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The Chairman and Members,  
Standing Advisory Committee for Medical Research in East  
Africa.

Under Minute X of the third meeting of the Committee  
it was agreed that all the available information on dietary  
surveys and nutritional assessment of Africans in various  
areas of East Africa should be collected and collated by the  
East African Bureau of Research in Medicine and Hygiene.  
In accordance with this, a report is now submitted.

Kenneth Martin.

DIRECTOR.

REPORT ON DIETARY SURVEYS AND NUTRITIONAL ASSESSMENT IN EAST  
AFRICA.

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## I. INTRODUCTION.

Dietary Surveys as such have not been carried out extensively in East Africa, though a number of workers have described in general terms the diet consumed by various tribes and given some useful information on this point.

Comparatively little also has been done as regards the correlation of signs of nutritional deficiency with the dietary intake. In these circumstances, while it has been possible to collate information on the work done on these subjects, the total of knowledge is not great, though enough to allow a very fair estimation of the nutritional state of the population.

Methods of assessment of nutritional status may be direct or indirect. The first consists of an evaluation of the occurrence of frank deficiency diseases and gross under-nutrition, the prevalence of signs of nutritional deficiency; and the second of the prevalence among the community of diseases considered to relate to under-nutrition, and of the reflection of vital statistics and other data.

In an attempt to present the state of affairs as widely as possible, all these matters will be considered in the following report.

## II. DEFICIENCY DISEASES.

The available records and experience suggest that the occurrence of Pellagra, Beri Beri and Scurvy is not such as to be of major importance in the East African territories, and periodic small outbreaks have often been associated with particular conditions. At the same time there is not inconsiderable other evidence of vitamin deficiencies in various areas, with a predisposition to precipitate into frank disease at times.

Tables showing the periodic incidence of these diseases are not included, as those available are too low to be of comparative significance, while the position is further invalidated owing to interruption for years of accurate disease returns.

i. Scurvy. In a brief historical review of this disease it is found that Gilks (1925) described nine cases of 'Rand Scurvy' among Masai prisoners in Nairobi Gaol, on an 'adequate' diet, which however contained less protein and much more carbohydrate than in their natural state. The Annual Report for 1906 of the Medical Department of Kenya described an outbreak of a disease with similar signs and symptoms among Nandi prisoners, whose food habits approximated to those of the Masai. Their protein diet was Indian corn and beans. Two of the Nandi cases were removed from their surroundings of close confinement and early amelioration was noticeable without any improvement of diet.

Wilson (1926) reviewed these and other cases reported, among them 13 specially confined Masai prisoners on a daily diet of 18 oz. maize, 8 oz. meat, 8 oz. potatoes, ½ oz. ghee, ½ oz. salt, and of 2 lemons weekly. This diet was considered by Kelly and Henderson (1927) to be barely adequate in fat and deficient in calcium and vitamin C. It was concluded that the development of the disease was due to close confinement, the pathogenic factor being lack of muscular exercise. Carman (1928) in noting a case of scurvy in a prisoner, thought that the psychological effect of confinement was a precipitating factor.

Occasional cases of Scurvy were reported among labourers on railway construction, and Esler (1929) described 4 cases among troops in the Northern Frontier Province following a period of prolonged drought with shortage of vegetables and milk. Rapid improvement resulted with the addition of raw onions and  
to the diet.

The type of Scurvy encountered, simulating the Rand Scurvy of South Africa, was probably in most cases associated with mixed deficiency. Mitchell (1933) for example, described cases in prisoners in Uganda who exhibited cardiac weakness, local oedema and petechial haemorrhages. The outbreak was attributed to the poor quality of the sweet potato in the diet, otherwise composed only of groundnuts or rice or beans in lieu of the potato, but cure resulted with a mixture of green vegetables, germinated beans and meat. Very few other reports are to be found, except that of a larger outbreak among labourers in Tanganyika in 1938, and one of the latest is that of Keremerwa (1941). He noted cases in long-term Karamojong prisoners in Uganda on a diet of maize meal, meat, beans and salt. The diet of free Karamojong varies according to season, being in wet seasons milk and blood, greens and tubers, and in the dry season maize, sorghums and seed pods.

Anderson (1943) said that cases of Scurvy occurred in African soldiers in the Northern Frontier Province of Kenya in 1940, there being 121 cases since the outbreak of war.

The main interest lies in the fact that has long been recognised that the relatively few cases are indicative of a much more widespread pre-scorbutic state, and that in given circumstances precipitation into frank disease may occur. Thus the Tanganyika Medical Department advised particular caution in the case of recruited labour arriving for employment after a long and arduous journey, while most cases seem to have occurred under conditions of physical and possibly mental stress. Indications of minor degrees of vitamin C deficiency have been described from many areas.

ii. Pellagra. Here again there is no evidence that this disease is or has been of frequent occurrence or of the same degree as found in territories further south. An editorial on the subject in the British Medical Journal of 1938 stated that Pellagra was unknown in Kenya in adults. Maize has for a long time been consumed as a staple in many parts of East Africa, the yellow variety formerly being grown, but was usually supplemented. Skin manifestations indicative of this particular associated deficiency have of course been described.

The first record in Uganda was stated to be by Boase, who found 19 cases of Pellagra in adults in Lira prison in 1927, and Nair had recorded one case in an adult Indian in Mombasa in 1924. Anderson (1939) described 6 cases of Pellagra in Africans, two being mental cases, four of which responded to a generous diet with marmite, and two to nicotinic acid. Harkness (1934) reported many undoubted cases of Pellagra in Africans in the Bukoba district of Tanganyika, whose diet was mainly bananas with occasional groundnuts and beans, with no available meat or milk following an outbreak of rinderpest. He also noted night blindness, corneal ulceration and parotid enlargement in this population.

Anderson (1943) stated that a few cases occurred in African soldiers during the war, but were probably due to pre-enlistment deficiency. Piers (1947) described a number of cases of Pellagra in mental cases in Nairobi, associated with other signs of mixed deficiency.

