by collapsed and folded chitinous laminations impregnated with caseous and calcareous *débris*.

In the sheep all gradations from the typical, simple, unilocular to the multicystic type occur and there seems to be no objection to the relatively simple explanation above given, that the various modifications are due to varying degrees of sclerosis of the adventitial tissues.

**Acknowledgments.**

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**References.**

(1) L. Sambon: *Journal of Tropical Medicine and Hygiene*, February 12, 1925, page 102.

(2) M. V. Carbonell and A. Zwanck: Second National Congress of Medicine, Monte Video, September-October, 1922.

(3) Wernicke and Ayerza: Quoted by F. Dévé.

(4) F. Dévé: Transactions of the First International Congress of Comparative Pathology, Paris, October 17, 1912.

(5) W. Ramsay Smith: "*Echinococcus Multilocularis*," *Medicine*, October, November, December, 1905.

(6) C. E. Corlette: "Hydatid Infestation of Bone, Multilocular Hydatid Disease and Ordinary Hydatid Cysts," THE MEDICAL JOURNAL OF AUSTRALIA, January 24, 1920, page 73.

(7) I. Clunies Ross: "*Echinococcus Multilocularis*: What is Meant by This Term?" THE MEDICAL JOURNAL OF AUSTRALIA, April 7, 1923, page 372.

(8) J. Llambias: "*El Equinococco Multilobar de los Bovinos*," *Anales de la Facultad de Medicine*, Monte Video, September, October, 1919, page 585.

(9) R. Melnikoff: *Centralblatt für Allgemeine Pathologie, Neue Serie*, 1899, *Seite* 670.

(10) F. Dévé: "*Echinococcose Alvéolaire Humaine et Echinococcose Multiloculaire Bovine*," *Anales de la Facultad de Medicina*, Monte Video, March-April, 1920, page 129.

(11) A. Parodi: Second National Congress of Medicine, Buenos Ayres, October, 1922, page 44.

(12) F. Dévé: Transactions of the first International Congress of Comparative Pathology, Paris, October 17, 1912.

(13) R. Virchow: *Berliner Klinische Wochenschrift, den* 31 *Dezember*, 1883, *Seite*, 824.

(14) F. Dévé: Transactions of the First International Congress of Comparative Pathology, Paris, October 17, 1912.

(15) Morin: Quoted by F. Dévé.

(16) Posselt: *Deutsche Archiv für Klinische Medizinische, Band* 59, 1897.

(17) F. Dévé: "*Nouveau Traité de Médecine*," Masson et Cie, Paris. Second Edition.

(18) Dobrotine: *Journal de Chirurgie* (Analysis), *Tome* V., 1910, page 320.

(19) Skaczewsky: *Münchener Medizinische Wochenschrift*, November 28, 1911.

(20) H. R. Dew: "The Histogenesis of the Hydatid Parasite (*Tænia Echinococcus*) in the Pig," THE MEDICAL JOURNAL OF AUSTRALIA, January 31, 1925, page 101.

(21) H. R. Dew: "Daughter Cyst Formation in Hydatid Disease: Some Observations on Its Causation and Effects," THE MEDICAL JOURNAL OF AUSTRALIA, October, 1925, page 497.

## FOOD DEFICIENCIES IN THE TERRITORY OF NEW GUINEA.

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MANY authors of works relating to dietetics emphasize the importance of the protein factor and some whose opinions are entitled to respect, go so far as to assert that among similar races living under identical conditions, the amount of protein in a diet determines the relative muscular power, physical endowment, degree of endurance, resistance to disease and even the place to which a tribe or race has won in manliness, energy and soldierly instincts.

If there be truth in this assertion and local observations support it, one can readily understand the lowly position in the scale of things of the Papuo-Melanesian tribes.

The average essential food requirements daily may be taken to comprise 120 grammes of protein, 500 grammes of carbohydrates, 50 grammes of fat and adequate vitamins of all types.

It is held by the writer that without a proper food balance or in the absence or relative deficiency of the essential vitamins no race can attain to physical excellence or civil progress.

The inhabitants of the Territory of New Guinea comprise two main primary stocks, modified by very many ancient and more recent invasions towards the production of a fixed composite population to which the name "Papuo-Melanesian" has been given.

