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Some Aspects of Food and Nutrition in Sierra Leone[1]

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Synopsis

I. Introduction

Sierra Leone is situated on the West Coast of Africa. It has an area of 27,925 square miles (72,300 km²) and a population of approximately 2½ millions. It is mainly an agricultural country with the main forest reserves in the south-eastern part notably in the Kenema District. The country is divided into 3 provinces – northern, southern, eastern, and the western area which includes Freetown, the capital, with 150,000 inhabitants. The name Sierra Leone comes from the Portuguese and means 'lion mountain'. In 1460, Pedro da Cintra and a group of Portuguese explorers, travelled down the West Coast and thought they heard the roar of lions during heavy rains and thunderstorms in the mountainous peninsula. There are 2 seasons, the wet season from May to October and the dry season from November to April.

There are at least 13 tribes, each with its particular language and customs. The two main tribes are the Mende and Temne, forming about ⅓ and ¼ of the population, respectively.

[1] From a seminar given in the Department of Nutrition, Institute of Medical Chemistry, University of Uppsala, Sweden, while author was a Visiting Fellow.

The main crops are groundnuts, tobacco, cassava, paw-paw, yams, maize, guinea corn, citrus fruits, pineapples, bananas, beniseed, ginger, colanuts, palmkernels, coconuts, avocado pears, mangoes, sweet potatoes, cocoa, rice, coffee and piassava. Agriculture is based on the land tenure system. Goats sheep and chickens are raised by most farmers. Cattle are raised mainly by the nomads of the Foulah tribe from the north and from Guinea.

The minerals exported are diamonds, iron ore, chrome ore (from early 1930), gold (up to 1963), bauxite and rutile – a titanium-bearing mineral, from (1966) molybdenite and platinum. Foreign companies and enterprises own the mines and control the export. However, the government is negotiating the ownership of 51% of shares of all four major companies and has acquired it for diamonds. The currency is the *Leone* (Le) equal to 10 British shillings or US $ 1.20. Le 1.00 = 100 cents. The country became independent from 153 years of British colonial rule in 1961.

II. Education

There are about 1000 primary schools, 64 secondary schools, 6 technical and vocational institutes, and 9 teacher training colleges. Fourah Bay University College, Freetown, founded in 1827 and affiliated to Durham University, England, in 1876, joined with the University College at Njala (founded 1964) to form the University of Sierra Leone in 1967. Present faculties include: arts, education, pure and applied sciences, basic sciences, Agriculture, including a department of home economics, engineering, law, economic and social studies, and institutes of marine biology, African studies and teacher education. There are no nutrition or biochemistry departments. The present primary enrolment is approximately 136,000, while the secondary enrolment is about 22,000. The University has 800 students. About 2,000 students are studying in foreign colleges and universities, the largest numbers in Britain, the United States, the Soviet Union, West Germany and the Middle East, in that order.

Primary education is neither free nor compulsory, but fees are relatively small.

III. Food Consumption and Households

People live in mud huts in the small villages and walk great distances to their farms. The average family is large and may include grandfather, father, sons and their wives and children. Although the extended family is the rule,

nuclear families are numerous especially in the towns. In 1951, households with low incomes (less than Le 24 monthly) spent 20.6% of their incomes on rice, the staple food of the country [8]. Expenditures for the higher income group on rice was 11.2%, the largest amount spent on any single item for both groups. However, it was noted that as incomes rose, the percentages of total expenditures allocated to dried bonga (a bony fish), rice, tobacco, and palm wine (from the palm tree) were reduced, while those for meat, bread, other dried and salted fish, fresh fish, groundnut oil, butter, tomato purée, fresh fruit, sugar, imported tins of milk, soft drinks and alcoholic beverages, rose.

IV. Agriculture and Crops

The land tenure system is still widespread although land can be purchased and owned in the western area. Rice is grown extensively and is the staple food. The West African Rice Research Station at Rokupr is now a part of the Ministry of Agriculture. Rice is grown in different types of soil, including swamp. Yields from this moist low-lying piece of fertile land have been reported to reach up to 2,500 lbs/acre if special precautions are taken.

V. Traditional Foods and their Composition

Cassava, a root crop with 94.1% carbohydrate [15], is widely consumed next to rice, especially during the 'hungry months' – in Sierra Leone during the rainy season.

