 6), the only indication

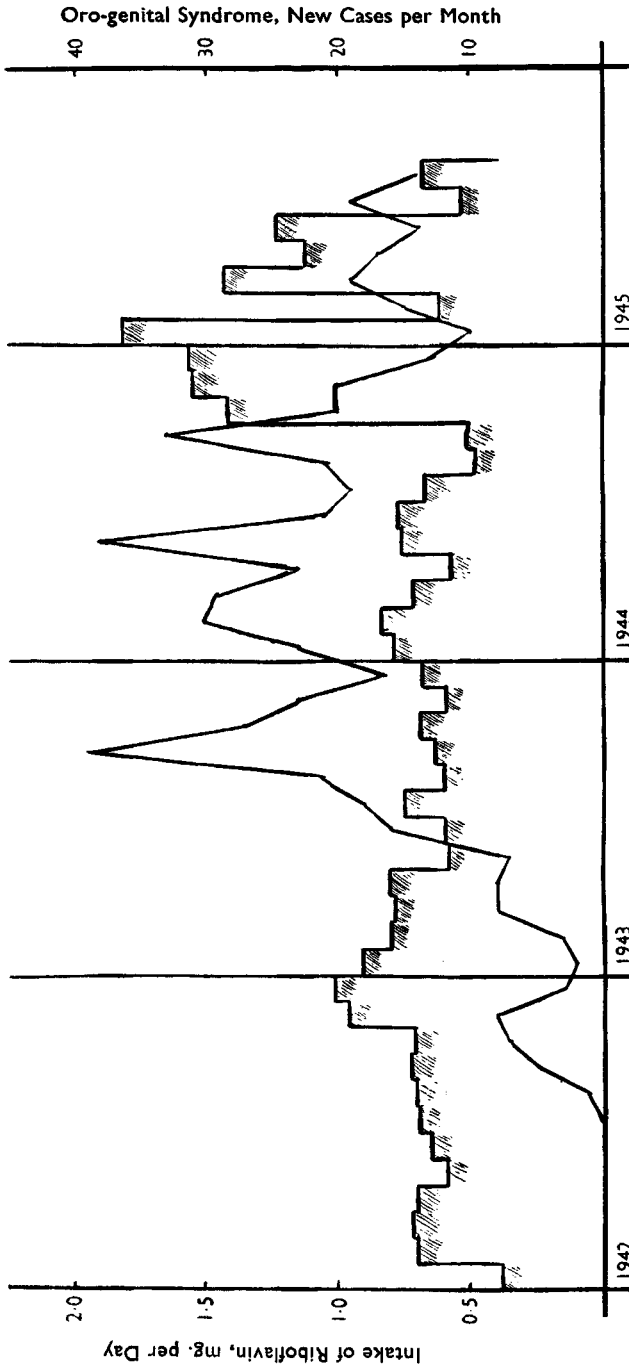


FIGURE 6.
RELATION BETWEEN THE INTAKE OF RIBOFLAVIN AND THE INCIDENCE OF THE ORO-GENITAL SYNDROME.
Shaded line, riboflavin intake; plain line, oro-genital cases per month.

of a connexion being a generally downward trend in the occurrence of the syndrome from October 1944 onwards, coincident with the increased intake of riboflavin at that time. No pure riboflavin was available in the camp, but most of these cases responded, though rather slowly, to the yeast which was grown in camp on a medium of mildewed, scalded flour, sugar, and soya bean residue. In fact, a number of patients relapsed so rapidly and regularly when yeast was discontinued that they had to be maintained on a small dose the whole time. For more than a year attempts were made to brew enough yeast for a daily dose for everybody, but the lack of material and containers, and the difficulty of preventing exuberant overgrowth by airborne, gas-forming organisms made the product therapeutically ineffective and the effort was eventually abandoned.

Macrocytic Anaemia

A condition, apparently due to deficiency of the vitamin B complex (see Spies, Vilter, Koch and Caldwell, 1945), which caused great anxiety, was tropical macrocytic anaemia of which there were 55 cases, 10 in pregnant women. Treatment was exceedingly difficult as there was very little liver and no such powerful yeast concentrate as marmite; our own yeast was not potent enough to be effective and there was a case mortality of over 20 per cent. The pregnant patients made apparently sustained recoveries after delivery or termination of pregnancy.

Nutritional Retrobulbar Neuropathy

The first case of amblyopia or nutritional retrobulbar neuropathy was noted by Dr. Hargreaves, the camp ophthalmologist, in October 1942 and there were in all 370 cases, arising in two distinct waves (Figure 7).

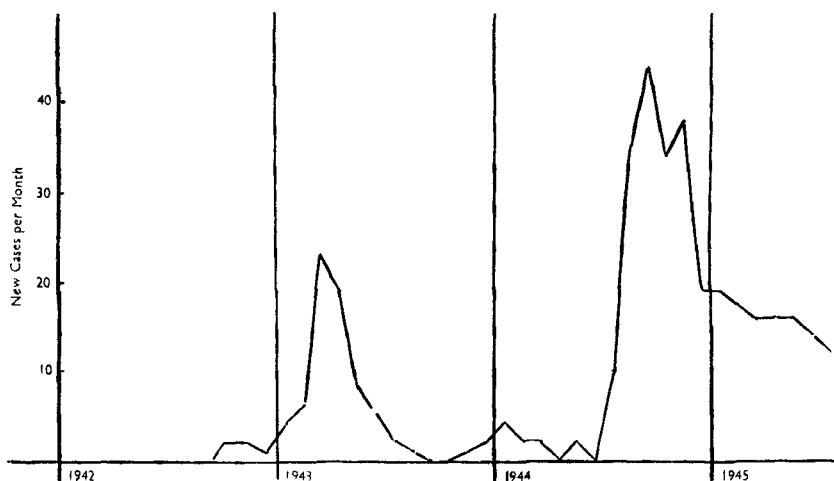


FIGURE 7.
INCIDENCE OF RETROBULBAR NEUROPATHY.

It is most difficult to show any correlation between the curve of incidence of the disease and any nutritional factor, the dietary intake of which can be calculated. Investigation eliminated all extrinsic toxic factors that could be thought of; for instance, the resemblance to tobacco amblyopia was immediately recognized, but more than 20 patients in the first group had never smoked. The condition occurred proportionally in all age groups and both sexes, though there were only 3 cases in children under 10 years. The clinical appearances were similar to those described occasionally before (Moore, 1930; Landor and Pallister, 1935; Wilkinson and King, 1944) and several times since, the presenting symptoms being diminution of visual acuity, disorders of perception, and either bulbar or retrobulbar pain in 54 per cent. of those affected. Consciousness of a "blind spot" was a spontaneous complaint in 6.5 per cent. of the patients. Vision of 6/60 or less was found only in 22 patients. Examination revealed a central or paracentral scotoma, constriction of the fields to colour discrimination in most early cases, degenerative colour changes round the macula in about 10 per cent., and definite optic atrophy in only 1 per cent., though temporal pallor of rather doubtful significance was seen in about 25 per cent.

Everything available was tried for treatment without success. Vitamins A and B₁ and nicotinic acid in large doses over long periods were without effect, except that nicotinic acid relieved headache in some cases, but as it was found to do so also in several cases of migraine this was not thought to be significant. Full dosage of yeast with dietary supplements of beans and groundnuts seemed to prevent deterioration in 50 patients who were thus treated for several months, but none showed more than slight and transient improvement. Of 15 individuals who were treated with large doses of vitamin capsules, containing riboflavin, panthothenic acid and pyridoxin, on their arrival in 1944, all but one showed improvement after a month's treatment, but the possibility must be seriously considered that this improvement was psychogenic, since it was the first time for many months that anything could really be done for them.

Several other nutritional diseases occurred, including some fairly definite examples of vitamin A deficiency, and a purpuric condition which did not respond to ascorbic acid and may have been due to lack of vitamin P, but these must be left undescribed.

In conclusion, two photographs are reproduced in Figures 8 and 9. They are typical of the prisoners' condition. The first shows a group of fairly mild cases of wet beriberi; the prevalence of skin sepsis, and the scars of ulcers are noteworthy. The other shows the degree of moderate emaciation which was present in 1945, and the amount of wasting of the calf muscles which can be obscured by even the amount of oedema present in these patients. The abdominal distension and kyphosis in the patient on the right are noteworthy also.

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FIGURE 8.
MILD SUBACUTE WET BERIBERI WITH OEDEMA OF THE ANKLES AND FACE. CIVILIAN
INTERMENT CAMP, HON KONG, AUGUST 1945.

Note the prevalence of cutaneous sepsis and the scars of ulcers on the legs.

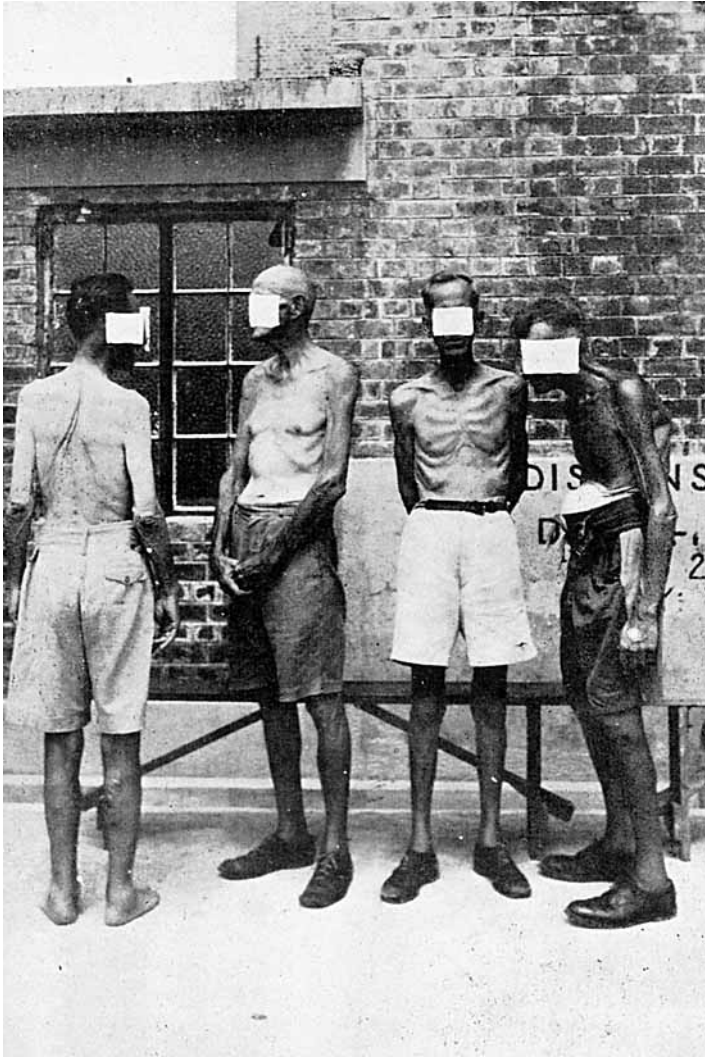


FIGURE 9.
NUTRITIONAL NEUROPATHY. CIVILIAN INTERNMENT CAMP, HONG KONG,
AUGUST 1945.