The original negrito stock, with close-curled and frequently "peppercorn" hair and the so-called "predravidian" stock with longer hair have fused irregularly to produce a hybrid tufted-haired stock and throughout the Territory variants of these types verging either to the true "peppercorn" or the typical "fuzzy-wuzzy" predominate.

To the north and east, however, and occasionally elsewhere there are evidences of a previous influx of oceanic Mongols, on the north probably from the southern Philippines, on the east by reflux waves of Polynesians from the south, but this alien stock has merged so closely with the basic population that it is apparent only in occasional resemblances of physical feature and tribal custom.

The primitive and isolated conditions under which Papuo-Melanesian communities live, render them extremely diverse in language, custom and habit. There are semi-nomadic and migratory tribes who do not till the soil, and whose "villages" are haphazard strings of single huts; there are also tribes of hunters, fishers, sailors or warriors who constitute primitive agricultural and fishing communities with highly developed social organizations, fixed institutions and sometimes considerable skill in boat building, decorative art and the like.

The agricultural facilities of the Territory are not by any means universally good since, owing to the broken and irregular nature of the country, one finds between the coastal flats and the central

snow covered mountains of New Guinea almost every possible variation in climate, water supply, soil and surroundings.

It is interesting from the point of view of dietetics to compare the physique of the natives resident in the better localities with that of the inhabitants of the less fertile or less fortunate regions.

The natives of Matupi, near Rabaul, and of the Markham River in New Guinea and of parts of the peninsula of Talasea and of several other food favoured localities are healthy, strong, upstanding people. On the other hand, the primitive natives for example of the Rai coast of New Guinea resemble very closely the sufferers from fat deficiency seen in such numbers in central Europe as a result of the war.

The ordinary diet of the natives is at its best bulky and innutritious; it is hard to digest, deficient in fat and in protein and often poor also in vitamins. At its worst it is a famine ration.

Civilized peoples are so accustomed to regard a diet that satisfies the appetite, as fulfilling every requirement essential to health that they fail to realize that the massive carbohydrate foods of the native in his own village satisfy his hunger without providing him with an adequate quantity of the vital food constituents.

This, be it recalled, is under the best of conditions, while it must be remembered that he is by no means always so fortunately situated, for his primitive agriculture and his insufficiency against the seasons render his sources of supply uncertain and unstable. Such is the thriftlessness of the native, for example, that following a particularly good season and the storing up of a surplus, he will pass his time in continuous feasting until long past the proper time for planting and will consequently be reduced to necessity within a month or two afterwards and even to actual famine.

Such a famine is often only relative, that is to say, there will not be an absolute dearth of food, but the best native foods will be absent, leaving merely woody roots and tubers which of all the foods are those most deficient in both protein and fat and most irritating to the alimentary canal.

It may even be said that a vast percentage of all natives living under native conditions in the Territory of New Guinea lives in a state of chronic malnutrition or even partial starvation.

Among the common foods of the native are the following: Carbohydrates—taro, breadfruit, maize, bananas, sweet potato, sugarcane, crude sago, tapioca and yams; fats are represented by very small quantities of animal fat, the coconut, the native almond and various forms of ground nuts or peanuts. Among proteins are the pig, fish, flying foxes, wallabies, various kinds of birds and various kinds of shellfish, lobsters and so forth.

Formerly cannibalism was very widespread, but is now very restricted in range and non-existent in most localities.

In certain localities the natives are preeminently eaters of taro, in others of *saksak* (crude sago); others again, island tribes, live mainly on fish and are dependent on their mainland neighbours for taro or other food. In the main it may be said that coarse carbohydrates are extremely plentiful; proteins are obtainable with some difficulty; fats are extraordinarily rare and highly prized.

With regard to the essential vitamins, vitamin *B* is common in many of the native foods and there is generally little deficiency in this regard amongst natives living in village communities. Vitamins *A* and *C*, however, are considerably less common and in fact various deficiencies in the native constitution may in the opinion of the writer be traced to their scarcity.

This lack is emphasized also by the avidity with which the native seeks fats, fruits, fresh vegetables and edible leaves. The greater part of the fats obtainable, however, is of vegetable origin which fats, as is well known, are inferior to animal fat in vitamins.