Cassava is cheaper than rice and is available all the year round. However, raw cassava contains 38 mg% of hydrocyanic acid (HCN) [15] a highly toxic compound. Soaking cassava in water is usually meant to soften it before preparation of various well-known foodstuffs, namely gari, kpokpogari, eba, lafun and panya in Nigeria, and fufu, gari, pap and ebeh (a mixture of yam, coco-yam or cassava, sweet potatoes and palm oil) in Sierra Leone. Fortunately soaking and processing reduce the HCN content to 1.9 mg% for gari, 2.5 mg% for fufu, 1.0 mg% for lafun and 1.1 mg% for kpokpogari [15]. In Sierra Leone before cooking into a sticky dough, fufu is pounded in wooden mortars to make it more refined and sieved in water once or twice while the residue, instead of being fried in iron pots and spread to dry in the sun to make kpokpogari as in Nigeria, is discarded. OKE did not mention this step in his description of fufu preparation. Pounding and sieving probably further remove HCN and may lower the figure of 2.5 mg% in the final preparation.

The sweet variety of cassava is usually eaten raw. Roots of the bitter variety *(Mannihot utilissima)* contain a cyanogenetic glycoside called linamarin which is hydrolysed to glucose, acetone and HCN by the enzyme linase [16]. The very small amount of protein in cassava (about 2.5%) is reduced to negligible amounts in the various foodstuffs.

Roasted groundnuts are pounded, mixed with sugar and gari, and sold as 'Kaña' (cayenne), a snack. Another snack made from roasted groundnuts is 'Kongu'. Since some Nigerian diets containing groundnuts (when fed to rats) caused liver damage and metabolic abnormalities because of the presence of *Aspergillus flavus* [5], it becomes clear that aflatoxin may seriously aggravate the already existing states of malnutrition in West African populations. A dose of 50 μg/kg/day of aflatoxin B (but not less) in the diet, caused very few monkeys to survive after a month ot two. Survivors showed histological changes in the liver and minor changes in the kidneys [7].

Rice is consumed as the staple food, and any excess crop sold as a cash crop. After parboiling rice, much of the iron, nicotinic acid and vitamin B_1 are retained, thereby rendering it more nutritive than highly milled rice. There is an intake of about 60% of calories from rice, the estimated calorie intake/person/day being 2,158 [6]. Rice also gives about 65% of the protein intake. At Rokupr research station is was found that red rice had a higher nicotinic acid but not necessarily a higher nutritive value than white rice.

Maize is not consumed as much as in South America. It is inferior nutritionally to rice and is given as weaning food to babies in the form of a porridge, ogi 'pap'. This probably is an underlying cause of kwashiorkor. It is also eaten by adults with palmoil sauce in the form of a thick paste 'Agidi'.

Fish is a very good source of protein and is included in sauces in many households. It is cheaper than meat. Fish is abundant, especially around the coastal areas. Many people fish in freshwater, rivers and streams, in the provinces. The regular intake of fish, however, does not necessarily provide all the protein required, because of the ratio of carbohydrates to proteins due to consumption of rice, fufu and other starchy foodstuffs. Sierra Leonean zoologists have now made a comprehensive survey and classification of fishes in the coastal waters around the peninsula in the western area. They have also made some progress in the classification of freshwater fish in the rivers in the other provinces. With the help of food composition tables, nutritionists, food analysts and home economists can now hope to plan better diets with adequate amounts of protein.

Fish in Sierra Leone include mullet, minnow, grouper (sea perch), mackerel, 'shiny-nose' *(Polydactylus)*, Snapper *(Lutjanus)*, sole, skate

(Raja), tuna and bonga. The average percentage of proteins in all raw fish is 18.8 (whole) and 21.6 (fillet) [FAO, 1968]. Because of lack of rapid transport and storage facilities, fish are smoked and dried to be kept longer. Dried fish contain a higher concentration of proteins than fresh fish. The government fisheries department is now distributing fresh-frozen fish and a canning firm for sea-food products markets tins of fish and provides refrigerating facilities.

Vegetables. Many plant leaves are used to prepare 'palaver' sauce which contains fish (sometimes together with meat), palm oil, salt, peppers, melon seed, and other seed. Among these are bitter cassava leaves *(Manihot utilissima)*, 'crane-crane' *(Corchorus olitorius)*, sorrel or 'sour-sour' *(Hibiscus sabdariffa)*, 'bologi' *(Crassocephalum biofrae)*, sesame leaves *(Sesamum indicum)* and spinach greens or 'green' *(Amaranthus viridis*, or *lividus* or *spinosus)*. Some of these leaves have a high protein content as follows: *Amaranthus* (30–32% of the dry product), *Manihot* (33%), *Sesamum* (30.5%), *Corchorus* (31.2%) [ADRIAN, 1969]. Tryptophane values are given as 388–457 mg% dry product, 589 mg%, 334 mg% and 380 mg%, respectively. Compared with other edible leaves in other African countries, these values are among the highest for tryptophane and protein although the tryptophane/protein ratio is low for the Amaranthaceae.