Hutton (1950) recorded a case of an adult African with severe neuropathy of the spinal cord and severe nicotinic acid deficiency, pellagrous type of tongue and patches of hyperkeratinised skin.

Apart from such scanty references, instances of occasional outbreaks of Pellagra have been found mentioned from time to time in departmental reports, and many of these have been in prisoners or patients in mental hospitals.

The vast majority of cases are in Africans, and the incidence in other populations amounts to nil. Of recent years the incidence reported from Uganda has been very low, and highest of the three territories in Tanganyika, but figures are so small that no particular problem seems to exist in regard to this disease.

iii. Beri-Beri. Again with regard to this disease reports are scanty, and the possibility of misdiagnoses must be considered. Wilson (1925) refers to the decimation of two companies of African troops in Somaliland from this disease. Gilks (1933) said that outbreaks of beri-beri were reported with some frequency just before the first world war in soldiers in the Frontier Province of Kenya, and a few during that war, mainly among Buganda. The condition with the local name of 'chachaleh' reported by Buchanan (1932) from Somaliland, is believed to be a mixed deficiency with a more prominent lack of vitamin B complex; and the paraesthesia noted was found in inmates of internment camps in the Far East.

Anderson (ibid) recorded 18 cases in Somali soldiers eating polished rice. Charters (1944) described a case of beri-beri in a European officer in Somaliland, living on a diet estimated to be deficient in vitamin B1 and also riboflavin.

The condition is certainly uncommon in East Africa, especially if consideration is given to the much greater facilities for diagnosis that exist today. One thing that emerges from a study of these diseases and of various manifestations of sub-nutrition is the possibility of mixed deficiencies, and the difficulty of accurate labelling of some conditions encountered.

Kwashiorkor. Brief mention is made of this condition, which is very fully documented, on account of its relation to protein deprivation and other matters. Published figures of incidence are remarkably low, figures in 1951 of in-patients in Government hospitals in Uganda and Kenya being 192 and 562 respectively, while in Kenya it was stated that 1218 cases were treated as out-patients. According, however, to the occurrence of the earlier and milder manifestations of the syndrome, particularly dyspigmentation, then the disease must be extremely common, and is of further importance because of the damage done to the liver and the effects in adult life.

A study of the distribution of kwashiorkor in Kenya shows that the disease does not occur, or the incidence is low in tribes consuming protein foods and milk. The main incidence is among the Kikuyu in the Central Province, where, however, considerable numbers of cattle and small stock are kept if not consumed. The problem may not be so much one of non-availability of animal protein, as of non-consumption in areas where vegetable protein is low. The reflection therefore is on food habits and predilections, especially at the weaning period and in early life, and the dietary of mothers; and becomes as much an educational matter as anything else.

It is of interest and importance to note that it is reported from more than one district that high prices are tempting the people to sell stock, milk, chickens and eggs, with the result that their diet is largely restricted to carbohydrates, and the children are deprived for example of the milk which they used formerly to be given.

In Uganda there is evidence of the occurrence of kwashiorkor in most parts. It is frequently seen in Kampala and Mbale District and is reported to be more commonly encountered in the West Nile District, but less common in such districts as Toro and Kigezi. Here again it is evident that dietary methods and predilections play a part.

In common with other deficiencies, there is a seasonal incidence or increase of this condition, usually during the second and last quarters of the year; and attributed to food shortages during the preceding months.

### III. DISTRIBUTION OF DEFICIENCY DISEASES.

Information on area or tribal differences in nutritional diseases is difficult to ascertain for several reasons, including the low returns. In Kenya the main incidence of kwashiorkor is in the Central Province among the Kikuyu tribe, being particularly high in the Embu-Port Hall district and in Meru. Diet is mainly maize, bananas, some beans and millet, and vegetables, and there is no doubt that little animal protein or milk is consumed. A high incidence is also reported from Makindu, which serves both the Kikuyu and Mkenba tribes, but is much less in the Machakos area of the Mkenba country. A very high number of cases was returned in 1952 from the hospital at Molo in the centre of a European highland farming area, which seems inexplicable; and these cases would be in children of farm labourers. The number of cases in the Coast Province is relatively low and of no apparent significance. The disease is very low or absent among the meat eating tribes in the higher parts of the Rift, and also among the Masai and the tribes of the Northern Frontier. Generally speaking incidence is low in the Nyanza Province, except for North Nyanza.

The number of cases of beri-beri and scurvy recently reported are so low as to be of no moment.

As regards pellagra, the two areas recording significant numbers are Nairobi and Kakanega. Both, however, serve wide areas and include prisons in both, and the mental hospital in the case of the former. Elsewhere the Coast Province shows a small but distributed number.

In Uganda the incidence of all deficiency states is highest in the Northern and then the Western Province. The incidence of kwashiorkor is highest in the West Nile district and the Bubulu district of the Eastern Province, and thereafter at Kampala. Pellagra, according to latest returns, occurred only in one district of the Northern Province, while scurvy appeared to be almost negligible. Expressed as a rate per 1000 in-patients the figures are, for all deficiency states, Buganda 4.4, Eastern Province 4.1, Northern Province 10.4, and Western Province 8.2.

Information is not available on these lines from Tanganyika, but a survey is proceeding from which results will be obtainable later.

### IV. DIETARY SURVEYS.

It must be stated that surveys with the object of accurately evaluating the various nutrients in the dietary and relating these to clinical findings of the nutritional state have not been performed on many occasions in East Africa, and those that have will be described first. Many workers, however, have made valuable contributions to the knowledge of dietary habits, and a resume of these will be given.

i. The dietary and nutritional survey of the Masai and Kikuyu tribes in Kenya done by Orr and Gilks (1931) from 1926 onwards, was a classic example that provided a stimulus for further work. It was found that the Masai diet consisted mainly of milk, meat and blood, and that the Kikuyu was mainly a bulk of cereals, with roots and fruits. As regards chemical composition, the Masai were shown to have a relatively high intake of protein, fat and calcium, and the Kikuyu a high intake of carbohydrate and a low one of calcium. The biological value of the protein in the male Kikuyu diet was considerably lower than that of the Masai and their diet was very low in fat. The chemical content of the male diet was high in phosphorus and very low in calcium, but the intake of calcium and sodium by women was much higher.