Note the moderate emaciation which was general at that time, the wasting of calf muscles, and the abdominal distention and kyphosis in the patient on the right.

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Experiences in the Civilian Camp at Singapore

Dr. G. V. Allen (King Edward VII College of Medicine, Singapore) and
Professor R. G. Scott MacGregor (Department of Physiology,
King Edward VII College of Medicine, Singapore)

Organization of the Camp

The fall of Singapore on February 15th, 1942, was followed immediately by the internment of British and many other European civilians. During the early weeks they were confined in greatly overcrowded conditions in camps which included a police station, a school and dwelling houses. There was no rationing scheme by the Japanese and the internees had to live on such food as they had been able to bring into camp with them and small quantities obtained from food stores in the town. Feeding under such conditions was very poor and great hunger was experienced by the majority. On March 6th the internees were marched out to Changi convict prison where they remained until May 1st 1944. This was the Singapore long-term convict prison which normally accommodated 600 convicts. The average number of internees in the prison throughout the two years was 3000. From May 1st 1944 until the closing of the internment camp in September 1945 the internees were housed in Sime Road Internment Camp in attap huts of a very primitive type. During this period the population of the camp rose to 4500 and the accommodation per head in each hut was approximately eighteen square feet.

The Japanese permitted internees to make arrangements for the internal running of their camps. A men's and a women's representative were elected in charge of the camp and were held responsible by the Japanese for the carrying out of their orders regarding discipline. Area or block commandants were elected also and these, with the men's representative, formed the executive committee of the camp. Other camp officials were quartermasters, officers in charge of gardens and so on. There were several standing committees in the camp such as the Messing Committee, the Commissariat Committee and the Medical Reference Committee. The Medical Reference Committee was formed to deal with problems related to nutrition which might arise in the camp, and the following description of internment is largely confined to the activities of this

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particular committee and the information on diet and health which it received from a variety of sources.

Work of the Medical Reference Committee

In April 1942 a petition signed by the members of the medical profession in the camp, drawing attention to the serious deficiencies in the camp diet and asking for the supply of certain essential foodstuffs, was sent to the Camp Executive Committee for presentation to the Japanese authorities. At the same time it was recommended that a standing committee should be appointed to advise the Camp Executive Committee on matters relating to nutrition. This was approved, and the following were appointed members of this body, which was called the Medical Reference Committee:

- Dr. F. E. Byron, Chief Chemist, Institute for Medical Research, Kuala Lumpur;
- Dr. R. A. Pallister, Physician, Johore General Hospital;
- Dr. J. O. Poynton, Institute for Medical Research, Kuala Lumpur;
- Dr. R. G. Scott MacGregor, Professor of Physiology, College of Medicine, Singapore.

Dr. Poynton resigned shortly after the creation of the committee. In December 1942 Dr. G. V. Allen, Principal of the College of Medicine, Singapore, was appointed chairman, and Dr. W. R. Duff and Dr. D. W. G. Faris, Chief Health Officer, Singapore, were appointed as additional members. The personnel of the committee remained unchanged throughout internment from December 1942, and met weekly, apart from special meetings, for nearly three years.

The function of the committee was to advise the Commandant (men's representative) and the Central Executive Committee of the camp in all matters relating to nutrition and deficiencies in diet likely to affect the health of the inmates. To enable the committee to exercise its advisory functions to the best advantage it was agreed that certain information should be supplied to it. This information included the proposed menus for each week and the actual weights of all foodstuffs issued to the camps daily. In addition, when supplies of foodstuffs became available for purchase, and particularly when any question of selection or choice arose, lists of the foodstuffs available were submitted to the committee for its views on the relative nutritive values of the articles concerned before an order was placed. Also, before any considerable area attached to the camp was planted, the committee was consulted as to the relative food values of the possible crops.

It was clearly laid down that the committee was not concerned with any matters relating to kitchen management, cooking, or serving food unless any method adopted led to the deterioration of the nutritive value or waste of the food. To ensure co-operation the chairman of the Medical Reference Committee attended meetings of the Camp Executive and certain other committees; the officer in charge of camp gardens, Mr. J. N. Milsum, agricultural adviser, and the chairman of the Messing Committee could attend meetings of the Medical Reference Committee.

Estimates of dietary values were prepared for the weekly meetings by Dr. Allen and Dr. Duff from such data as were available in the camp, the

chief sources being Aykroyd's (1938) tables of analyses of Indian food-stuffs, and Rosedale's (1935), Oliveiro's (1934) and Leong's (1940) publications on Malayan foods.

In addition to reports received by Dr. Faris and Dr. Pallister through the camp medical and health organizations regarding cases of illness and suspected deficiency diseases, a series of examinations was carried out by Drs. Allen, Duff and Scott MacGregor on 150 normal male internees of varying age and physique, who were known as "guineapigs", with the object of getting a sample of the reactions and health of the normal individual during internment.

Diet

Food Supplied by the Japanese

Cereals consisted largely of rice. At certain periods a percentage of unpolished or partly polished rice was supplied. Additional items were flour supplied in small quantity during one or two of the earlier months and occasional issues of maize.

Soya beans were issued in quantity during a brief period of rice shortage, but were otherwise unobtainable. Small quantities of beans were occasionally given.

Some fresh meat and tinned meat were issued from April to December 1942. From January 1943 issues of tinned meat were negligible and the small issues of fresh meat ceased in June 1943. From that time on, 0.7 oz. dried fish daily was the main source of animal protein, but in the last year this supply decreased and was intermittent. Some fresh fish was very occasionally supplied.

From May 1942 vegetables varying in amount from 2½ to 6 oz. per head were issued daily. The quality of these vegetables supplied by the Japanese was often poor and, as the produce of the camp gardens increased, this supply diminished.

Salt was supplied throughout all periods of internment but at one period the supply fell far below physiological requirements and had to be supplemented by salt made in the camp.

Sugar and cooking oil were supplied in small and variable quantities.

Tea and pepper were supplied throughout internment. The quantities of the different foodstuffs, which varied considerably at different periods of internment, are summarized in Table 1.

TABLE 1
AVERAGE DAILY ISSUE OF JAPANESE RATIONS OVER VARIOUS PERIODS

Item	oz. per head daily			
	Feb. 1942 to Jan. 1944	Feb. 1944 to June 1944	July 1944 to Feb. 1945	March 1945 to Aug. 1945
Rice, maize or beans ..	13.0	14.0	16.0	10.0
Vegetables	3.5	3.0	4.0	2.5
Cooking oil	0.2	0.7	0.6	0.3
Meat or fish	1.8	0.7	0.8	0.6
Sugar	0.7	0.6	0.6	0.5
Salt	0.2	0.5	0.7	0.5
Tea	0.2	0.2	0.2	0.2

Vegetables Supplied by the Camp Gardens

In December 1942 it became obvious that the Japanese authorities had no intention of increasing the vegetable ration. The Medical Reference Committee adopted Aykroyd's (1938) minimum vegetable requirements for diets low in animal protein, namely pulses 3 oz., green leafy vegetables 4 oz., non-leafy vegetables, including roots, 6 oz., per head daily, and recommended that the camp should attempt to grow sufficient green leafy vegetables to satisfy these requirements, and purchase or obtain supplies of pulses from the Neutral Agent.

A group of bean gardeners including a number of agricultural experts, the leaders being Mr. A. R. Westropp, Mr. R. Thurston, Mr. D. H. Grist and Mr. J. N. Milsum, had commenced work in one of the prison yards, an area of just under two acres. In December 1942 the Japanese approved the extension of gardening activities and allocated an area of about two acres outside the prison for cultivation of leafy vegetables and about 5 acres to be planted with sweet potato. The vegetables grown in the inside and outside garden were bayam (*Amaranthus gangeticus* var. *seliseh*, Corner), sweet potato (*Ipomoea batatas*), kankong (*Ipomoea reptans*), Ceylon spinach (*Basella rubra*, *Basella alba*). In the Sime Road Camp greater acreage was available and the urgent necessity of gardening to try to combat the continued deterioration in the diet supplied by the Japanese became increasingly clear to everyone. Figures in Table 2

TABLE 2
PRODUCTION OF GREEN LEAFY VEGETABLES IN CAMP GARDENS

Camp	Period	Quantity lb. per week
Changi	Jan. 1943	2000
	Sept. 1943	5000
Sime Road	July 1944	9000
	Sept. 1944	10,000
	Feb. 1945	12,000
	May 1945	17,000

After May 1945 values rarely fell below 16,000 lb. per week.

for the production of green leafy vegetable show the results of these efforts. During later months of internment the values rarely fell below 16,000 lb. a week. Tapioca also was grown in Sime Road Camp.

Food Supplied by the Red Cross

The Japanese refused to allow any supply from the Red Cross which would have been sufficient to relieve the food situation in the camp. The following did, however, reach the camp: food items amounting to about 18 lb. per head from the South African Red Cross Society in 1942; over 500 individual food parcels from the United States Red Cross in 1943; about 6600 individual food parcels, many of them badly deteriorated through age and ill usage, in 1945.

Food from other Sources

Salt was obtained from sea water in an installation set up and controlled in the camp by Mr. M. Jamieson, Chief Government Chemist, and

Professor N. Alexander, in 1943 when the salt ration was very poor. They also undertook the drying of tapioca leaf for addition to food and, towards the end of internment, methods of growing and drying guinea grass were tested and put into operation. The collecting and breeding of local snails as an article of food was in progress also at the end of internment.

Notes on the Dietary Values of the Foodstuffs in the Camp and the Significance of those Derived from Sources outside the Japanese Issue of Rations

The dietary values, which were calculated in the camp from week to week on the basis of quantities issued per head per day from the available sources, reflect variations which took place at different periods of internment. Graphs showing the values thus obtained for the content in the diet of vitamin B₁, total protein, animal protein, and Calories, and averaged for four-weekly periods for 1943, 1944 and 1945 are shown in Figures 1 and 2.

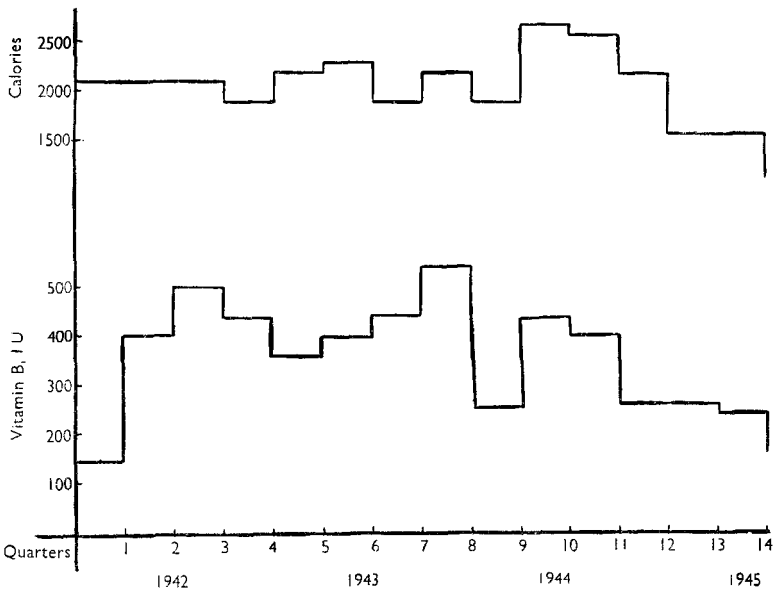


FIGURE 1.
DAILY INTAKES OF CALORIES AND OF VITAMIN B₁.