However, the incredibly high proportion of carbohydrates in a typical Sierra Leone meal and often the scanty sauce seen decorating the top of a large bowl of rice makes it logical to conclude that protein intake in general is very low indeed. This would be particularly so considering that some strains of cassava leaves *(Mannihot utilissima)* have only 7.3% protein but up to 200 mg% of calcium and vitamin C and 1.9 mg% of iron [12]. OKE [16] gives the following figures for young cassava leaf content from his and other authors' analyses: 130–160 IU vitamin A, 15–33 IU/100 g vitamin B_1, 0.306 mg% niacin, 150–180 mg% vitamin C and 0.2 mg% vitamin E. Vitamin B_2 is lost during boiling and extraction, and cassava flour contains very low values; 56% of vitamin C is lost during cooking of starchy foods in general and 67% during cooking of cassava. Gari and fufu have 8 mg% and 4 mg%, respectively, of this vitamin [15]. Sweet potato leaves *(Ipomoea batatas)* have similar properties to cassava leaves and are widley used in Sierra Leone, as is the latter, to prepare 'palaver sauce'. Potato leaves have high useful quantities of vitamin A, an average of 5,870 µg% [9, 11].

Benniseed or sesame seed *(Sesamum indicum)* are grown to a limited amount for export and for home consumption. They have 20% protein [6]. In the fermented form ('ogiri') they are a major ingredient of 'palaver sauce'

and gives it its specific flavour. Fermentation increases riboflavin (B_2) and thiamine content of Indian rice and gram [18]. Fermentation also increases nicotinic acid and the B vitamins in cereals [17]. Melon seeds are roasted and ground into a flour known as 'egusi' which is also used to give substance and flavour to the sauce.

Meat production is rather low. There are about 150,000 head of cattle in the northern province mainly of the 'Ndama' strain which is reported to be resistant to trypanosomiasis ('sleeping sickness'). Nomads of the Foulah tribe have a long 'expert' tradition for rearing and travelling long distances on foot to sell their cattle. No local methods of drying and conserving meat as exists in other parts of Africa have been noted. There is a low milk yield which is used up for the calves. Meat is in limited supply and the average villager cannot afford to buy meat at 40 cents per pound or 90 cents per kg.

Milk from the Ndama cows is not economic and is not feasible to improve milk consumption in Sierra Leone [6]. No explanation is given for this statement but one would assume that the feed is probably responsible and that better methods of breeding are needed. Obviously this is an important area for investigation by the Ministry of Agriculture and the university's research potential. For example, lysine, an aminoacid was added to an experimental diet containing 17% protein and fed to growing pregnant sows 13–14 months old for 196 days. Significantly higher milk productivity of from 12.8–23.2% was obtained [21].

The Foulahs themselves use the milk to make 'Foulah butter' (Ghee) which is eaten with rice and sourmilk. Sourmilk is self-sterilizing in 24 h because of a pH of 4 and may be consumed fresh. Sourmilk is also used as baby food among the Foulahs but no reports are available about the effects on the babies. Tinned evaporated milk is imported in large quantities from Holland and Britain and is bought chiefly in the towns. Twenty-five per cent of school children have been receiving about 25 g/day powdered milk from the USA in the CARE programme. BLANKHART [6] says none of this was available to pre-school children with malnutrition.

Eggs are sold, paid as tax, or given to guests as gifts. Many villagers raise their own chickens, but do not consume many eggs. These are sold rather than eaten because they bring in a good amount of cash used to buy more rice, fish, palmoil or clothes. Children seldom eat eggs, since the taboo is widespread that if they did, they would become thieves. It is reported that a European zoologist has a large poultry farm at Newton, about 30 miles from Freetown, and supplies department stores, wholesalers and other commercial enterprises in Freetown and other urban areas. People tend to eat

more chicken and eggs in the towns. The university college at Njala also produces good quantities of eggs and maintains a special breeding stock of hens. In Freetown and some coastal regions, the higher consumption of eggs and a high intake of fish account for about 30 g more protein intake/day as compared with other parts of the country. Salt and oil intakes are high, especially in the Freetown area where overweight, hypertension and other clinical symptoms have been reported in the hospitals.