In contrast the Masai diet contained a liberal supply of the mineral elements.

Physical measurements showed that the full-grown Masai male was on an average 5 inches taller and 25 lbs. heavier than the Kikuyu counterpart, and muscular strength determined by dynamometer was 50 per cent greater.

Bony deformities, dental caries and anaemia, pulmonary conditions and tropical ulcer were much more prevalent among the Kikuyu. Rheumatoid arthritis and intestinal stasis were more common among the Masai.

Signs of malnutrition and symptoms suggestive of rickets were common among Kikuyu children, especially males. In addition to bone deformities, 40% of the boys had some dental defect, 48% were clinically anaemic, and 62% suffered from spongy gums. There was also a high incidence of enlarged tonsils and cervical adenitis. No mention was made of other signs.

The report contains an elaborate series of analyses of the content of various dietary constituents.

Complementary to this a survey of another part of the Kikuyu Reserve was done by Anderson (1937) at Kianbu, a district where European farms are contiguous with African areas. He found the bulk of the daily intake to be  $3\frac{1}{2}$  lbs., the same as that in the previous survey. New foods such as the potato had been introduced, and the variety was greater, though low in animal protein and deficient in fats and calcium. Deficiency diseases, apart from kwashiorkor, were rarely seen, xerophthalmia was uncommon and ulcer rare. Dental defects were found in only 4.3% of the children, a much lower figure. The incidence of pneumonia in Africans employed on farms, whose diet was mainly maize meal, was five times higher than in those living in the Reserve.

ii. A small dietary survey of 13 district and 25 town families was carried out in Zanzibar by the Smiths (1935), which was followed by a nutritional review undertaken by a Committee. A survey of Penba had previously been done by Young.

Locally grown foodstuffs were entirely inadequate, and importations of the following articles were necessary to allow of the poundage per annum per head shown, which was the actual consumption:

Rice (polished)	159 lbs.
Wheat	41 "
Millet	14 "
Maize	5 "
Sugar	52 "
Tinned milk	$1\frac{1}{2}$ "
Meat and fish	4 "
Edible fats	4 "

Figures of local production were not available, but foods grown included rice, cassava and sweet potatoes in small quantities, and plantains. Milk, eggs and fish were consumed rarely in low amounts. It was evident that the diet was markedly deficient in animal protein and fat. Meat and dairy produce were hardly used by the bulk of the population, and coconut oil was the only fat commonly available. There was an existence of an unknown degree of avitaminosis, and, while no evidence of gross malnutrition was encountered, two-thirds of the school children were said to be under-nourished.

iii. A survey of the nutritional position of the natives of Tanganyika, undertaken by an ad hoc Committee in 1937, provided little specific information. It was stated that the majority of the population did not get enough meat or milk, and that shortages occurred periodically as a result of the habit of

There was no definite information as to whether tribes suffered as a unit in prosperous years from food deficiency, but cases of malnutrition were common with shortages. Primary mineral insufficiency had not till then been reported in man. Deficiency diseases had been reported from many districts, particularly beri-beri and rickets in the Tanga Province, and scurvy in the Lupa area.

iv. An interesting combined agricultural and health survey was undertaken in 1936 by the Agricultural Survey Committee in Teso, Uganda, the members including Loewenthal (1937). Two communities, the Ajuluku and Opani, were concerned. Apart from the regular consumption of fish by the Opani, the diet of each was similar.

The staple food was millet, augmented at times by sorghum, cassava and sweet potatoes. Groundnuts, simsin and beans were consumed on most days in small quantities, with butter-nut oil for cooking, and green vegetables were available for most of the year. Meat and chickens were very rarely eaten, but fish was eaten almost daily by the Opani.

Using certain criteria Loewenthal showed that there were marked differences between the fish-eating Opani and the non-fish-eating Ajuluku. Signs of vitamin A deficiency were common, but distinctly less in the Opani. Ulcer was not infrequent among the Ajuluku, and the only case seen in the whole of the Opani was a man who did not eat fish.

Other conditions were not significantly different. Pellagra, beri-beri and scurvy were not seen.

v. A report on nutrition and its context in Bukoba district on the western side of Lake Victoria was made by A.T. and G.M. Culwick in 1939, and covered all aspects of diet and agriculture. Although this was related to the nutritional state of the people, there was no detailed account of a representative sample.

Bananas formed the predominant article of diet, with beans, peas, vegetables and stewed fish or meat as side dishes. The main article was varied by eleusine, yams or sweet potatoes, and though cassava was sometimes eaten, maize was never used. Sorghum was reserved for beer. Meat was a rare luxury, fish freely used, and milk and butter scarce.

Analysis showed that the protein intake was poor in quality and quantity. Calcium, iron and vitamin A reached a bare minimum, while vitamins B and C and phosphorus were in good quantity.

The general health was of low standard, though the nutritive status was relatively high. The most marked signs of deficiency were a glazing and crackling of the skin, and there was a noticeable difference between the few children who got meat and milk and the remainder.

The findings seen to be in marked contrast to those of Harkness during the previous years, but this was under near famine conditions and the Culwicks' investigations were confined to lake shore areas.

vi. A small survey was done by the Tanganyika Nutrition Officer of the Mlalo basin in the Usambaras in 1948. Foodstuffs consumed varied with season, and consisted of maize, sweet potatoes, beans, vegetable leaves and fruit. Meat was eaten very occasionally, and milk taken in small quantity, but dried fish was available. On a correlation of the clinical and dietary findings there was evidence of inadequate intake of protein, or certain amino-acids, and of B vitamins.

Follicular keratosis was prevalent in school boys. It was mild and not associated with eye changes, probably the high seasonal carotene intake from pumpkins and guavas providing sufficient reserve to prevent signs of vitamin A lack.

vii. This officer also carried out a dietary survey and nutritional assessment at Newala in the Southern Province of Tanganyika, on a plateau at 2,600 feet.