Since the absence of the vitamins mentioned is considered to predispose towards tuberculosis, it is interesting to note that of the *post mortem* examinations performed in Rabaul over the last two years, the lesions of a rapid and fatal tuberculosis were demonstrated in one-third.

The character of the carbohydrate eater is opposed to the character of the races which include in their diet an adequate proportion of animal protein, in that it is deficient in the qualities of energy, initiative and progress, though, under the best conditions the carbohydrate eater equals and may surpass the protein eater in the power of endurance at monotonous physical tasks. Such nations readily become the hewers of wood and the drawers of water for the more vigorous nations. They make ideal porters and pack carriers and apparently they do not desire to be otherwise.

The eater of coarse carbohydrates, too, presents a generally lowered vitality and a definite diminution of resistance to such diseases as pneumonia, intestinal disorders and various ulcerations, while there is often seen an early general debility.

These manifestations are quite distinct from the classical food deficiency diseases which from time to time appear.

If the foregoing observations were accepted as established and the routine native diet were considered, it would be probable that the native of this Territory would be poorly developed and short in stature, inclined to the prominent abdomen and thin legs of malnutrition, lacking in energy and initiative, though possessed of occasional considerable endurance, particularly prone to intestinal diseases and various ulcerations and liable to succumb very readily to respiratory diseases, especially tuberculosis. This precisely mirrors the condition that is actually found.

When free natives are brought from their village fastnesses to work under indenture upon plantations or as Government labourers, the whole problem of their diet and feeding is rendered much more complicated.

To civilized people such a transfer seems a trivial matter, but to a native it is actually a period of most considerable danger.

He has lived in his village from infancy, isolated from the outside world and because he has been untouched by outside diseases, is surprisingly susceptible to them. Moreover, he has accustomed himself to feed upon a diet which, though almost always below the optimum scale set by investigators, he has learned to assimilate to the satisfaction at least of his minimal needs.

Once this isolation is invaded and its defences overset by his being brought under the menace of new diseases, a new environment, new conditions of work and new dietetic needs, the weaknesses of the native constitution are immediately manifest.

Apart from accidental epidemic visitations, the two factors which affect the death rate of labourers in this Territory are, respectively: (i.) the diet provided and (ii.) the proportion of labourers recently brought from primitive outlying districts (previously untouched) to the total labour strength.

Thus, for example, in any year in which many natives previously not in contact with the white man, are brought to work upon plantations or alternatively in which there is considerable movement of natives during the year from plantation to plantation, there will be a very considerable increase of morbidity and irrespective of the excellence or otherwise of the medical work the mortality statistics will rise considerably.

During the last year in the Territory of New Guinea there have been reached for indenture several native tribes previously unvisited by the white man and the mortality amongst these new recruits has been very heavy indeed in spite of every attention. Pneumonia and dysentery have been the the principal agents of destruction and it has been particularly noticed that the dysentery has directly followed the wholesale change of dieting which has been encountered, while the pneumonia has been in a large proportion of persons a terminal infection subsequent to the diarrhœa and dysentery above mentioned.

These natives were hill men and lived formerly on coarse native foods. They were transferred at once to shipboard conditions and a diet of polished rice and tinned meat.

It was noted by the present writer on his arrival in the Territory as Director of Public Health that while there were several alternative diets, that which was in most common use consisted of polished rice and tinned meat. There were many factors which brought about this lamentable state of affairs, among which perhaps the principal were that rice and tinned meat keep indefinitely, are readily portable and are packed in known and weighed quantities. As a result, though alternatives were offered under the Native Labour Ordinance, this dangerous diet has become almost the sole diet for indentured labour, with lamentable results.

It was at once decided that all the available native foodstuffs of the Territory should be investigated with a view to determine a diet which would meet the requirements of the natives and which at the same time would not impose too heavy a burden upon the small planter.

While this work was in progress, the need for urgent and drastic change was evidenced by two outbreaks of beri-beri in concentration camps which had been established to cope with the spread of gonorrhœa. On March 23, 1925 (March being a period of changeable weather during which the resistance of the unclothed native to disease is always lowered), all the patients at Vulcan Island, namely five hundred and thirty, were examined for the presence or absence of knee jerks and in fifty-nine knee jerks were found to be absent or very sluggish.