Beverages. Palm wine from the palm tree is consumed a lot in Sierra Leone. The distilled 'gins' are drunk in large quantities but less frequently. TOURY [1969] has shown that palm wine contains much vitamin C, the content of which decreases with time. A half litre of wine consumed fresh covers the daily requirement of vitamin C. Distilled beverages are of less nutritional value (TOURY) and 'Omole' (Sierra Leone gin) has been found to be highly toxic to experimental animals [19].

Infant mortality is very high and may be responsible for a stagnant population throughout the years. Mortality rate is higher in children who are underweight and was about 130/1,000 in the Freetown area in the last decade. There are no reliable statistics for the whole country. Certain taboos account for malnutrition in many infants. For example, fish is supposed to cause worms in small children. Consequently no fish is given during the weaning period before the age of 1 year, and almost 40% have no fish or milk up to the age of 2 years. Cassava and corn, but no rice, are popular weaning foods in the second half-year and are given as a 'pap' or porridge. Usually no vegetables are given before 1 year but skimmed milk powder is used sometimes before this age.

It has been observed that the weaning patterns differ from region to region. In the north, cassava, sweet potatoes and cornflour are seldom used as weaning foods. In the northwest, cornmeal and milk are exclusively used. Breast milk is given until the age of 1½ years, seldom after the child is 2 years old. Soft-boiled rice and palmoil are given to the child during breast feeding from 1½ to 2 years of age [20].

Anemia is a common disorder during pregnancy in Sierra Leone. It has been estimated that about 45% of pregnant women suffer from iron-deficiency anemia resulting most probably from lack of eggs, meat, chicken, beans, groundnuts, palmoil, groundnut oil, fish or oysters. Various taboos (e.g. a newborn baby may turn out to be a monster, a monkey, or a devil), forbid them to include these items in their diet. Because of the small amount of iron in breast milk, young children suffer most from iron deficiency, especially if late weaning is practised [4]. BALL noted that the mother's diet does

not influence the iron content of the breast milk and that in Nigeria, where in the forest belt 20–30 mg or iron per day can be obtained from the diet, women with European-type diets usually suffer from iron deficiency. It must be noted here that millet, which is so abundant in Sierra Leone, and sorghum (guinea corn) are rich in iron and calcium as well as having a higher and better protein than maize [11]. It has been reported that a local baby food called 'Benniseed Mix' which consists of benniseed (sesame), groundnut paste, rice flour and palmoil, has been put on trial in 1966 by the ministries of Health and Social Welfare [20].

Nutritional diseases. The main nutritional diseases in Sierra Leone are kwashiorkor, marasmus, anemia, ariboflavinosis, goitre and to a lesser extent, beri-beri. Night blindness, xerophthalmia (drying of the eye), and keratomalacia (softening and necrosis of the thin membranous cornea covering the eye) are practically absent obviously because of the heavy consumption of palmoil which contains good amounts of carotene. These disorders are usually due to vitamin A deficiency and carotene is a precursor of the vitamin. Kwashiorkor is the most widespread disease and was first described in Sierra Leone in 1956. Signs of the disease are edema or swelling with underweight, anemia, skin diseases, irritability and mental disorders. Rice 'pap' and, worse, cornflour 'pap' have been known to lead to pre-kwashiorkor conditions. It is reported from Ibadan, Nigeria, that serum transferrin provides an accurate assessment of the exact nutritional state and gives a true measure of severity and response to treatment in protein-calorie malnutrition [14]. Marasmus is similar to kwashiorkor but there is no edema or dermatosis. Iron deficiency anemia is perhaps the most prevalent nutritional disorder after kwashiorkor. It is diagnosed particularly in pregnant women and children. Not much information is available on the incidence and distribution of macrocytic anemias due to B_{12} and folic acid deficiencies. Ariboflavinosis is a disease due to vitamin A and B_2 deficiency and is prevalent again in mothers and school children. Symptoms are angular stomatitis ('cook mot' or 'lassi' in the local vernacular), a sore red tongue, and blepharitis (a disease of the eye-lids). Goitre is confined to the northeastern Kono and Koinadugu districts. It is seen mostly in women in this mountainous region. A causative factor may therefore be the distance of the region from the coast. A careful controlled search for goitrogenic substances in vegetable leaves used to make 'palaver sauce' and perhaps in sourmilk and other foodstuffs may prove to be quite useful. Beri-beri, brought about by a deficiency of vitamin B_1, seems to have been on the decline in Sierra Leone in the last 10 years or so, possibly because locally

produced and milled rice was gradually substituted for the once imported highly-milled rice.