Vitamin Content of the Diet

From the early days, when an outbreak of beriberi was threatening, and throughout all periods of internment the vitamin content of the diet was a serious problem. The Committee strongly urged the purchase through the Neutral Agent, whenever possible, of rice polishings, groundnuts and green dhal (katjang-idjo). They were stored in the camp and issued in such quantities only as would maintain the vitamin B₁ values in the diet at a level at which there should be no immediate threat of an outbreak of beriberi. When the Japanese issued in the stores a certain percentage of unpolished, undermilled or parboiled rice, additions of

special sources of vitamin B₁ did not need to be great, and stocks could be built up but, when highly polished rice was issued and undermilled rice could not be obtained from the Japanese, the issue of polishings, nuts or pulses had to be raised. Rice polishings were dried and stored in tin-lined chests made in the camp. The drying was carried out in a rotating drum adjusted over a charcoal fire in such a way that the temperature of the polishings did not exceed 80° C. Without this treatment polishings deteriorated rapidly. Stored rice polishings, groundnuts and green dhal were constantly examined for any signs of deterioration during storage.

When the green leafy vegetables in the camp gardens and also in the private gardens of internees in Sime Road Camp were produced in large quantities they made a very significant difference to the dietary values, affording a particularly useful supply not only of vitamins A and C but also of vitamin B₁ and of the vitamin B₂ complex.

Red Palm Oil

During the early period of internment when the supply of vegetables was extremely low, red palm oil was issued to avoid a lack of vitamin A in the diet.

Salt in the Diet

In 1943 the Japanese made drastic cuts in the salt issue which caused the salt content of the diet to fall from a value sufficient for living and working in the tropics to one of 5 g. per head daily. The manufacture of salt in the camp at this period provided a source of the greatest importance and prevented severe salt deficiency.

Protein in the Diet

The total protein in the diet was maintained by the addition of the rice polishings, nuts and pulses and, towards the end when protein values were low, the larger quantities of green leafy vegetables contributed a most significant addition and supplied a high variety of essential amino-acids at a time when there was no means of adding animal protein to the diet. The supply of animal protein, originally maintained when it was possible to purchase eggs and extra dried fish, became very low in the last year (Figure 2).

The Energy Value of the Diet

During the greater part of the first two years of internment, except for certain weeks of rice shortage, the supply of cereals was such as to maintain the energy value of the diet at values approximating to 2000 Calories or over per head per day. During the last year of internment the maintenance of the energy value of the diet became a serious problem. Not only were cuts made by the Japanese in the rice ration but the sacks provided were often well under the nominal weights and no allowance for this loss was permitted. The Japanese rations allowed 100 g. rice supplements to workers in certain fatigues but their ration scale penalized men non-workers. This category included invalids and the incapacitated, whose numbers were increasing at an alarming rate. Women and children were equally affected and some of them were receiving rations containing

little more than 1000 Calories per day during the last months. Red palm oil was of value during this period to supplement not only the low fat content of the diet but also the energy value. Sweet potatoes and cassava (tapioca) also were added, but were obtainable only in limited quantities. The cassava which was being grown extensively in the gardens was not due to yield on a large scale until a later period, but it appeared to be the intention of Japanese policy that, when that time was reached it should serve to substitute rather than supplement rice in the diet.

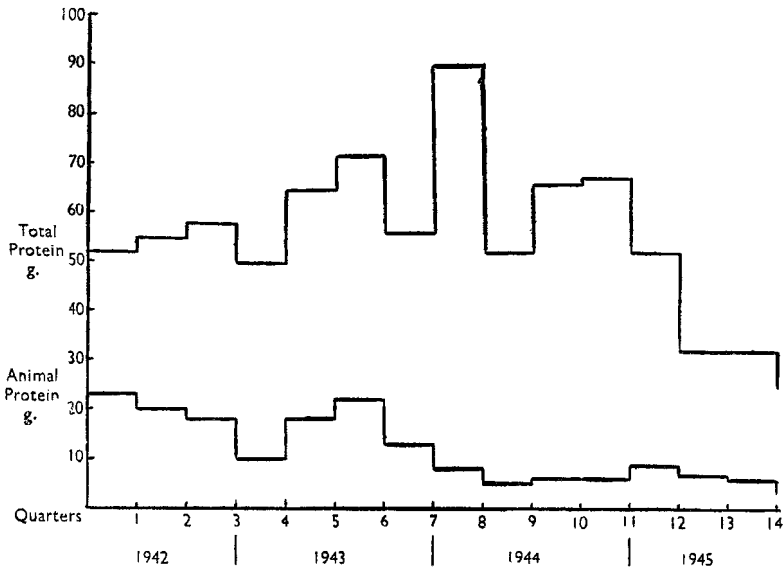


FIGURE 2.
DAILY INTAKES OF TOTAL AND ANIMAL PROTEIN.

The conclusions suggested to be drawn from a survey of the camp diet are, (1) That, had the camp relied on the Japanese ration issues alone for its food supply, there would have been severe outbreaks of dietary deficiency diseases, and every reason to doubt the survival of many of the internees for three and a half years of internment; (2) that the addition to the diet of rice polishings, nuts and pulses, in the early days when these were obtainable, and of vegetables grown in the camp during the later periods, did much to prevent this from taking place.

Health

Although the average age of the camp inmates was 44 years, the mortality was under 10 per cent. in spite of poor diet and overcrowding. The health measures adopted were successful in checking outbreaks of dysentery, although cases were always present throughout internment, and malaria and tropical typhus occurred in the Sime Road Camp.

Signs of dietary deficiency diseases were present in some form or other at all periods. Beriberi appeared after 3 months of internment and, by

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July 1942, there were 30 clearly established cases, but after the end of 1942, as a result of improvement in the diet, there were no further cases except a small number which appeared during the last year of internment.

Signs of deficiency of the vitamin B₂ complex appeared in 1942, but it was in 1944 and 1945 that outbreaks of pellagra occurred. Septic skin infections and ulcers, present throughout internment, were worst in 1942 and again in 1945. A wave of cases showing amblyopia (nutritional retrobulbar neuropathy) reached its maximum in 1943.

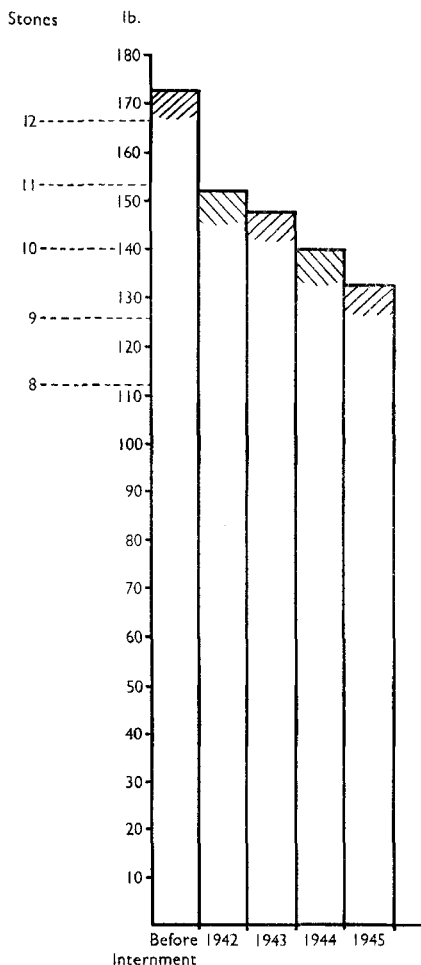


FIGURE 3.
MEAN WEIGHT OF A GROUP OF
MEN IN INTERNMENT AT YEARLY
INTERVALS.

Oedema and other signs suggesting dietary deficiency were present also. The oedema appeared frequently in the form of swollen ankles in many apparently healthy individuals; it appeared to be due to a variety of underlying causes. The only one of these which was clearly established

was that in which the oedema arose from the addition of salt to the diet in excess of physiological requirements when the supply of salt allowed this to be done. Oedema cleared up in these cases when the individuals omitted extra salt. A group of individuals was weighed by Dr. Carlile for the Medical Reference Committee and given extra salt. All showed an increase in weight within the next 4 days, and 5 out of 7 showed visible oedema; a control group did not exhibit these changes.

In order to obtain information for the Medical Reference Committee, observations were made at intervals on 150 male internees of different ages and physique, selected to afford an average sample. The following information was obtained.

Weight

In March 1943 the average weight of the group was nearly 2 stone below their average weight before internment (Figure 3). The expected weight of this group, calculated from life insurance tables, and based on height and age, was below their average weight before internment and corresponded closely with the value maintained during the first year after the initial fall. During the last year of internment the entire camp was weighed by order of the Japanese, and the average weight for it was only slightly less than that of the weighed group. Towards the end of internment loss of weight caused many of the internees to assume the cadaverous appearance which had been limited to a section only of the community in previous years.

Height

A loss of height varying from $\frac{1}{2}$ to 1 inch was found in many cases. This was presumably due to loss of muscular tone, together with absorption from ligaments, joints, intervertebral discs and heel pads.

Blood Pressure

Systolic pressures appeared on the average to be lower than would have been expected before internment. Many individuals who claimed to have had a high blood pressure prior to internment showed a value close to the average but, in certain pathological cases of established hyperpiesis falling outside the physiological group, the blood pressure did not decline, and some of those affected died during internment. Many of the systolic values were in the nineties; some appeared to be even lower. During the course of internment the average systolic pressure rose slightly. Differences between age groups were not great. Diastolic pressure did not appear to be much below normal values during most periods of internment but the average value fell towards the end of internment (Table 3).

Haemoglobin and Red Blood Cells

The haemoglobin values measured by the Tallquist method gave an average of 80 per cent. in Nov. 1942, August 1943 and Oct. 1944; during the last year haemoglobin values above 80 per cent., or red blood cell counts above 4,000,000, were extremely rare in internees. Although the iron content of the diet appeared to be between 20 and 30 mg. daily

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there were certain individuals whose haemoglobin percentage and red cell count fell below the average when they could not be given medicinal iron from time to time.