All these natives were put on 2·5 grammes of "Marmite" (autolysed yeast) with biscuit once a day and a plentiful supply of fresh native foods, while the "Marmite" was increased to 15·0 grammes twice daily on those days on which native food (fresh vegetables) was not obtainable.

On subsequent reexamination twenty natives out of the fifty-nine had recovered active knee jerks and eighteen had recovered sluggish knee jerks or active knee jerks in one leg only. On May 7, 1925, it was possible to report that every one amongst these suspects had recovered.

Of twenty natives with definite beri-beri which actually developed, six only were remaining in hospital on the date mentioned and these all ultimately recovered.

It was particularly noticed that in all cases in which the diagnosis was made before the stage of inability to walk without a stick, the patients were cured with apparent ease by rest and diet. Once past this stage, however, improvement was very slow, the patients retaining for a considerable time definite cardiac symptoms upon even the slightest exertion.

A mild epidemic of diarrhœa preceded the outbreak mentioned above, as is usual.

The outbreak described followed very definitely the closing of the native market adjacent to the Vulcan Island compound where on two days in the week native foods were purchased. The market stopped suddenly on February 27 owing to certain events of importance to natives drawing the native vendors elsewhere and within three weeks the first cases of beri-beri (nine) were diagnosed.

The second outbreak, which was in Kavieng, New Ireland, was more serious and arose from no such sudden cause, but as a result of a constant lack of all but a small percentage of fresh native foods. Of a monthly average of two hundred and eighty-four patients over the several months of the epidemic a total of 14% was affected, males suffering more heavily than females. At the time there was a certain amount of overcrowding amongst the male patients and these were engaged upon hard work. It was particularly noted, however, that males who were indentured labourers and had therefore been living on a changed diet, suffered to a greater extent than those who had been before admission to the

compound free kanakas. The actual figures were 23·1% and 14·8% respectively. Shortly after the epidemic became well established, supplies of native foods again became obtainable and there followed a general improvement.

With a few striking exceptions the disease was insidious in onset and attended by most of the clinical features described in textbooks; œdema of a fleeting type was frequently observed; severe œdema was not, however, a common occurrence.

The disease when established was in 95% of the patients of the dry type with rapid wasting of the muscles of the thigh and calf.

The mortality amongst these natives owing to a temporary but absolute lack of native foods rose at one time as high as 36%.

In 90% of the fatal cases the patients were bedridden and generally emaciated prior to death, but occasionally sudden death occurred from cardiac involvement.

These ominous and regrettable outbreaks were presented vigorously to the attention of the Government as instancing the urgent necessity of instituting by law fuller and more suitable native dietaries and the figures were supplemented by an examination of all contract labourers, undertaken on the instruction of the writer by the medical officers in charge of the outstations (notably at Manus). Indentured labourers at this station can only with the greatest difficulty obtain supplies of native food.

On examination of the police boys, Government labourers and Government prisoners of this station it was found that 59% were suffering from loss of knee jerks, partial or complete, the incidence being greatest amongst prisoners and least amongst the better fed police boys.

The diets now recommended for native labourers in the Territory allow of very considerable variation and the provision is insisted upon of adequate supplies of fresh food on a certain number of days per month. Though by no means ideal, they represent a very great advance upon present conditions. The main stipulation is that rice shall not be used on more than fourteen days in any one month.

The present standards under recommendation are not to apply to "house-boys" and are preliminary changes only, intended to deal urgently with the present position.