Here again consumption of foodstuffs was seasonal, and they consisted of maize, rice, sorghum, groundnuts, peas, vegetable leaves and fruit. Animal products were rarely available in quantity. No cattle were kept, and goats' milk was used only occasionally. Chickens and small game were sometimes eaten.

A low intake of vitamin B complex was shown by such signs as cracked inelastic skins, etc., but was not so marked as in Mlalo, being probably a reflection of the variation in the staple and the use of grain beers in the latter. Follicular keratosis was present but mild.]

viii. Laurie and Trant (1951) recorded results of a dietary and nutritional survey of Ukara island in Lake Victoria. The staples were millet and cassava, with small quantities of sweet potato, yams, maize, rice and groundnuts. Green vegetables were available, but little oil and fruit. The average annual consumption per head of beef was estimated at 28.4 lbs., fish 102 lbs. and milk 51.5 lbs. The calorie intake of males and females was respectively 2500 and 2000.

Other than one case of pellagra, no deficiency diseases were seen, and no case was identified as tropical nutritional anaemia. Night blindness was common, but xerophthalmia and keratomalacia were not seen, and there was very little phrynoderma. Respiratory diseases were common and affections of the gums were noted, but tropical ulcer was extremely rare.]

ix. In addition to these representative surveys which are not completely exhaustive, a number of workers have recorded observations on tribal diets and the relation of diet to health.

Callanan (1926) and Carman and Roberts (1934) described the diet of the Luo tribe, with little difference between that of males and females. In addition to staples consisting of maize, millet, cassava, sweet potato, beans and vegetables, blood, fish, chicken and eggs were consumed. Children were given sour milk and gruel, and used the milk of sheep and goats. In common with some other tribes, milk might be mixed with cow's urine.

McNabb (1929) gave the diet of African employees of the Magadi Soda Company as 14 lbs. maize meal, 2 lbs. meat, 2 lbs. peas and beans with salt weekly, and occasional vegetable supplements. The improvement in weight, vigour and physique in six months residence was marked. Serious illnesses such as pneumonia were uncommon and tropical ulcer was rare.

This improvement on a presumptive adequate diet and relative freedom from disease has constantly been noted among labour and military recruits, Procter (1931) and Anderson (1943) giving examples in each case.

Other examples of such notes are those by Kernerwa (1941) on the diet of the Karanojong, and by Gokhale on that of the Sandawe tribe, in which he emphasized the absence of ulcers in this meat-eating tribe.

As regards experimental work, it has been shown on numerous occasions that there is a marked response and comparative improvement in physique and tone in African children given a regular supplement of milk. Improvement has also been noted when wheat was substituted for maize flour.

#### V. SIGNS OF NUTRITIONAL ILL-HEALTH.

Much of the earliest work on this subject in East Africa was done in Uganda. Loewenthal (1933) described the condition known as Phrynoderma, believed then to be pathognomonic of vitamin A deficiency. Previously he had described a dermatosis in the form of a non-suppurating papular eruption in prisoners in the Uganda Central Prison, most of whom showed also night-blindness

and xerophthalmia. All these manifestations cleared up with the administration of cod-liver oil.

Other Uganda workers, Owen and Mitchell (1933) found xerophthalmia and keratomalacia in prisoners. No such signs of deficiency occurred among prisoners in the Mengo gaol, where the sole diet was 4 lbs. of sweet potato daily.

Loewenthal (1935) in referring to this, stated that he had seen no signs of deficiency until then in thousands of free Buganda. He had demonstrated a follicular eruption in prisoners in Kenya in 1932, when Sequeira stated he had seen numerous cases of this in various parts of Kenya. In an examination of 1112 Buganda, 1000 being school children, Loewenthal discovered 300 cases of vitamin A deficiency, the signs recorded by him being xerophthalmia, night-blindness and phrynoderma. The percentage in children was 30, and in adults 8, and deficiencies were more readily seen in young children than the older. Aligning this with a system of monoculture, these deficiencies were seen in the dry season when there was a great lack of the staple sweet potato, milk and vegetables. It should be noted that night-blindness was known to have been of not uncommon occurrence among prisoners, and Gilks (1933) referred to the many cases seen by him as early as 1912.

Gordon and Sequeira (1933) described cases of xerophthalmia and dermatosis in cases in the Nairobi Mental Hospital on a diet of maize, groundnuts, rice, potatoes and meat, which responded to cod-liver oil and fresh vegetables. Among these there was a possibility of refusal of food.

Owen and Hennessey (1932) showed that liver disease caused severe ophthalmic manifestations of vitamin A deficiency by interfering with the metabolism of carotene, while Hennessey (1932) also showed experimentally that the anti-infective action of the vitamin was not related to the mobilisation of leucocytes.

Harkness (ibid) found in 1934 among the population of the Bukoba district of Tanganyika a common incidence of signs indicative of a mixed deficiency. These included night-blindness, corneal ulceration, parotid enlargement, tongue signs and dermatoses. Near famine conditions existed in the area at the time.

Anderson (1937) in an examination of the Kikuyu in the Kiambu district found xerophthalmia to be uncommon, though the diet was deficient in vitamin A.

Mackenzie (1939) reported on the examination of 200 Africans attending Morogoro hospital in Tanganyika. The local tribes eat very little meat or fish, and imported labourers fed almost exclusively on maize and beans, with very little vegetable supplement. The majority showed signs of vitamin A deficiency. Phrynoderma was found in 50%, and xerophthalmia and Bitot's spots in 4%, but keratomalacia was rare. There was poor dark adaptation and consequently low reserves of vitamin A in 93% of a group of 94. This improved under vitamin A treatment, and vitamin A itself was more powerful in this respect than vegetable carotene. Other work on hypovitaminosis was done by this author.

In observations showing the response of the African soldier to a balanced ration, Anderson (1943) noted that in early 1940 follicular hyperkeratosis was often seen and xerophthalmia and night-blindness not uncommon in troops in forward areas unable to obtain full rations. The use of a vitamin A fortified ghee was preventative.