TABLE 3
AVERAGE BLOOD PRESSURE OF GROUPS OF INDIVIDUALS AT THE BEGINNING AND END OF INTERNMENT

Age	Number in group	Date	Systolic pressure mm. Hg	Diastolic pressure mm. Hg
30 to 59	70	Apr. 1942	109.6 \pm 1.2	75.2 \pm 0.8
		Sept. 1944	115.8 \pm 1.6	64.5 \pm 1.2
30 to 39	29	Apr. 1942	108.4 \pm 1.8	73.8 \pm 1.5
		Sept. 1944	114.5 \pm 2.3	60.8 \pm 1.4
40 to 49	26	Apr. 1942	107.3 \pm 1.8	74.0 \pm 1.4
		Sept. 1944	114.6 \pm 2.4	66.5 \pm 2.1
50 to 59	15	Apr. 1942	116.2 \pm 2.5	80.2 \pm 2.0
		Sept. 1944	120.3 \pm 3.1	67.9 \pm 2.1

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Experiences in the Military Camp at Singapore

Dr. R. C. Burgess (Malayan Medical Service)

The total calorie intake of the prisoners of war in the Changi camp, for nearly 3 out of the 3½ years, was not grossly inadequate. By means of pooling money and purchasing on a wholesale basis it was possible to supplement the Japanese rations, so that the intake of Calories was maintained above the level of 2500 for almost the whole of this period. During the last six months, the Japanese ration scale was reduced; food could no longer be purchased and the intake fell below 2000 Calories. The majority of the prisoners of war were called upon to labour, and the diet was not enough to prevent a loss of weight. A group of non-obese healthy men, whose weight prior to becoming prisoners of war was on record, were found to have lost an average of 16 lb. in the first 3 years; the same group lost a further 15 lb. in the last six months.

The problem with which we had to contend for the greater part of our imprisonment was one of an unbalanced diet rather than of a lack of total

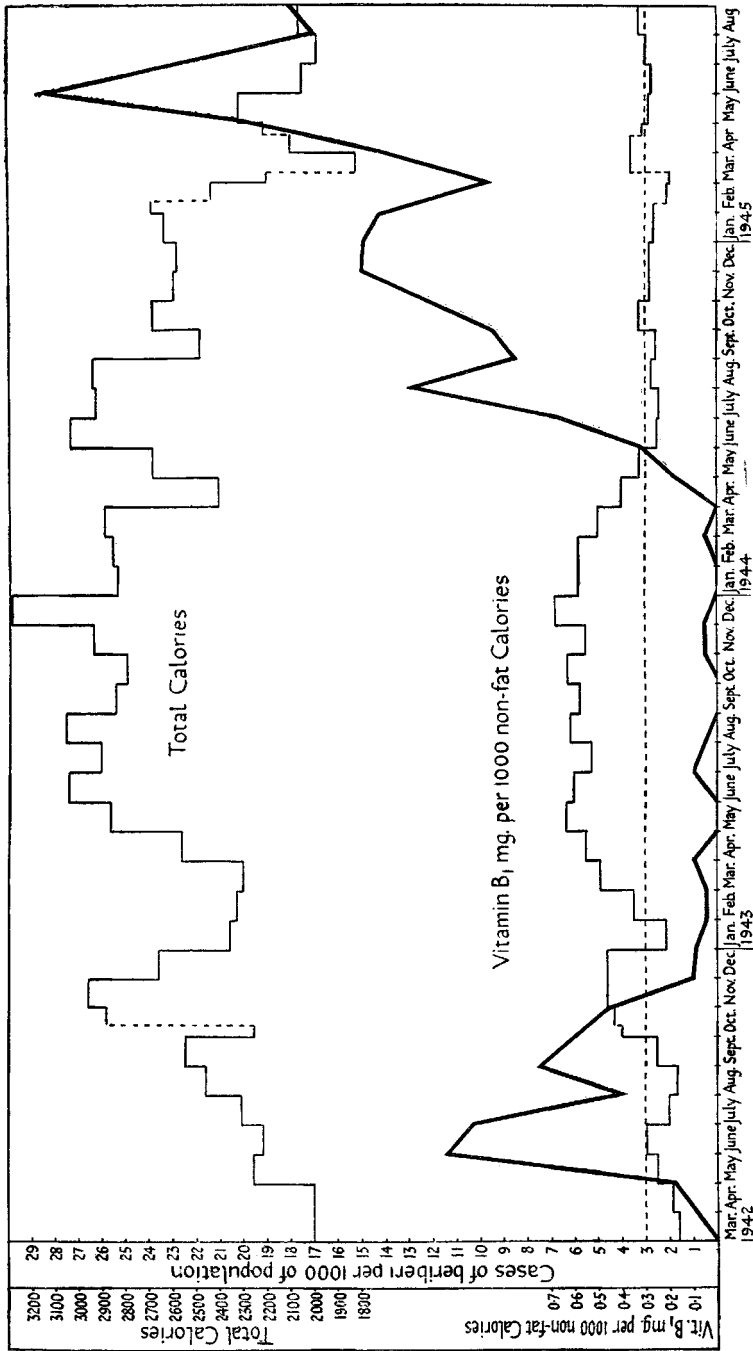


FIGURE 1.

INCIDENCE OF BERIBERI IN RELATION TO INTAKE OF TOTAL CALORIES AND OF VITAMIN B₁ PER 1000 NON-FAT CALORIES.

The bold line indicates incidence of beriberi; the dotted line the ratio of vitamin B₁ to non-fat Calories below which beriberi is to be expected.

calories. The imbalance was in respect of the components of the vitamin B complex; an estimation of the food value of the diet did not reveal any other deficiencies and there was no clinical evidence to suggest the occurrence of any during the first 3 years.

Deficiency of Vitamin B₁

Figure 1 shows the incidence of beriberi. Below is shown the vitamin B₁ content of the diet in mg. per 1000 non-fat Calories. This formula was suggested by Williams and Spies (1938) as a means of appraising diets in relation to the causation of beriberi. The straight line on the chart indicates the value for this relation below which clinical evidence of beriberi can be expected to occur. This formula was used by us as prisoners of war and it allowed us to forecast with accuracy the incidence of beriberi.

From the earliest days of the camp it was clear that beriberi must appear; it took a month to six weeks to do so. The estimated vitamin B₁ content of the diet at this time was 0.4 mg. or 130 I.U. This first outbreak, as can be seen from Figure 1, was small and came to an end with the improvement in the diet. In May and June 1944 the falling ratio of vitamin B₁ to non-fat calories made it clear that a further outbreak of beriberi could be expected. In the later months of 1944 fresh cases kept occurring but the incidence was not high. In April and May 1945 a further increase of new cases occurred. Figure 1 shows the great decrease in the calorie and protein intakes at this time, and famine oedema was now complicating the picture. The clinical aspect of this will be dealt with by Dr. Cruickshank.

Access to means of prevention varied at different times; between November 1942 and March 1944 pay was coming in and we were able to supplement the diet with rice polishings and legumes. In the earlier period there was no money to purchase foodstuffs, and in the later period there were no foodstuffs rich in vitamin B₁ to purchase. During these periods we were thrown back on our own resources. Yeast was grown but, as was to be expected, proved of little value and was abandoned as a means of prophylaxis.

A measure to which we paid considerable attention, and which we believe was warranted in these circumstances, was the preparation and cooking of rice so that the vitamin B₁ was not lost. Rice supplied about half the vitamin B₁ intake when times were bad and, if it was washed and cooked in an excess of water which was afterwards discarded, more than half the vitamin B₁ it originally contained was lost.

Deficiency of Other Members of the Vitamin B Complex

Figure 2 shows the incidence per 1000 of the population per week of fresh cases of mouth lesions, aching feet and scrotal dermatitis, disease conditions usually attributed to vitamin B₂ complex deficiency. In the main there was a similarity in the trends of incidence of these conditions. The estimated contents of riboflavin and nicotinic acid in the diet are shown also in Figure 2. These are expressed in mg. per 1000 total Calories. It will be seen that when the riboflavin intake was low the incidence of these diseases was high and that outbreaks of disease were terminated when the riboflavin content of the diet was at the higher levels,

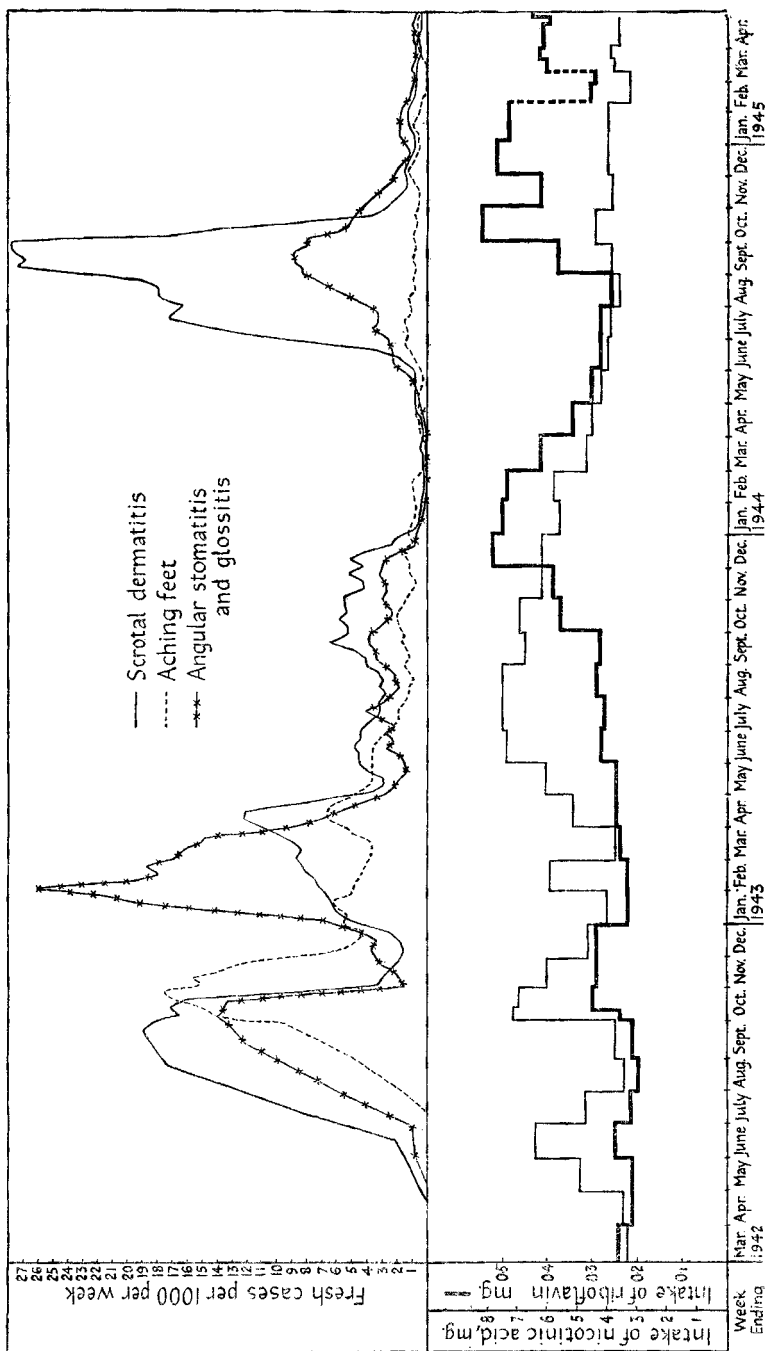


FIGURE 2.