Infectious diseases are often associated with nutritional diseases in the tropics. Chief among the former in Sierra Leone are measles, tuberculosis, malaria, diarrhoea and hookworm disease. In 1961 there was a marked increase and severity of kwashiorkor which usually followed an attack of measles [6]. The highest incidence of the kwashiorkor/malaria association is reported to be in the rainy season from May to October. The author also points out that protein malnutrition often leads to poor digestion, gastro-enteritis and eventually diarrhoea, which may be cured only by protein foods. Anemia is sometimes accompanied by malaria in small children. A post-measles complication causing corneal ulcers has been reported and mistaken occasionally as being related to vitamin A deficiency. However, no Bitot's spots (glistening white triangular-shaped plaques of thickened epithelium) are present in the condition. These spots are a major symptom of kerato-malacia. Hookworm disease caused by the worm *Necator americanus*, has resulted in loss of blood and iron deficiency anemia in children in Nigeria. This loss of less than 10 mg/day can be balanced by the high content of iron in the food [4]. Unfortunately, no figures are available as yet on the iron content of various foodstuffs, hemoglobin pattern of blood, and losses due to diarrhoea in Sierra Leone.

It becomes clear that protection against infectious diseases will certainly result in a lower incidence of kwashiorkor if combined with improved weaning practice. As a corollary, good weaning practice will raise the resistance to infectious diseases and thereby reduce mortality rate among infants. Therefore malnutrition is a public health problem in Sierra Leone and other African countries, whereas in more advanced countries it is not.

Several problems make it difficult to improve the nutritional standard of the population viz.: (a) climate which favours infectious diseases; (b) lack of funds for a comprehensive nutrition programme. Since Sierra Leoneans have not had the monopoly or control over the mineral wealth of the country for many, many years now, it has been difficult to obtain funds adequate enough for large-scale public health nutrition programmes, and (c) lack of sufficient trained personnel.

The proposals of the 1967 National Nutrition Seminar held at Njala University College for investigation of weaning foods are of considerable interest. For example, it is suggested that 6-month-old babies be given rice 'pap' (parboiled with added beaten egg, milk and sugar to taste), millet 'pap' (cooked with pounded fish or meat, groundnut paste and red palmoil), bean

'pap' (cooked with pounded fish or meat, red palmoil and served with skimmed milk), and benniseed 'pap' with milk. For a 7-month-old child, very soft-boiled rice, beans with 'plassas' (spinach and related leafy vegetables), cooked with pounded meat or fish, groundnut paste, red palmoil and served with dry skimmed milk are recommended. Soft-boiled rice with beans (or millet with beans), groundnut stew cooked with pounded meat or fish and served with skimmed milk are also proposed, as well as 'egusi' soup cooked with 'plassas', pounded meat or fish and served with skimmed milk. Egg must be given 2 or 3 times a week. A 9-month-old baby can eat all family foods except pepper. However, some of these items may be postponed until the baby is older because some of the chemical substances in plant foods (fatty acids, glycosides, aflatoxin, etc.) may have a deleterious effect on a baby's delicate system.

VI. Conclusions

A look into the Swedish-Ethiopian children's nutrition programme could be of much help to the problems in Sierra Leone. A nutrition unit or department in the University of Sierra Leone or elsewhere in the country will certainly be of benefit as far as training personnel, education and research are concerned. There are many interesting questions to be answered. For example, how does the climate influence fungal and other growths and transformations in foods? How toxic do the foods become? What is the nature of the moisture from parboiled rice? Are there any other local plants and vegetables that have not been eaten so far that may be non-toxic and contain high amounts of required nutrients? Are there goitrogenic and mutagenic substances in the wide selection of leafy vegetables?

Surely Sierra Leoneans, in the years ahead, can look forward to better milk production and quality, improved refrigeration, storage and transport facilities for meat and fish, strict control of prices and foreign economic domination so that the average man in the village does not continue to suffer and the establishment of local food industries.

The ultimate solution to Sierra Leone's nutritional problems, and for that matter those of other African countries is not the inclusion of lysine and vitamins in bread or rice to improve protein intake and growth rate [13], nor in the fermentation products of petroleum, but rather in the greater use of more of the nutrient-containing local foodstuffs. Perhaps the most difficult task in trying to solve these problems will be for the social worker who will be needed in a team with the nutritionist, the food analyst and the public

health worker or educationist. This task will be to try to change effectively the food habits and spending patterns of the populations.

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