They are as follows:

*Diet No. 1.*

1. Rice ..... 1 lb.
   There may be substituted for rice any one of the following: Maize meal (1 lb.) or bread or biscuit (1½ lb.) or *saksak* (dry) or tapioca (dry) (2½ lb.).
2. Good quality wholemeal barley or sharps ..... ½ lb.
   There may be substituted for barley or sharps any one of the following: Dried peas, beans or lentils (½ lb.) or peanuts or galips (without shell) (¼ lb.) or germinated peas, beans or lentils (6 oz.); one only coconut per person may be given alternatively, but in that case the rice issue must equal not 1 lb. but 1½ lb.
3.[1] Fresh Meat (mutton, beef, goat, pork or other recognized native meats, all free of bone) ..... 3 oz.
   Or, alternatively, fresh fish (free of head and tail) 4 oz.
   There may be substituted for fresh meat or fresh fish any one of the following: Native oysters or shellfish (without shell) (4 oz.) or native lobsters, crayfish or crabs (with shell) (8 oz.) or at the option of the employer in cases of sickness, duck or hen eggs (two only) or milk (½ pint).
4. Pure water, for drinking purposes only ..... 6 pints
5.[2] Salt (distributed as one issue of 1 oz. weekly) .... 1/7 oz.

*Diet No. 2.*

1. Taro or breadfruit or yam ..... 5 lb.
   There may be substituted for taro, breadfruit or yam any one of the following: Bananas (7 lb.) or green maize (6 cobs); 7 lb. of *kaukau* (sweet potato) may be substituted, but it is not to be issued on more than fourteen days in any one month.
2. Coconut (ripe): One between two persons, approximately ..... 3 oz.
   Or alternatively Australian beef dripping ..... 2 oz.
3.[3] Preserved or salt or smoked or dried meat (all free of bone) or alternatively preserved or salt or smoked or dried fish issued in two, three or four issues weekly at the option of the employer, to equal weekly ..... 1 lb.
4. Pure water, for drinking purposes only ..... 6 pints
5.[4] Salt (distributed as one issue of 1 oz. weekly) .... 1/7 oz.

*Diet No. 3.*

1. Rice ..... 1½ lb.
   There may be substituted for rice any one of the following: Maize meal (1½ lb.) or bread or biscuit 2 lb.) or *saksak* (dry) or tapioca (dry) (2½ lb.).
2. "Marmite" or autolysed yeast ..... ½ oz.
   There may be substituted for "Marmite" any one of the following: Edible native leaves, free of stems, such as native spinach: *Aibika, kalakala, a-upa, kumu, kasut, pit, ailu* and so forth, or other recognized edible native leaves or shoots (½ lb.); or green vegetables, such as green peas, string beans, tomatoes or other similar vegetables, native or introduced, approved by the Director of Public Health (½ lb.); or green maize (2 cobs);[5] or fresh fruit, such as *papaia* (pawpaw) mango, avocado pear, cucumber, pineapple or other fresh fruits, native or introduced, approved by the Director of Public Health (1 lb.).
3.[6] Preserved or smoked or salt or dried meat (all free of bone) or alternatively preserved or smoked or salt or dried fish, issued in two, three or four issues weekly, at the option of the employer, to equal weekly ..... 1 lb.
4. Pure water, for drinking purposes only ..... 6 pints
5.[7] Salt (distributed as one issue of 1 oz. weekly) .... 1/7 oz.

*Cooking Arrangements.*

One native cook shall be employed for every forty or proportion of forty labourers employed.

[1] If preferred fresh meat or fresh fish may be distributed at the rate of 1½ lb. of the former or 2 lb. of the latter weekly in two or four issues.

[2] Alternatively an equivalent amount may be cooked with the food and thus issued.

[3] In place of preserved meat or fish, fresh meat or fish in the quantities and with the alternatives shown in Item 3, Diet 1, may be substituted.

[4] Alternatively an equivalent amount may be cooked with the food and thus issued.

[5] Where green maize is issued, 1 lb. of rice is sufficient and may be substituted for 1½ lb. rice.

[6] In place of preserved meat or fish fresh meat or fresh fish in the quantities and with the alternatives shown in Item 3, Diet 1, may be substituted.

[7] Alternatively an equivalent amount may be cooked with the food and thus issued.