INCIDENCE PER 1000 OF THE POPULATION PER WEEK OF FRESH CASES OF SCROTAL DERMATITIS, ACHING FEET, AND ANGULAR STOMATITIS IN RELATION TO INTAKE OF NICOTINIC ACID AND RIBOFLAVIN.

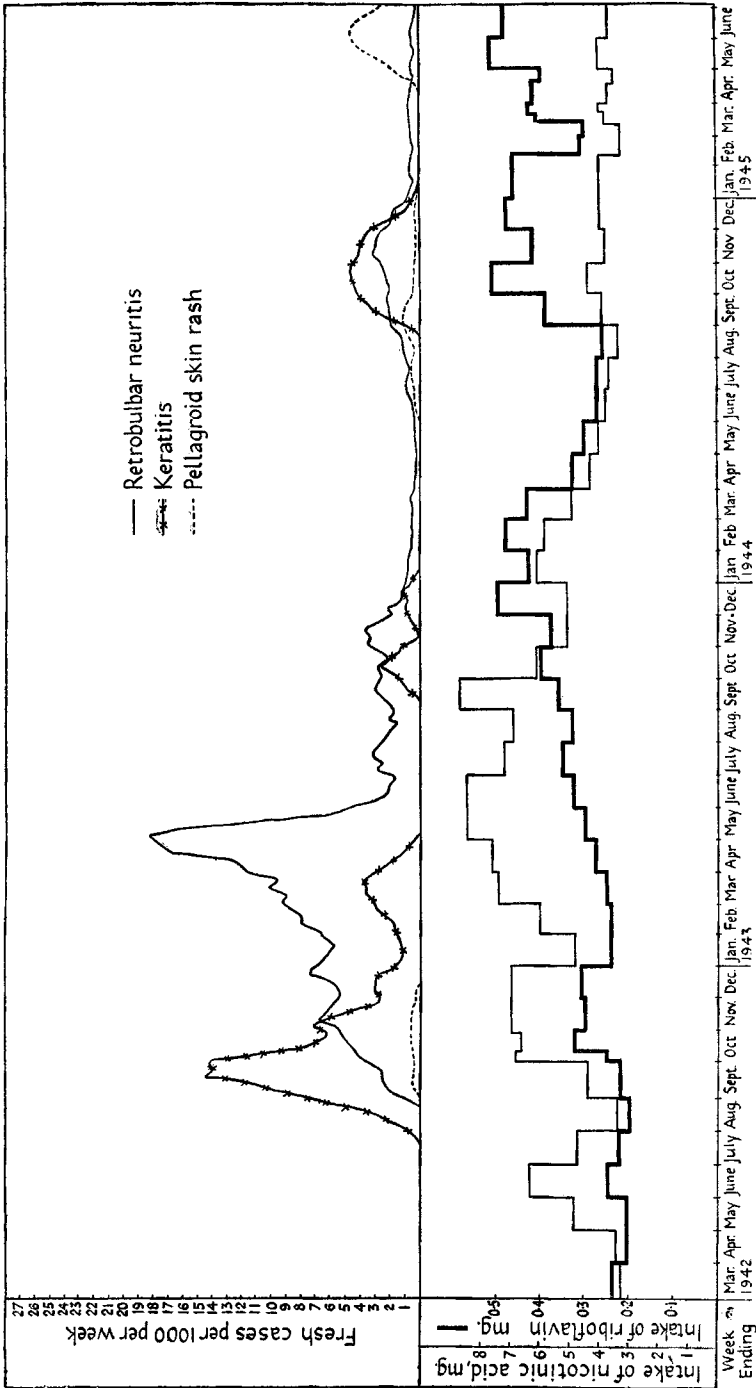


FIGURE 3.

INCIDENCE PER 1000 OF THE POPULATION PER WEEK OF FRESH CASES OF RETROBULBAR NEURITIS, KERATITIS AND PELLAGROID SKIN RASH IN RELATION TO INTAKE OF NICOTINIC ACID AND RIBOFLAVIN.

but that there appeared to be little relationship between the incidence and the estimated nicotinic acid level.

Figure 3 shows the incidence of retrobulbar neuritis, keratitis and pellagroid skin rash. The incidence of keratitis followed fairly closely that of the diseases given in Figure 2. Retrobulbar neuritis had a somewhat different incidence; it was slow in affecting large numbers compared with the other disease conditions. The behaviour of pellagroid skin rash was again different and could be correlated rather with the intake of nicotinic acid than of riboflavin.

Prevention of these diseases was based mainly on raising the riboflavin content of the diet. The most obvious source was the green leaf but, in the early period, green leafy vegetables could not be obtained. We, therefore, tried to get riboflavin from grass and other vegetation that grew around the camp. The leaves were crushed until their cellular structure was broken and then macerated in water, and the extract was drunk. It was effective only when rapidly growing green shoots were used. As might be expected, the extract from coarse tropical grasses was not of much value. An attempt was made to increase the riboflavin intake by supplementing the diet with legumes and this was ultimately achieved but the amount required was very high. During the last year there was a relative freedom from these diseases and this was in all probability due to the consumption of green leafy vegetables. Before there was any evidence of the last outbreak ceasing, however, the daily intake of green leaf vegetable was in the region of 180 g.

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Experiences in the Military Camp at Singapore

Dr. E. K. Cruickshank (Department of Medicine, Foresterhill, Aberdeen)

Dr. Burgess has described the camp diet and demonstrated graphically the incidence of deficiency disease per 1000 of the population plotted against the estimated vitamin content of the diet. This was the main clinical problem in the camp, and the clinical aspects of the more important and interesting syndromes are described below.

Vitamin B₁ Deficiency

Diagnosis

The criteria on which a diagnosis of vitamin B₁ deficiency disease was made were as follows:

(1) Neurological manifestations

- (a) Definite subjective and objective sensory changes;
- (b) Muscular weakness and aching, with reflexes markedly diminished or absent;

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- (c) Wernicke's encephalopathy, *i.e.*, vomiting associated with nystagmus, paralysis of the external muscles of the eye and mental confusion.
- (2) Cardiovascular manifestations
- (a) Oedema which could not be attributed to nephritis, valvular disease of the heart, venous obstruction, or protein deficiency;
- (b) Tachycardia with cardiac enlargement, alterations in the heart sounds and the appearance of murmurs without obvious cause.

A diagnosis of vitamin B₁ deficiency was made if the findings fell under any one of the above subheadings. Usually, however, more than one of these signs were present in a given case.

During the first three years of imprisonment when oedema was present alone, the possibility that protein deficiency was the cause was considered unlikely except in special cases on the following grounds:

- (1) The protein intake, although low, was, as Dr. Burgess has shown, probably sufficient to maintain the serum proteins at a normal level.
- (2) Muscle wasting was not a feature of the cases until 1945 when the total calorie intake became low.
- (3) The oedema disappeared rapidly in most cases, associated with a diuresis, after one week's rest in bed, or on the administration of supplements containing vitamin B₁.
- (4) The incidence of this oedema was high when the ratio of vitamin B₁ to non-fat Calories was low and *vice versa*, without any marked alteration in the protein intake (see Figure 1, p. 117).

In 1945, however, particularly in the last three months of captivity, a considerable number of the cases of oedema was undoubtedly due to protein deficiency. In these cases emaciation was well marked, and the protein intake was very low. They were uninfluenced by large doses of vitamin B₁ given intravenously, and serum protein estimations made in 20 such cases immediately on release, before the protein intake was increased, gave an average value of 4.72 g. per cent.

The case records of 400 cases of beriberi which were first seen as out-patients have been examined. An analysis of the symptoms and signs and their correlation with one another are given in Tables 1 and 2.

Two special observations of some interest were made. In a number of cases with gross oedema and cardiac changes with oliguria, hypertension was found. The blood pressure rapidly fell to normal or below it a few days after diuresis had occurred and the oedema had begun to disappear.

When heart failure occurred, it was acute left ventricular heart failure which predominated in the great majority of cases. When right heart failure occurred left heart failure also was nearly always present and no clear cut case of right heart failure alone was seen.

Treatment

Rest was prescribed in all cases. A supplement of 1½ oz. marmite or 3 oz. of raw rice polishings daily was given in 46 per cent. of the cases. In selected cases intravenous injections of vitamin B₁ and an extract of rice polishings of which 1 pint was equivalent to 1 lb. of rice polishings

TABLE I
INCIDENCE AND INTERRELATION OF SYMPTOMS OF VITAMIN B₁ DEFICIENCY WHEN THE 400 CASES WERE FIRST SEEN

Symptom	Weakness	Paraesthesia	Numbness	Muscle pains	Cramps	Oedema	Breathlessness	Palpitation	Pre-cordial discomfort	Lassitude	Anorexia	Dizziness	Headache	Vomiting or nausea
Weakness ..	168	47	74	48	9	90	50	10	7	75	47	9	5	7
Paraesthesia ..	47	79	36	16	5	44	20	3	1	36	24	1	1	3
Numbness ..	74	36	115	29	10	50	33	7	5	45	31	3	4	3
Muscle pains ..	48	16	29	93	9	71	26	8	5	42	19	—	2	2
Cramps ..	9	5	10	9	20	10	4	—	1	6	3	—	—	—
Oedema ..	90	44	50	71	10	314	108	16	13	137	70	6	3	6
Breathlessness	50	20	33	26	4	108	138	14	12	83	42	6	4	2
Palpitation ..	10	3	7	8	—	16	14	18	4	18	6	2	—	1
Pre-cordial discomfort ..	7	1	5	5	1	13	12	4	17	15	5	1	—	—
Lassitude ..	75	36	45	42	6	137	83	18	15	164	78	9	4	7
Anorexia ..	47	24	31	19	3	70	42	6	—	78	88	4	—	6
Dizziness ..	9	1	3	—	—	6	6	2	1	9	4	12	1	1
Headache ..	5	1	4	2	—	3	4	—	—	4	—	1	7	—
Vomiting or nausea ..	7	3	3	2	—	6	2	1	—	7	6	1	—	10

TABLE 2
INCIDENCE AND INTERRELATION OF SIGNS OF VITAMIN B₁ DEFICIENCY WHEN THE 400 CASES WERE FIRST SEEN

Sign	Weakness	Reflexes diminished or absent	Hypalgesia	Oedema	Tachycardia	Cardiac enlargement	Altered heart sounds	Cardiac murmurs
Weakness	159	90	95	82	28	8	19	13
Reflexes diminished or absent ..	90	109	85	76	32	4	16	12
Hypalgesia	95	85	161	106	31	1	15	10
Oedema	82	76	106	317	39	16	56	37
Tachycardia	28	32	31	39	61	7	21	17
Cardiac enlargement	8	4	1	16	7	21	19	11
Altered heart sounds	19	16	15	56	21	19	57	27
Cardiac murmurs	13	12	10	37	17	11	27	51

Incidence of Some Other Signs

Muscle wasting .. .. .	.. .. .	18 cases	Audible vessel sounds	.. .. .	10 cases
Poor muscle tone .. .. .	.. .. .	17 "	Distended neck veins	.. .. .	7 "
Muscle tenderness .. .. .	.. .. .	43 "	Liver enlargement	.. .. .	12 "
Hyperaesthesia .. .. .	.. .. .	1 case	Ascites .. .. .	.. .. .	9 "

was given in doses of from 5 to 20 oz. daily. These two last remedies were given separately or together.