Piers (1947) described signs of a mixed deficiency state in mental cases in Nairobi, exhibiting pellagrodema, follicular lesions, perliche, and Bitot's spots.

Philip (1943) contributed a useful review of work done by him in observations on over 2000 Nairobi African school children. 55% of these were found with phrynoderma, which was taken as a

sign of vitamin A deficiency, and in others without this sign practically all had a defect of night-blindness. It was stated that the majority showed a deficiency of the pellagra-preventive factor in the form of mosaic skin. While no definite cases of scurvy were seen, 26% of children had bleeding gums. No indication was given of the presence or absence of other signs, but 17% were definitely anaemic.

In school children in a rural area of the Nyeri Reserve in Kenya, phrynoderma was found to be very common, and there was also a prevalent mosaic-like pattern on the skin. On the other hand, evidence of vitamin A deficiency was much less among the Wadigo at the Coast, where the yellow variety of maize was grown.

Macgregor, in a small survey in the Usambarara region of Tanganyika, found evidence of vitamin B complex deficiency in 23% of those examined, the criteria being cracked, dry or shiny skin, angular stomatitis and cheilosis. All but 3% had a haemoglobin distribution of under 71%. An avitaminosis survey of Kongwa in Tanganyika by Henderson Begg in 1948 showed the following results in 64 people examined, believed to be mainly children. Practically all had roughening of the skin in the same distribution as that of hyperkeratosis found in 11%. Xerophthalmia was present in 3%, and 12.5% showed photophobia and excessive lachrymation. Cheilosis was found in 6.3%, but no angular stomatitis. There was no disease of the gums.

Finally, among the few recorded analyses of stigmata of malnutrition, the following table by the Nutrition Officer, Tanganyika, of the results of surveys in the Usambarara region, the Southern Province and in Dar-es-Salaam, all in Tanganyika, is reproduced.

% Incidence of Signs of Nutritional Ill-Health.

Signs of Ill-Health	Newala 121 Women	Newala 548 Child- ren	Mlalo 353 Children Apr.1948	Dam 249 Girls Oct.1947	Dam 245 Boys Jul-Aug. 1947
Hair. (Dry, straight, hypo-chromatrichia)	2.4	5.5	15.3	9.6	32.6
Eyes. (Photophobia, Conjunctival changes)	9.1	9.7	17.0	0	29.4
Lips. (Cheilosis, Angular stomatitis)	11.4	9.0	12.2	1.2	44.8
Gums. (Swollen, bleeding on pressure)	3.3	8.6	2.6	0.4	9.0
Teeth. (Caries)	68.5	20.5	7.4	22.9	74.3
Tongue. (Colour changes, fissures, changes in papillae)	10.7	1.9	2.8	0.8	11.3
Skin of body & limbs					
1) Dry, inelastic, cracked permanent gooseflesh	14.7	14.6	39.4	4.0	-
2) Follicular keratosis	11.6	9.5	10.5	6.4	-
Ulcers & Ulcer Scars	2.5	10.3	36.5	8.0	3.7
Musculature - poor development	0	8.6	17.0	3.6	15.2
Anaemia gross	12.4	9.9	-	-	-

Many children had shaven heads.

VI. OTHER CONDITIONS.

The occurrence of certain other diseases may be taken to indicate to some extent at least a state of impaired nutrition and

Lowered resistance.

Respiratory diseases, pneumonia, broncho-pneumonia and bronchitis constantly rank high among morbid conditions. Some caution is necessary in drawing any inference from the incidence of tuberculosis, which varies throughout the territories. Recent tuberculosis surveys have in general shown a high rate of tuberculin reactions with a low incidence of obvious disease, and it has been shown that a high proportion of Africans are capable of overcoming primary infection. While dietary lack may be an important aetiological factor in the acute and rapidly fatal form of the disease that may be seen, there is no doubt that many Africans develop tuberculosis, or increased sensitivity rate are shown, when they adopt urban residence or otherwise live under conditions where the chances of infection are enhanced.

Enteritis above and below the age of two years is not uncommon, and Mackenzie (1940) described cases of severe afebrile non-infective diarrhoea with high mortality among African labourers supplied with inadequate and ill-cooked food. There are other instances of severe and fatal dysentery recorded among debilitated Africans under conditions of stress.

Much work, which is not quoted, has been done on the subject of anaemia, in conjunction with the study of kwashiorkor and otherwise, and there is a considerable amount of information on the various forms of anaemia encountered. Evidence is accumulating that substantial degrees of anaemia are common and widespread, in which, apart from infections, dietary lack particularly of protein appears to be important; though the part of helminthic infestations does not seem to be decisive as a rule. While there should in principle be little difficulty in the African obtaining adequate supplies of iron from his high cereal diet, there is much iron deficient anaemia, which may be precipitated by infection or infestation. The field of mineral deficient anaemias in particular could well be further investigated.

Physiological changes such as the imbalance of serum proteins in a state of protein deficiency, and as correlated with anaemia, have been studied, and further work on these lines is proceeding.

If tropical phagaedenic ulcer be regarded as associated with a state of malnutrition, then its incidence is evidence of widespread deficiency of food elements, probably of protein and the vitamin B complex in particular, and possibly also of fat and vitamin A. This question is discussed in another report, but in brief the incidence, which may be as much as 30% of a given population, is highest in those communities on a preponderantly carbohydrate diet with little or no animal protein or milk; and conversely low or absent.

Tropical ulcer indeed affords a very significant manifestation of the effects of poor diet in Africans.

## VII. FOOD TABOOS.

These are among factors that militate against proper food intake, especially of animal protein. They are many and varied, interesting and intriguing and sometimes associated with ceremonial. Taboos may operate even when there is a shortage of staple articles of diet and foodstuffs which are taboo are available.

Chicken and eggs are commonly forbidden for women and girls in many tribes, but may be allowed for small girls in addition to the males. It is common, however, as part of the economy for eggs not to be eaten, though addled eggs which the hen does not hatch out may be consumed. Women of the Luo tribe in Kenya were debarred at one time from eating the meat of sheep, elephant, rhinoceros and hippopotamus, and such fatty foods are proscribed in some tribes for pregnant women possibly to ensure a small child at delivery. Kikuyu women eat a great deal of high

calcium containing millet and beans after childbirth as a lacti-  
ficient, and also consume plant ash.