TABLE OF FOOD VALUES.

| Foodstuff. | Calories. | Vitamins. A. | Vitamins. B. | Vitamins. C. | Remarks. |
|---|---|---|---|---|---|
| Polished rice | 1,632 | 0 | 0 | 0 | The absorption of rice diminishes rapidly with the quantity ingested; the larger the quantity, the smaller the assimilation beyond an optimum point. This diet is deficient in the antiscorbutic vitamin, but this is largely offset here by sunlight; and pawpaw which contains ++ vitamin *C*, is readily accessible on most plantations as an addition to diet. The issue of meat should be increased by half a pound daily to make the protein and fat adequate. |
| Wholemeal barley | 1,002 | + | ++ | 0 | |
| Fresh meat (water and salt) | 304 | + | + | Low | |
| Total | 2,938 | + | ++ | Low | |
| | | + | + | | |
| Taro (*Caladium colocasia*) | 2,916 | Very low | ++ | 0 | Ten per cent. of the value of taro is wasted owing to the method of cooking. There is an absence of *C* vitamin and planters should make available for addition to the diet any of the following: Sprouted beans (++), sprouted cow peas (*Vignum sinense*) (+++), germinated lentils (++), pineapple (++), pawpaw (++), tomato (+++); all these grow very commonly and readily. There is a great deficiency of protein, needing an addition of 50% total protein in grammes. |
| Coconut | 52 | + | ++ | 0 | |
| Preserved fish | 136 | 0 | + | 0 | |
| Total | 3,104 | + | ++ | 0 | |
| | | | ++ | | |
| | | | + | | |
| Polished rice | 2,448 | 0 | 0 | 0 | It will be noted in this diet that "Marmite" is official, but is in general too expensive to use. Planters should note that natives often reject edible leaves unless supervized, eating only rice and owing to the rice being cooked dry, the leaves must be cooked separately. Fresh fruit as above, particularly tomatoes, actually make a better addition. Caloric value is the lowest of the series and is actually even lower than is shown, since a considerable proportion of the whole value is not assimilated. Protein is low, also fat, the latter particularly so and half a ripe coconut should be added to provide a sufficiency. Where possible this diet should be used only if others are unobtainable. |
| Edible native leaves | 90 | ++ | ++ | ++ | |
| Preserved fish | 136 | 0 | + | 0 | |
| Total | 2,674 | ++ | ++ | ++ | |
| | | | + | | |

All foods must be of good quality and in the case of barley, sharps, dried peas, beans or lentils or similar articles issued with rice, maize meal, bread, biscuit, *saksak* or tapioca must be issued ready cooked.

Alterations or modifications in this schedule to suit the exigencies of local circumstances may be made by the Director of Public Health on application to him in writing and such approved alterations or modifications expressed in writing shall thereupon be regarded as a sufficient ration issue in respect of the labourers for whom such is solicited.

Where labourers are patients in hospital their food rations and weekly or monthly issues of tobacco, matches and pipes may be withheld, at the discretion of the medical attendant, where considered necessary for medical reasons; otherwise full issues must be made.

None of the diets set out above is sufficient, but each represents the greatest advance acceptable to the Administration upon present diets. In actual fact the diet that is official for the Territory at the present time and that these suggestions should correct to a large degree, represents a daily food value of only 2,550 calories and is absolutely lacking in vitamins of any kind whatever.

An analysis of the essentials of diets 1, 2 and 3 are given in the table.

From the foregoing it will be observed that these additions to diet are merely preliminary. The outstanding feature of the case, however, is that the position with regard to diet deficiencies is now apprehended.

It is trusted that with these immediate alterations and with subsequent supervision and correction, the diet for indentured labour throughout the Territory of New Guinea will greatly improve, while propaganda work in the villages is directed towards establishing better conditions in this most vital and least regarded aspect of native development and welfare.

I have to express my indebtedness to Dr. T. Clive Backhouse, formerly of Kavieng, and Dr. E. T. Brennan, now of Madang, from whose careful observations and figures in relation to the epidemics of beri-beri at Kavieng and at Vulcan Island respectively my own are drawn in these regards.

## SURGERY OF THE FRONTAL SINUS.[1]

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I AM introducing the subject of surgery of the frontal sinus in the form of a critical analysis of the different types of operation devised for the cure of frontal sinus suppuration.

My experience during thirty years has not been confined to a small number of cases and during that period I have encountered many which have required great judgement in the selection of the particular operation suitable to the condition. The question of

[1] Read at a meeting of the Section of Oto-Rhino-Laryngology of the New South Wales Branch of the British Medical Association on May 27, 1926.