The average duration of oedema, while under treatment, was 11.6 days for 254 cases, but recurrence was common.

The average duration of neuritic signs was 14.8 weeks for 126 cases.

Other Syndromes Possibly Attributable to Vitamin B₂ Deficiency
Painful Feet

This syndrome first appeared three months after imprisonment. The peak incidence, as will be seen from comparing Figure 1 (p. 117) with Figure 2 (p. 119), occurred when fresh cases of beriberi were rare. The earliest symptom was a dull throbbing in the heads of the metatarsals in the evenings. Then sharp shooting stabs of pain in the pads of the toes and in the metatarsal heads lasting $\frac{1}{2}$ to 2 seconds and frequently repeated became superimposed on the dull constant ache. The pains shot longitudinally through the foot and later spread to the ankles and occasionally up to the knees. In some cases they appeared also in the fingers and wrists. As time passed the constant ache became more severe and the sharp pains more frequent. The pains were always worst at night, keeping the patient awake. Some temporary relief was obtained by exercise, and some men walked about for hours at night. The patients became worn out from pain and loss of sleep; rapid loss of weight occurred and the appetite often became poor. Tightly gripping and massaging the feet gave some relief and men adopted a characteristic attitude in bed, sitting forward, crosslegged, gripping their feet. Cold water helped some; others preferred to wear two pairs of socks.

On examination the patient often looked exhausted with red-rimmed, dark-ringed eyes. Some were almost tearful from the pain. The only abnormal findings in the feet were hyperaesthesia to pin prick and light touch in the majority, and excessive sweating in some of the severe cases. No deformities, vascular changes or sensory disturbances other than those mentioned were found when the cases were compared with a group of controls. A review has been made of 500 cases. Nearly 80 per cent. gave a previous history of scrotitis or stomatitis and, at the time when the cases came under observation, the percentage in which evidence of other deficiency diseases was present was scrotitis 30, angular stomatitis 27, glossitis 4.6, defective vision from retrobulbar neuritis 13, vitamin B₁ deficiency 8, oedema 6.2, absence or sluggishness of reflexes 2.2, and hypo-aesthesia of legs 1.8.

In this group with painful feet other abnormal findings were:

(1) Gross exaggeration of knee and ankle jerks and some exaggeration of the arm reflexes in 23 per cent. This finding appeared 1 to 2 weeks after the onset; it persisted while the symptoms were present, often for several months, and disappeared 1 to 2 weeks after the pain had abated.

(2) Hypertension in 51 of 189 cases where blood pressure readings were taken. The upper limit of normality was taken as 130/90 mm. The average reading for the 51 cases was 142/104, the highest being 200/142. The average age was 28. The average value for the other 138 cases was 118/76. The average for 500 cases without sore feet was 121/78. In 11 patients hypertension developed while they were under observation,

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TABLE 3
RESULT OF VARIOUS FORMS OF TREATMENT FOR BURNING FEET

No. of cases	Nature of daily treatment	Effect of treatment										Remarks
		Complete relief		Marked improvement		Improvement		No change or worse				
		No.	Aver. time	No.	Aver. time	No.	Aver. time	No.	Aver. time			
119	Nicamide,* 5 to 8 intravenous injections of 2.0 ml.	20	During or within a few days of injections	62	During or within a few days of injections	19	During or within a few days of injections	18				Majority given 2 oz. daily of rice polishings after injections, as out-patients; 15 relapses within 1 to 2 weeks
20	Boiled green gram, 8 oz.			11	19 days	7	29 days	2	35 days			All hospital cases, severe and long-standing
323	Rice polishings, 3 oz.			128	6 weeks	51	6 weeks	144	6 weeks			Mostly out-patients
38	Marmite, 1 oz.			21	3 weeks	5	26 weeks	12	2 weeks			Mostly out-patients

* Di-ethylamide of nicotinic acid; 2.0 ml. = 340 mg. nicotinic acid.

appearing in an average of six weeks from the onset of symptoms. In the remaining 40 it was present when the first blood pressure reading was taken.

The hypertension disappeared 1 to 3 weeks after marked improvement or disappearance of the symptoms.

Treatment. All severe cases were rested in bed as far as possible. An attempt was made to increase the intake of vitamin B₂ complex. Details of the more specific remedies employed with results of treatment are given in Table 3.

The Spastic Syndrome

This syndrome first appeared in September 1942 after seven months' captivity. Between 40 and 50 cases occurred during the ensuing ten months. The earliest symptom was weakness in one or both legs and, in some cases, in one or both arms, with an unsteady gait and a tendency to trip easily. Some cases showed marked mental deterioration.

On examination the findings were those of a pure upper motor neuron lesion involving the legs and sometimes one or both arms. No evidence of involvement of the sensory or cerebellar pathways was found. The cases were afebrile. The blood and cerebrospinal fluid were normal and free hydrochloric acid was present in the gastric juice of all the seven cases given test meals.

Treatment. The cases were treated with rest, all the available preparations of vitamins including vitamin B₁, nicotinic acid, marmite, vitamin A and liver extract, and meat, eggs, milk and pulses were added to the diet. No dramatic improvement resulted. There was gradual betterment over about six months and thereafter very little. Residual spastic signs persisted in the more severe cases.

Other Vitamin B₂ Deficiency States

Such conditions as glossitis, stomatitis, scrotitis, and pellagroid skin changes answered to the standard descriptions.

Nutritional Conditions among Women and Children in Internment in the Civilian Camp at Singapore

Dr. C. D. Williams (e/o Director of Medical Services, Kuala Lumpur, Malaya)

On February 15, 1942, Singapore capitulated and two days later the Japanese ordered the "British U.K." to be interned together with the American and Dutch nationals. Most of the European women with children had already left Malaya, some to reach a healthier country, some to be bombed and sunk on evacuating ships, and some to be captured and interned on Sumatra and other neighbouring islands.

Conditions in the Camps

The women who remained in Singapore to be interned belonged mainly to three categories:

- (1) Wives of British civilians who were interned or prisoners of war, mostly without children.

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- (2) Professional women, nurses and doctors, who remained to work in the hospitals and in the emergency medical service.
- (3) Non-European (Eurasian, Chinese, Indian) wives of British civilian internees and prisoners of war, many of them with children.

Category (3) was being constantly increased as the Japanese swept into internment more of these women and children. In March 1942 there was a total of about 400 women and children. The numbers slowly increased. In March 1945 large numbers of Jewish women and children were brought in so that when the Japanese capitulated in August 1945 there were about 1000 women and 300 children.

The population of the women's camp was thus composed of a varying number, and of very mixed ages, races, social status, and educational and nutritional background and is, therefore, difficult to assess statistically. During the whole period there were 20 births and some 30 deaths in the women's and children's camp.

On February 18, 1942, a motley group assembled in the middle of the town and, after a long, hot day in the sun with no food and very little water, they were marched about 6 miles to houses in Katong. Some transport was provided for the very sick and the very incapable but most had to walk, including one woman who had had a Caesarean section less than a month previously, pushing her baby in a perambulator. In Katong there was little food, no sanitation, and gross overcrowding. After three weeks there was another long march to Changi prison.

The Diet and its Effects

The women and children occupied one section of the prison and were supposed to have no communication with the men. For about a month food was exceedingly short, and there were no facilities for cooking it, but the men were then permitted to take over all the cooking and we received the average camp rations, while special provision was made for the children, the sick, the aged and the infirm. On the average, the women's camp probably received just about the approximate values shown in the figures supplied by the Medical Reference Committee (Allen and MacGregor, 1946). Some individuals saved all they could and, with a wealth of culinary skill and inventiveness, they converted it into something tempting for their relatives and friends in the men's camp. Others accepted these touching compliments from "the other side" with equal alacrity. In the early days when a certain amount of shopping was permitted, either above or below the rose, most people were able to get hold of some money or make contacts outside the camp, and thus add variety to their diets. Later on this became far more difficult and expensive.

On the whole the women, having smaller metabolic demands and on the whole less basic anxieties than the men, stood the exigencies of the diet better than they did, and had less evidence of gross nutritional defects. Women, on the average, found it easier to occupy their hands and their time with minor industries and busy-ness. The extreme shortage of the first few weeks was only important to those who were already worn out with lack of food, overwork, anxiety, and enteritis. After this period many people did well and many, especially from the local population who were accustomed to a rice diet, put on weight. Others, mostly

among the imported population, complained of asthenia and bowel irregularities.

Individual variations were marked. A diet that was sufficient for some was quite inadequate for others. The mental outlook and its effects on appetite and assimilation were of supreme importance. Most of the internees had been accustomed to a diet containing unlimited fruit and dairy products, high in protein and with wheat flour as the standard carbohydrate. They were now on a diet that contained no dairy products, little or no fruit, low in protein and with rice as the basis. It is no wonder that adjustment was not easy, and for some of the older people it was almost impossible. The coarse, bulky nature of the diet made it very liable to give rise to diarrhoea. Many cases were controlled simply by advising patients to rub their soup through a sieve contrived from a tin with holes punched in the bottom.

An important point is that there was relatively more hospital accommodation for the women than for the men. Women were, therefore, admitted earlier in cases of illness and stayed in longer. Hospital diets always contained some extras and often were very considerably better than those in the camp. There were some extras, too, for hospital workers, particularly for those on night duty.

Loss of Weight towards the end of internment was almost universal and in some cases severe, while asthenia and malaise were increasingly so.

Hunger was not only distressing as a sensation, but it was generally accompanied by an increase in feelings of insecurity and anxiety. There was not so much a physical craving for food as an inescapable obsession with phantasies of *nice* food, a perpetual pre-occupation and hence a perpetual frustration. It was generally accompanied by some degree of mental indolence which not only makes intellectual effort tiresome and concentration impossible, but induces also impatience and selfishness because the individual shrinks down and can no longer make the effort of wider perceptions and sympathies.

Giddiness was troublesome, especially among the older women. Sometimes it was increased by neuroses and was very hard to differentiate from them. It was often overwhelming on assuming the erect posture and almost uncontrollable at night. It was, I think, somewhat improved by persistent balancing exercises.