In the Mwanza district of Tanganyika a variety of peculiar  
foodstuffs are not consumed by anyone. These include the meat of  
carnivores, snakes, small mammals, insects except grasshoppers,  
various coloured cattle, and cripple stock. The women do not eat  
certain types of fish (a common taboo), goat, sheep, pig, hare and  
chicken and other domestic fowls; while both women and young men  
do not eat the stomach of any animal. Small children do not eat  
liver or intestine.

In Uganda, taboos on eating chicken and eggs are wide-  
spread as far as women are concerned, and certain fish, locusts  
and game birds are prohibited to men in the Western Province.  
Taboos on beer vary everywhere. Goats' milk is consumed only by  
infants of Nyoro and buttermilk not by the men.

Perhaps the above short account of taboos, restrictions  
and customs is an adequate indication of the varying practices.  
Much of the dietary habits were bound up with ceremonial occasions,  
childbirth and so on. With the considerable lessening of the old  
tribal sanctions many are not now operating so rigidly, and  
education, Christian conversion and other factors have brought  
about a considerable change in the observation of taboos.

(Note. Further details of taboos among various tribes, too long  
to reproduce in this report, is in the hands of the  
author)

VIII. STATISTICAL AND OTHER DATA CONCERNING NUTRITION.

It is generally assumed that indirect supporting evidence  
of poor nutrition may be found in data concerning maternal and  
infant mortality, and in the prevalence of certain diseases.  
These matters will be considered.

1. Infant Mortality. Johnstone (1924) in a statistical survey  
in Central Kavirondo, Kenya, estimated  
the infant mortality rate to be about 400, and this was  
probably very close. 17.6% of total deaths occurred within a  
few days of birth.

During the period of weaning, taken as from 9 months to 18  
months, and which is critical in the African population, 21%  
of the total deaths up to 16 years of age occurred.

Of the total deaths occurring up to age 16, 72.5% were in  
the first year of life. Only 43% survived to 16 years.

Platt (1946) gave the infant mortality rates in Uganda and  
Tanganyika respectively from figures available 1935-1946 as  
116 and 243. However the Director of the East African Statis-  
tical Department provided more recent figures in 1952 as  
follows. In explanation of the term infant wastage is meant  
the number of deaths under 1 year of age per 1000 live births,  
taken over a period of time and not for one year only.

Infant Wastage Rate Among Women Recorded in the Age  
Group 16 to 45 Years.

Kenya	184
Uganda	200
Tanganyika	172

Other Areas.

Uganda Buganda Province	207
Uganda Western Province	182
Tanganyika Lake Province	203
Kenya Central Province	130
Kenya Nyanza Province	228

In a restricted area of the Lake Province recent figures avail-  
able suggest an infant mortality rate of 28%, and the deaths  
of a further 15% before the age of five. It would appear that  
approximately 61% of the children survive to the age of five,

unfavourably with Europeans, they were distinctly superior to their fellows in India and Singapore.

It is undoubted that the economic condition of the Asian in East Africa has improved immeasurably over the last thirty years, and that the population on average now enjoys a very reasonable standard of living. The great majority live in urban centres, 22% of the total in Nairobi, and their customary food supplies are generally available in adequate amount, while any occasional shortages in items of vegetarian diet can be rectified by a changeover in selection.

The available evidence shows that the nutritional status of this population is maintained at a very reasonable level.

X. PRODUCTION AND AVAILABILITY OF FOOD.

The latest stock censuses in East Africa give the following figures:

	<u>Cattle.</u>	<u>Sheep.</u>	<u>Goats.</u>	<u>Pigs.</u>
Uganda.	2,745,499	1,051,431	2,471,749	13,198
Tanganyika.	6,263,394	2,338,907	3,478,336	15,066
Kenya.	7 million	3,293,000	?	?

The total human population of Kenya, Uganda and Tanganyika combined is about 19 million, the African population being 18½ million.

A useful indication of the consumption of meat is given from Kenya. The cattle population in the African areas of this Colony is approximately 6 million head. About 12% of these are consumed annually within the African areas, making available some 100 million pounds of meat a year. In addition, some 20 million pounds of mutton and goat flesh are consumed each year in these areas. On equal distribution this would provide less than a half pound of meat per head each week. In the Nyeri district it is estimated that the adult consumption of meat is 3 lbs. per head per month.

In Uganda the total availability per head per week on equal distribution is about 6 ozs.

The African areas in Kenya also supply about 18 million pounds of beef a year to the urban markets of Nairobi and Mombasa via the abattoirs operated by the Meat Commission, and these markets further take 2½ million pounds of mutton and goat flesh. This again is supplemented by about 18 million pounds of beef a year from the European areas of Kenya, most of which goes to these markets. Availability of meat in the larger urban areas in Kenya is therefore adequate, though price levels do not permit of high consumption by Africans. 70% of the mutton and goat flesh supplied to Nairobi and Mombasa is probably consumed by the Indian population.

The consumption of cattle and small stock in Uganda in 1951 was about 55 millions pounds of meat, allowing on average about 10 pounds of meat per head during the year. Consumption in 1952 was stated to be 10% less than this. Figures for Tanganyika are not readily available, but as far as can be calculated, average consumption might be even less still.

The overall consumption of meat, as compared with the stock available, could without doubt be higher, but is governed by a number of factors. Firstly a change in food habits combined with a reversal of the general disinclination to slaughter for consumption must be brought about. Stock is regarded largely as a form of wealth. Recent high prices, which are now almost double those obtaining two years ago, are a main reason for the decline in numbers sold, which is now noticeable. The stock-owner is able to satisfy his cash needs by the sale of a limited number of animals and prefers largely to retain his surplus wealth in the form of cattle. This may be accentuated if the rains are good and there are plentiful foodstuffs and surplus agricultural

produce, which is now fetching enhanced prices, can be sold. Culling is not always acceptable, though it may occur to some extent in severe drought by forced slaughter of beasts. The supply position may therefore be very variable and, as an example, the number of stock sold for slaughter in Tanganyika in 1951 was the lowest for four years, and was attributed to the excellent preceding agricultural seasons. It is probable that, following the recent poor seasons which demanded the importation of food-stuffs, the position may at the moment be different.