Nocturnal diuresis was a puzzling but very constant phenomenon throughout the whole of internment. In the early months the nights were perpetually disturbed by the overcrowding, by crying babies and prowling sentries, by women having nightmares, by quarrels among cell mates, by attacks of enteritis, indigestion and anxiety. All these factors tended to settle with familiarity and conditioning, but even when fluids were avoided during the latter half of the day, nocturnal diuresis persisted, in most cases until some weeks after release and the return to a well balanced diet. A little poem which appeared in the camp periodical illustrates the state of affairs:

“How doth the little internee
To eat her rice delight.
She grabs and guzzles it all day
And liquidates all night.”

The same phenomenon was observed by McCance and Widdowson (1946) in their Experimental Study of Rationing in which human subjects received a restricted diet rich in cereals. It is possible that the prevalence of nocturnal diuresis may be accounted for by two considerations. In the first place, carbohydrate metabolizes into more water than protein or fat and, in the second, a diet low in vitamin B₁, if it does not produce anuria, may still produce some delay in kidney action so that this organ works slowly and through most of the night as well as the day. Atonia of the bladder muscles also may have contributed to the condition.

Menstruation. The majority of women who were previously menstruating normally either ceased altogether, or the period became scanty or irregular. In some cases the shock of the campaign and the anxiety and privations seemed to have just as important an influence as the low diet. In some cases one or two meals high in protein were enough to start off a show of bleeding.

Anaemia was seen in mild degrees in almost the whole camp. Severe anaemia was very rare and this was probably due to the high proportion of leafy vegetables contained in the diet, and the fact that people were all advised to eat eggs if ever there was any opportunity of buying them.

Specific Vitamin Deficiencies

Specific vitamin deficiencies were not common.

Vitamin A. Our diet after the first year was rich in this vitamin because it nearly always contained red palm oil. Two of the non-European women came into the camp with "mosaic" skin on the lower part of the tibia and both improved during internment. Two well marked cases of typical "phrynoderma" appeared in two sisters, children who came into the camp only in March 1945. Both cleared up rapidly with an antiseptic ointment prescribed by Dr. J. V. Landor. I am not qualified to comment on the eye conditions but doubtless Dr. A. Williamson will make a report.

Vitamin B₁. Frank cases of beriberi were rare. Oedema appeared in most people at various times but mostly in a mild degree. In the early days this oedema may have been caused by some sort of "rice intoxication" because it was not found among the non-European women who were already habituated to a rice diet. In some women the swellings were recurrent, extensive and very troublesome. There appeared to be three causes of oedema: (1) Vitamin B₁ deficiency, (2) protein deficiency, (3) rice intoxication. There was a generally unstable water balance. Salivation was often troublesome. Rhinorrhoea appeared when eating even the blandest of foods. Exudations were stimulated without sufficient cause.

One severe case of oedema occurred in a woman after five months in a Kempei Tai prison, and improved when vitamin B₁ was administered together with a more generous diet. This patient, before and during the onset of oedema, showed a great slowing of the pulse, from a normal 80 to 42, with what felt like a considerable rise in blood pressure, though this could not be tested with a sphygmomanometer. There was never anuria, but considerable polyuria when the swelling was subsiding.

The neuritic forms of beriberi were common in a mild form. Changes in the reflexes were usual, and often the knee jerks would disappear before the ankle jerks. Also there was patchy but usually persistent occurrence of anaesthesia, paraesthesia and hyperaesthesia. Some cases of obstinate constipation and bowel disturbances were probably due to a lack of vitamin B₁.

Blood pressures were taken regularly and great variation was noted. In the early days there was a considerable and almost universal lowering of blood pressure, often associated with giddiness and fainting. Later on many women tended to show a rise beyond the normal, often accompanied by headaches, insomnia, malaise and slowing of the pulse. Asthenia and irritability, with failure to concentrate were very usual and rarely there were some delusions.

Pellagra appeared as typical cases of *mal de rosa* after the camp was moved from Changi prison to Sime Road where most people spent far more time out of doors. Many of these cases were controlled simply by keeping out of the sun. There was almost no nicotinic acid available for treatment. There were numerous cases of haemorrhagic blebs and blisters on the mucous membranes and glabrous skin. Some cleared without treatment; some became ulcerated and were very painful. Many of the mouth ulcers improved with silver nitrate as also did many cases of angular stomatitis, which was very common during the last year.

Scurvy. In the first year or two some cases of gingivitis were said by the dental surgeon to be scorbutic, but no other symptoms were seen suggestive of scurvy.

Ulcers and Boils were not nearly as common, severe or persistent among the women and children as among the men. Individuals were troubled from time to time with boils or whitlows or impetiginous sores which were painful and incapacitating. Scabies and fungus diseases also were the cause of some invalidism.

Condition of the Children

The children in the camp were under the supervision of Dr. Margaret Smallwood and Mrs. Eva Farrer, who should be congratulated on a magnificent record. We started with about 100 children under twelve. Later the boys were transferred to the men's camp at the age of ten, and more and more women with children were brought into the camp so that by the end there were about 300 children under ten years of age. Twenty babies were born in the camp. The only deaths among the children were two which occurred in babies a few days after they were brought into the camp, from diseases contracted outside.

Throughout internment anything that could possibly be secured in the way of extra food was saved for the children, often at considerable deprivation for the adults. There can be no assessment of what these extras amounted to because they varied from day to day and, while some mothers would deprive themselves further to give more food to their children, there were others who would convert the children's rations to their own uses.

On the whole it may be said that the children did well. There were no major epidemics. A few mild cases of diphtheria appeared from

time to time. In January 1944 and again in March 1945 whooping cough was brought into the camp by new admissions. Some cases were severe but all pulled through in spite of the great difficulties of trying to look after numbers of coughing, vomiting children, in grossly overcrowded conditions, in a strictly maintained blackout.

On the whole the children were small and light for their age, but they were not unenterprising or apathetic. Those who had been long in the camp showed no deficiency disease in any marked form. There were exceptions to this among the children brought in during 1944 and 1945. One of these was a child of two who, after an attack of enteritis, became a perfect picture of "malignant malnutrition". The oedema, the enlarged liver, the skin rash which peeled off and left the typical raw, red areas of "kwashiorkor" were all exemplary. This child made a perfect recovery when given a good diet. To all appearances he was Anglo-Saxon but nominally of Eurasian parentage.

Mothers during pregnancy and lactation were given all the extra diet that could be secured for them. The numbers of births among women who had been in the camp for any length of time was not sufficient to permit of any deductions as to the effect of this diet on pregnancy or birthweight. Breast feeding was persistently advocated and was achieved in every single case. Supplementary feeding was started at about six months but breast feeding was not discontinued until after the end of the first year.

Most of the children have showed rapid gains in weight since release. Older girls appeared to mature normally. Some, whose social and educational opportunities were improved rather than the reverse by the conditions of internment, appeared to develop with striking improvement both mentally and physically.

Conclusion

In conclusion it may be stated that, compared with most of the victims of Japanese occupation, the women and children interned on the Island of Singapore were fortunate in the conditions to which they were subjected and in the manner in which they stood up to these. They owe their good fortune to, (1) The authorities and individuals in the men's camp who did everything in their power to improve these conditions. Some of them paid with their lives for the risks they took in obtaining supplies, both of material things and of news, which did much to maintain the women's camp in good health and good heart; (2) our many friends outside the camp, Chinese, Eurasians and others who also took great risks in sending in supplies and news, particularly in the early days when this was possible; (3) the members of the Medical Reference Committee who took the greatest pains to assess and to improve the diets; (4) the doctors in both camps, and the nurses and hospital aids, who did their utmost to prevent sickness and to care for the sick; (5) perhaps most of all to the fact that the Japanese had not yet fully learned their "cultural" lessons from their Axis leaders.

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Discussion

Dr. J. V. Landor (c/o Crown Agents for the Colonies, 4 Millbank, London, S.W.), opener: I shall make my comments on these papers in correlation with my personal experiences regarding the Civilian Internment Camp in Singapore. I was interned there in January, 1943, but during the previous eleven months after the fall of Singapore I was allowed to continue to work as physician to the Civil General Hospital, which later was moved by order of the Japanese and under very trying conditions to the Singapore Mental Hospital, called by the Japanese "Miyako Byoin", i.e., City Hospital. This had been left very ill equipped owing to its having been evacuated during the actual fighting on Singapore Island.

During these eleven months the worst sick from the Civilian Internment Camp were usually sent out to the Civil Hospital, but this was stopped in 1943. When I was first sent into internment, I continued to see medical cases in occasional consultations in the camp and then, from the middle of 1943 till our release in September 1945, I was in charge of a dermatological clinic in the camp, to which all severe cases of skin disease and all cases of suspected nutritional disorder of the skin and mouth were referred.

Skin Diphtheria

Col. Bennett mentioned diphtheritic infections of skin lesions; many other observers in prisoner of war camps in this war also have mentioned them. I think neither they nor we in Singapore were able to test for the presence of *Corynebacterium diphtheriae* by culture and virulence tests, and Adami, Bowman and others (1918) during the last war threw considerable doubt on almost the very existence of skin diphtheria as judged by such tests. The ulcers that I suspect to have been diphtherial had a purple-black base with a deep purplish-red halo, and later developed a firmly adherent membranous dark grey slough with a foul smelling discharge; they always followed some injury, often very slight, and several patients a few weeks later developed paralysis with or without paraesthesia; two such cases developed palatal paralysis. Personally I think the evidence is strong that these were true cases of skin diphtheria but that such lesions are likely to occur only in the presence of severe malnutrition.

Blood Blister Disease

At my clinic 123 cases were seen of superficial, blood-containing blisters in the skin or mouth, often on the palate, and many other cases occurred in the camp but were not sent to the clinic, as it was known that no effective treatment was available, and the condition was not in general troublesome. These blood blisters were usually small, about 1/3 in. in diameter, and would soon burst and dry up; they would often recur, and occasionally they would leave an ulcer; sometimes they were quite large, containing clotted blood. Reference to this condition has been made by several speakers this afternoon. Some of the cases were associated in our camp with subcuticular haemorrhages, but both these conditions more often occurred independently. There is a remarkable

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resemblance here to onyalai, the disease supposed so far to be confined to Africa, between the equator in the north and Johannesburg in the south. Stein and Miller (1943, 1, 2) in South Africa found severe thrombocytopenia in all the cases of onyalai that they investigated and concluded that it is essentially similar to *purpura haemorrhagica*, thrombocytopenic purpura; they and other observers (Gear, Yeo and Bodenstein, 1944) have reported the condition in white people and Chinese as well as in Africans. In our cases, in ordinary blood films, there was no obvious thrombocytopenia, but no good technique was available for counting the thrombocytes. I suspect that we would have found thrombocytopenia, but the outstanding fact is that such blood blisters were not observed in Malaya before, and as they were so common in prisoner of war camps in the East I feel that the condition was due to malnutrition, and would suggest also that there may be a nutritional factor in the causation of *purpura haemorrhagica*. Although the condition as such was not serious in camp, I think that it played a part in haemorrhagic complications of other diseases that occurred. Gilkes (1934) suspected that onyalai was due to a vitamin deficiency; I found by trial that vitamin A (red palm oil), vitamin B complex (marmite and multiple vitamin capsules supplied by the Red Cross), vitamin C (fresh green vegetables, limes, pure ascorbic acid) and vitamin D (multiple vitamin capsules), were all ineffective. Fresh limes often pleased the patients but many relapsed in spite of having them and I think it unlikely that vitamin P was the missing factor; Stein and Miller (1943, 1, 2) consider that vitamins P and K are not related to onyalai. The deficiency of normal tissue support to the capillaries in the subcutis and submucosa may possibly play a part, and the disease may be due to lack of fat in the diet.

Anaemia

Anaemia was not a marked feature in our camp, as it was mentioned to be by Prof. Scott Macgregor and Dr. C. D. Williams.

Nutritional Oedema

Oedema was very common, and its causation probably varied greatly at different times of captivity. Disturbance of the salt balance in the diet, either upwards or downwards, often seemed to play a part. Low protein in the diet may actually have caused a low enough plasma protein content to cause oedema, especially in view of the interesting statement by Dr. Cruickshank that the plasma protein went as low as 4.72 g. per cent. Oedema was only occasionally due in our camp to beriberi, or so we considered.

Nocturnal Diuresis

This complaint, mentioned by Dr. Williams, was common in the men's camp as well as the women's, and was no doubt due to the relatively large carbohydrate content of the diet as rice.

Diarrhoea

I have nothing special to add. Soya bean needed very careful preparation to avoid its causing diarrhoea.

Beriberi

I would hesitate to diagnose beriberi on Dr. Cruickshank's single criteria. Loss of the knee- or ankle-jerk, associated with a positive squatting test, or oedema associated with either of these two, I would regard as positive proof. Beriberi was present in the camp up to the middle of 1942, but was soon controlled by the methods described by Professor Scott Macgregor, and never became serious later.

Riboflavin Deficiency

It is doubtful even yet whether we can accept stomatitis and eczema of the scrotum, to which some refer as the oro-genital syndrome, as evidence of riboflavin deficiency; Landor and Pallister (1935) in Malaya attributed these conditions, associated with spastic ataxia and amblyopia, to a deficiency of vitamin B₂, and perhaps the whole is a syndrome of riboflavin deficiency, but other portions of the vitamin B complex may be concerned. The combined degeneration of the cord without extensor response, referred to by the Chairman in his opening remarks, is described in that paper, and fractional test meals which we undertook at that time failed to show achlorhydria. It is of great interest to me that the whole of this complex has been observed in prisoner of war camps in the East.

Some cases of stomatitis in camp yielded to riboflavin, but it seemed to need doses as high as 20 mg. a day, and we had insufficient to make a satisfactory trial. Some cases of eczema of the scrotum with stomatitis occurred in 1943 and yielded to marmite; they were under the care of Dr. Pallister. The syndrome was hardly present later when more specific therapy was possible.

I think that burning feet is a separate syndrome, though quite possibly due also to a lack of some portion of the vitamin B₂ complex. Dr. Cruickshank mentioned that nicamide given intravenously afforded relief to several such cases, but this has long been known as a successful vaso-dilator, and vaso-dilatation rather than a specific vitamin effect may account for the relief. Burning feet was always a common symptom among Tamil coolies in Malaya, whereas it was not specially common in the gaols in 1933 and 1934 when Pallister and I made our investigations.

Nicotinic Acid Deficiency

Pellagrous dermatitis starting as a bright purplish-red erythema, the *mal de rosa* of Southern Europe, going on to desquamation, leaving a pale pink centre with brownish pigmentation and continued scaling at the edges, was observed by me in nearly 300 cases during our last 15 months of internment, *i.e.*, after our transfer to the more open area of Sime Road Camp. It occurred mostly on the dorsum of the feet and the back of the calves, less often on other areas exposed to the sun, never on areas not exposed to the sun. The affected skin sometimes blistered; the fluid in the blisters was usually serous, but sometimes blood-stained, suggesting the added deficiency of blood blister disease. It was rapidly curable by nicotinic acid unless delayed by blistering; stomatitis was not. I had reported (Landor, 1939) that nicotinic acid did not cure stomatitis with eczema of the scrotum in Singapore institutions. The apparent self-cure of many of our cases of pellagrous dermatitis may well have been

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due to refection, *i.e.*, manufacture of the missing vitamin by bacteria in the bowel, but they all had a tendency to relapse.

Phrynoderma

Dr. Williams made a reference to this; a few apparent cases occurred in our camp, but I think they were due to dryness and dirtiness of the skin rather than to any vitamin lack.

Septic Lesions of the Skin

These were common in the men's camp; their frequent slowness of healing was no doubt due to general malnutrition of the tissues.

Erythema Nodosum

I saw 36 cases of a disease resembling *erythema nodosum*, nearly all during the last 12 months of internment. The only points against this diagnosis were the oedema often present and the fact that the lesions were not always, though usually, well circumscribed. Several cases gave a recent history of dysentery or malaria or other general disturbance, but streptococcal infections, rheumatism and pulmonary tuberculosis were not markedly associated with the condition. Price (1946) mentions bad feeding and insanitary conditions as possible causes, and these were certainly present in our camp. In Osler's *Principles and Practice of Medicine* (Christian, 1944) it is stated that oedema of the surrounding tissues is sometimes present with *erythema nodosum*; this is not usually seen, but the support of such an authority makes me feel that this was in fact the diagnosis and that *erythema nodosum* may sometimes be due to malnutrition.

Hypotensive Symptoms

Dr. Smith and Dr. Williams mentioned that symptoms of hypotension were common amongst our men, especially on such a sudden lowering of the diet as occurred towards the end of 1943, after the Japanese secret police raided the camp. People tended to accustom themselves gradually to such changes and the symptoms would then become less prominent.

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Dr. F. Wokes (Ovaltine Research Laboratories, King's Langley, Herts): Could any of the speakers state whether the cereals, *e.g.*, barley, rice, or pulses used in prisoner of war camps had been germinated and if so what were the effects? Good results obtained by the Japanese themselves with a mixture of germinated barley, soya and green vegetables

have been reported to me by my former colleague, Dr. S. G. Willimott, who was a prisoner for several years in Japan. His findings, which are being included in a detailed report now being drawn up for the Admiralty, may link up with work now being done on the feeding of infants in Germany with foods made from germinated barley, pre-digested wheat or other cereals, and soya with suitable mineral and vitamin additions. These foods have been evolved as a result of experiments in a number of laboratories in this country with which we have been collaborating.

Dr. G. N. Jenkins (University of Durham Medical School, King's College, Newcastle upon Tyne): Could any of the speakers say what happened to the teeth of their patients? Was there a high incidence of dental caries?

Dr. D. A. Smith replied: In our camp there was a certain amount of dental caries, but to what extent it could be attributed to the nutritional factor I do not know. The facilities for treatment were so limited for such a long time that it is difficult to say whether it would have developed in any case without care or attention.

Incidentally, I had a few cases of supposed scurvy referred to me by the dental surgeon, but in none of them could I find any evidence of scurvy nor did they improve on administration of ascorbic acid. I think the condition was due to the continuous consumption of soft food and the absence of tooth brushes. Gingivitis was common.

Dr. R. C. Burgess replied: It is common practice in the East to sprout legumes, and we had in our diet a large amount of greens that were sprouting. This is supposed to raise the riboflavin content, but I do not speak with any authority on that. Apart from that I cannot say anything about germinating barley.

Dr. S. K. Kon (National Institute for Research in Dairying, University of Reading): Both Dr. Smith and Dr. Burgess mentioned the fact that treatment with yeast produced in camps did not give very spectacular results. I should like to know in what form the yeast was used; was it given fresh or was it killed? Evidence is now increasing that the factors from yeast are not well absorbed if it is still alive.

Dr. P. S. Selwyn-Clarke (Government Medical Department, Hong Kong): The experiences in the camps differed very much. In the Stanley Camp the soya bean residue was used rather than sugar, and the results from the yeast were very satisfactory indeed.

Dr. D. A. Smith replied: The results were satisfactory in our camp in so far as mouth lesions were concerned, when the yeast was given over a long period and in fairly big doses. It was not killed; it was given fresh. We had to give at least 2 oz. in order for it to be effective. We tried to reduce the dose but that made it ineffective, and we were unsuccessful in preparing enough to be of value to the whole population.

Dr. H. S. Stannus (13 Harley Street, London, W.1): Gopalan (1946), of the Coonoor Nutritional Laboratories, has recently reported an excellent response of "burning feet" to intramuscular injection of calcium pantothenate daily for a fortnight.

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Dr. E. Kawerau (Trinity College, Dublin): Was there any improvement in the enforced state of malnutrition in such conditions as mild diabetes, hypertension and cardiac arrhythmia?

Dr. P. S. Selwyn-Clarke: I am not qualified to talk about hypertension, but I can say that the carbohydrate diet appeared to help a number of conditions, for example, duodenal ulcers. I think there were three diabetics in Stanley Camp and they survived with flying colours after forty-four months of internment. There was a small supply of insulin, but it was not always satisfactory in quality.

Dr. D. A. Smith replied:

To Dr. Kawerau: Quite a large number of known hypertensives improved enormously in the first twelve months in our camp. Their blood pressures nearly all came down, but in the following two years they showed a tendency to accommodate to the new conditions, and their blood pressures at the end of internment were in most cases back where they had been at the beginning.

To Dr. Landor: In treatment of burning feet with nicotinic acid, we had no amide and we used the acid itself. We got a very marked symptomatic improvement when we gave doses of 100 mg. on an empty stomach by mouth, but we were unable to convince ourselves that the patients did not get pain again the next day.

Chairman's Closing Remarks

Dr. P. S. Selwyn-Clarke (Government Medical Department, Hong Kong): We have listened to a lot of very valuable observations this afternoon, and I will put one suggestion to the meeting. I think it would be rather a pity if more study was not given to this subject, and I am going to suggest for the consideration of the chairman and secretary of this Society that, when the opportunity arrives to give further study to these experiences in prisoner of war camps and internment camps, perhaps another meeting might be held. It would be a pity if this subject were not pursued, and I stress it because at the moment, as you have probably seen, Burma, which normally exports $3\frac{1}{2}$ million tons of rice a year, and Indo-China, which exports 1,600,000 tons a year, are unable to make those contributions to the other Far Eastern countries because of the general unsettled conditions. Therefore, I feel that the pooling of these experiences might give rise to suggestions as to how we can assist in this problem.

It is a matter of vital importance to my mind that colonial governments especially should be able to get the very best possible advice in connexion with these nutritional requirements. I will leave the matter in the hands of the chairman and the secretary, but I think it would be worth while having another meeting to give this question rather more consideration than is possible now.