There are vast areas of the territories where cattle do not exist owing to tsetse or other factors, while in the cattle containing areas overstocking of poor quality beasts is a serious problem. Some improvement in supply and distribution is being effected by an increase in abattoirs and cold stores at large re-sale centres. There are still, however, prodigious problems in distribution to more remote areas, unserved by good road or rail services, including the hazard of movement owing to disease or interruption of communications.

It is possible very greatly to increase the output and quality of stock in East Africa, and much attention is being paid to this. This, however, involves a number of scientific and other considerations which are beyond the scope of this report. At present the average consumption of animal protein is much below reasonable limits, and is conditioned by a complex of factors in which the attitude of the African towards animal management and his own dietary is perhaps not the least. Among other things, a considerable educative process and effort is required if the desired improvement is to be brought about.

ii. Dairy products, fats. It is quite impossible to give any idea of overall milk production and consumption in East Africa. In many areas cattle cannot be kept at all, and in others the yield from African owned cattle is insignificant or low owing to their very poor quality, pasture and management. The amount of cow's milk obtained by infants is exceedingly small by European standards, and some tribes allow calves to run at foot. On such calculations as can be made it is doubtful if the amount of milk produced in the territories would permit an equal distribution of more than a pint per head of population per week, and this may be a high estimate.

In urban areas price levels in relation to wages operate, and at the Nairobi African milk centres it is significant for example that purchases drop by a half or more in the last weeks of each month. Production is variable according to season and other factors.

It may therefore be said that on the whole African consumption of milk is low and inconsistent, while distribution difficulties and non-production are such that some areas are deprived.

In Kenya, about 6 millions pounds of butter are produced annually, of which rather less than one-third is exported. The annual production of ghee, mainly from African sources, and the great bulk of which is consumed by Asians, amounts to 1,120,000 lbs. Very little butter is consumed by Africans, though a small quantity of ghee is used for cooking and so on. The Highlands of Kenya is the main butter producing area in East Africa.

Milk and ghee production in Uganda is low, though a not inconsiderable quantity of poor quality ghee is produced by Bahina herdsmen.

In Tanganyika 2¼ million pounds of clarified butter and separator ghee was produced in 1951.

The production and consumption of vegetable sources of fat, especially nuts, soya beans and others, is difficult to

ascertain with any accuracy. Small quantities of groundnuts are grown in the Nyanza and Coastal Provinces of Kenya, and about half a million pounds of cashew nuts were bought in 1952 in the latter Province. There has been a substantial increase in the production of groundnuts and cashew nuts in Tanganyika. A large proportion of the cashew nuts produced in East Africa, however, is exported.

In Uganda in 1952 in the Eastern Province 10,000 tons of groundnuts were produced, and a further unestimated quantity in the Western Province. Also in Uganda large quantities of cotton seed oil and cake, with smaller amounts of groundnut oil and cake and of sinsin oil are manufactured; a good proportion of each being exported. The status of sinsin as a cash crop is declining, though production is well maintained in the Eastern and Northern Provinces where it is established. Some shea butter nuts are taken from natural stands of trees in these Provinces. The cultivation of sunflower is increasing. The production of soya bean, sinsin and palm oil is on a comparatively small scale in East Africa.

iii. Staples. The production of staples varies and broadly speaking is related to ecological zones, as, for example, in the Kikuyu country of Kenya. Here, in the high bracken zone, maize, foxtail millet, sweet and European potatoes are grown. In the Kikuyu grass zone the main crops are maize, beans bananas, sweet and European potatoes, pigeon pea, some dolichos, cassava, European vegetables and colocasia. This area is the richest and generally produces a surplus. In the grass woodland zone the same crops are produced, and in addition sorghum, millets, cowpeas and green grain. In the last and low zone sorghum, millets, cowpeas and green grain are the main crops, with cassava increasing. There is a bigger population of goat and cattle than in the more fertile zones.

In the Nyanza Province, maize, sorghum, beans, millet, peas, green grain, cassava, rice and groundnuts are grown in different zones, and in the Rift Valley maize, pulses, grains, tubers, millet, sweet potatoes and bananas.

In the coastal strip and hinterland of the Coast Province in order of importance are maize, cassava, beans, cowpeas and coconuts, with small quantities of bananas, sweet potato and sinsin. Rice is grown along the Tana and Sabaki rivers.

Uganda. In the Eastern Province sorghum, finger millet, sweet potatoes, plantains and cassava are prominent. Much the same obtains in the Northern Province, with also a high production of pigeon pea, and in the Western Province. In the Buganda Province very high quantities of plantain are produced.

In Tanganyika maize, bananas, sorghum, millets, cassava, pulses, sweet potato and rice are produced in variable quantities in different zones.

Although these are briefly representative of staple crops, there is a change of emphasis coming about. Maize is being planted more extensively, as in the case of Uganda and Tanganyika in areas where it was not grown previously, and sometimes in favour of sorghums. The acreage of cassava is increasing in many suitable areas as an addition to diet and as a reserve against grain-crop failures.

Further, production is not necessarily a true indication of local consumption, and a cash incentive may have a large influence on this. For example, in Kenya in 1952 as the price incentive was not enough, Africans tended to keep their cassava and sell their maize. Cash crops are of course grown, such regards sometimes being obtained at the expense of destroying good grazing land; and in some cases subsistence may be affected seriously.

As regards seasonal variation in diet, crop production dependent on rainfall, there being the long and short rainy

In years of good rainfall, when stores are well filled crops there is little variation in diet. The major food crops, maize and sorghum, are planted for the long rains March-June, and usually take about four months to mature. Generally speaking in the long rains the acreage under maize and sorghum is greater than that under beans and pulses, and in the short rains at the end of the year the reverse is the case. In years of poor harvest there is of course a change in between the two annual harvests. As the cereal crop from the first harvest dwindles, so bananas, cassava and pigeon pea may become the main items of diet. Proceeds from cash crops may be used for purchase of cereals at this time. If the short rains fail there is a lean period from April to July, when corn on the cob may be eaten freely where available. The pulse crops, beans, cowpeas and green grain are grown more extensively during the short rains. It may be said that periods of food shortage start in September if the long rains fail, reach their peak in January to April if the short rains fail and are not relieved until the first quick term long rains harvests in early June. Some areas are subject to seasonal crop failures, put in the case of the Coast Province in Kenya at one crop in three. Lack of rainfall through not causing river flooding or natural flooding of land may seriously affect rice production. This crop, while popular as an article of diet, is not very widely grown, and could well be increased.

While rainfall is the great single factor affecting production and dietary, other factors have some bearing. The balance between cash and subsistence crops is one that possibly too often goes in favour of the former. Losses by crude methods of storage and lack of conditioning also contribute, while depre-dations of animals, insects and birds, the last of which wreaked havoc with the wheat crop recently in Tanganyika, have to be taken into account. The periodic droughts, which occur from December to March and again from July to September, may exert a paradoxical effect. The grass dries up and cows produce very little milk during these periods. On the other hand more meat is commonly eaten in drought periods, some of the cattle having to be killed. Vegetables, which are normally consumed quite freely, may not be obtainable; and root crops may provide the major item of food.

At this juncture it is not possible to omit mention of the effect on production in certain areas, e.g. among the Kikuyu, of the hereditary system of land tenure which brings about land fragmentation. This practice, which is firmly adhered to, creates an increasing number of divided, distant, and in many cases ludicrously small and uneconomic holdings. It constitutes a very serious barrier to sound farming. The shifting cultivation and monoculture that also obtain in some districts are further deterrent to the proper use of land and to full production.

It is a very difficult matter to assess what proportions of the African population grow their own food, and those that buy it, partly or wholly. In the African areas it is believed that the percentage of those who grow what they eat varies from 75 - 100%, according to district, and that therefore up to 25% may have to purchase. There is normally a considerable amount of sale or interchange of produce at marketing centres.

As regards employed labourers, the man in urban areas usually has to purchase his own food, though a very small percentage receives a full ration. A much larger percentage in rural areas receive either a full or partial ration. Resident labourers are hardly ever given any rations, and grow their own food. Men in employment near their land units may live at home and cultivate a small garden. As nearly as can be estimated, 15% of the employed population grows its own food. Nearly all employees in townships do not grow their own food, but a number receive supplies from their homes.

The cost of food to Africans employed in townships is now a serious matter in relation to wage levels. Without comment a comparative table of the cost of a diet considered to be of minimal adequacy and of about 3200 calories a day, is shown below.

Diet, 30-day month.		Cost 1943. Sh.	Cost 1953. Sh.
Maize	30 lbs.	2.70	8.40
Mwinbi	7½ "	0.50	1.00
Beans	2 "	1.00	1.60
Ghee	2 "	2.60	6.00
Vegetables	6 "	1.00	3.00
Meat	7½ "	2.50	7.50
Potatoes	7 "	1.00	1.00
Sugar	3 "	0.63	1.47
Milk	8 pints	2.40	4.00
Total		14.33	33.97

The East African Statistical Department in 1951 studied the pattern of income and expenditure among unskilled labourers in Jinja, Uganda. It was found that those living alone spent Sh.28/39 per month on a diet which consisted, in addition to very small quantities of vegetables and seasoning, of 2 - 2½ lbs. meat, 2 lbs. fish, 5½ lbs. beans, 9 lbs. cassava, 33 lbs. maize meal and a large quantity of plantain. Average income was Sh.45/-.

The amount in grams of protein, fat and carbohydrate, and their calorific values of certain items of diet, for the expenditure of one cent of a shilling was estimated in 1943 for an urban area as follows:

Item.	Amount in grams for one cent.			
	Protein.	Carbohydrate.	Fat.	Calories.
Meat	3.49	-	0.73	21.1
Milk, raw	0.64	0.91	0.66	12.5
Fish (Lake)	0.29	-	trace	1.2
Potatoes	0.81	10.28	0.01	45.4
Vegetables (cabbage)	0.37	2.47	0.03	11.9
Beans (butter)	1.74	4.52	0.14	27.0
Maize meal	4.51	36.52	1.84	184.9
Sugar	-	21.60	-	88.6

At current 1953 prices, the amounts available for one cent in the case of meat may be reduced 3 times  
 " " " " milk " " 1.8 times  
 " " " " Fish " " 1.5 "  
 " " " " potatoes " " 1.5 "  
 " " " " cabbage " " 3 "  
 " " " " beans " " 1.6 "  
 " " " " maize meal " " 3 "  
 " " " " sugar " " 3 "

#### XI. COMPOSITION OF FOODS.

Important contributions as regards dietary analyses have been made by French (1937), Raymond (1940), Anderson, and Paterson and Harvey (1943). The first author gave figures for the composition of foods grown in the Mpwapa district of Tanganyika, and advised that legumes, soya, cowpea and dolichos should be grown and used more.

In a discussion on diets for Africans, Raymond estimated the calorific requirements calculated from surface area to be 2525 for eight hours moderate work and 3200 for hard work. He suggested that the protein in the diet should be higher than European standards, 100 gn. including at least 10 gn. of animal or fish protein. A 50 gn. standard of fat was proposed. It is stated

protein and fat and dairy products are not available in sufficient quantity to ensure an adequate amount for proper nourishment on average.

5. The total dietary is likely to be affected by lack of rainfall especially, and by other factors. Changes in practice are tending to occur, for example the increased planting of maize, and of cassava as a stand-by crop.

6. Other evidence is quoted to show the state of nutrition in the African and Asian population.

7. The difficulties and inhibitory factors affecting increased production are mentioned.

8. Tentative proposals for further work on nutrition are put forward.

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