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COMPARISON OF NUTRIENT INTAKES
IN
EAST AFRICA

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Comparison of Nutrient Intake in East Africa

This paper is a review of the available literature regarding food intake in East Africa. In the first part I will report on the food pattern and the nutrient intakes, and in the second part, I will show some factors which are responsible for a change of them.

East Africa is a huge area of 1.775.000 km² and consists out of three countries: Kenya, Tanzania and Uganda. The population, which is quick increasing - between 2-3 % per annum -, has now reached a number of 32 millions, compared with 10.1 millions in 1925.

	area (in 1000 km ²)	population (in millions)		density (people/km ²)	number of tribes
		1925	1971 (estimated)		
Kenya	585	2.6	10.8	18.5	40
Tanzania	945	4.5	12.2	12.9	125
Uganda	245	3.0	9.0	36.8	30
Total	1.775	10.1	32.0	18.0	

There are different ecological zones as coast regions, river and lake zones, dry steppes and fertile highlands. There live almost 200 different tribes, and each tribe has a number of clans, and all have different traditions. Many were exposed different influences, like European settlers, missionaries and urbanization; others were living for a long time undisturbed.

It is therefore rather difficult to make some general statements for East Africa at the whole, this applies to the food pattern as well.

The available information can be classified in the following way:

- 1) food balance sheets for the whole country or regions
- 2) there are many general descriptions of the different tribes and areas and what they are eating
- 3) nutritional status surveys show which nutrients are lacking
- 4) dietary surveys report on nutrient intakes of families or individuals.

This information concerns

- 1) rural populations
- 2) peri-urban and urban populations
- 3) labourers
- 4) institutional groups: hospitals, schools, prisons, etc.

Since more than 90 % of the population is living in rural areas and only 4-5 % have a regular employment, I will talk mostly about the rural people.

For a comparison of the nutrient intake a population has to be classified as well in

- 1) infants and pre-school children
- 2) school-children and adolescents
- 3) adults
- 4) pregnant and lactating women.

There are much more impressions reported. The collection of quantitative data is still rather difficult, especially regarding individuals. Therefore most reports give us information about the whole family.

Food balance sheets give us an indication of the average consumption per calculated period. They cannot show geographical, seasonal and demographic distribution. If the input - food production, trade, etc. - is right, then of course the average consumption will be a true one. But in East Africa the big majority of people is living as subsistence farmers, and rather less exact information about yields, storage losses, consumption of wild leaves and berries is available. The results have to be judged carefully.

Table 1) shows the amount of food which is available for human consumption and table 2) the nutrient intake in the three countries for different years. The rather wide variation is not only reflecting the difference in production, it shows the difficulties to calculate with reasonable figures originating from subsistence farming with small and scattered plots. The highest differences are to find for starchy foods, vegetables and cereals. Cash crop yields are much more consistent, but not without doubtfulness, examples are

- for Uganda is a beef production stated with 34.000 tons (10) and 47.000 tons (72) respectively for 1957
- the beef production in Tanzania was in 1959 98.000 tons (101) and in 1960 127.000 tons (122).

An interesting estimation for the annual human milk yield in Tanzania was done by Latham (115): 180 millions litres of breast milk were given to the children.

The figures of the food balance sheets show that in East Africa should be enough food for all people, although there is no surplus. If we leave out the highest values - the requirement on calories and protein is met with appr. 2.200 - 2.300 cal and 60 - 80 g protein. The intake of animal protein and fat is too low, especially in Tanzania with 8 and 25 g respectively. Tanzania seems to have the lowest intake generally.

The calories derive to more than 75 % from the staples cereals and starchy foods, and in some parts of Uganda even up to 90 % and more. Roughly the same share they give to the intake of protein, and they supply most of the vitamin B₁, niacin, vitamin A, calcium, phosphorus and iron. Fat comes almost complete from plants. The estimated calcium intake is 300 - 400 mg (122,169), which is low, but fair. Rowland estimated the iron intake for Tanzania with 27 mg (173), which is an excellent one.

If the average intake meets just the requirement one can assume, that some have a higher intake and the other will get too less. Some few examples, which will show us that the food is not even distributed: Tables 3) and 4) give the intakes for calories and protein for the four regions in Uganda, and from which foods they derive. The northern and eastern regions have with 115 g protein intake almost the double intake as Buganda and western region with 65 g, due to higher cereal or lower plantain consumption respectively. In Tanzania people living in the southern parts can afford only 5 g meat per week whereas the Masai have a consumption up to 9 kg per week and person (60). The known fact of insufficient storage and the occurrence of rain failures, which lead to marked seasonal shortages indicate further maldistribution and at least seasonal undernutrition.

The danger that there is too less food can be shown by the following comparisons, too: For the average family (5.5 members) are needed at least 1.6 ha to ensure enough food for the whole year under the existing conditions. The actual plot size is mostly less, especially in dense populated areas. The average income is approx. 40/- Shs. per month - the calculated cost for an adequate diet is as well 40/- Shs.

In the following I tried to compile all information about food patterns and generalized them to food zones, see figures 1a-c). Plantains are most common in Uganda around the Lake Victoria and in the West Lake and Kilimanjaro Region of Tanzania. Millet is common in the eastern and northern parts of Uganda, in the Nyanza Region of Kenya and in Tanzania from south of Lake Victoria up to Central Region. The remaining parts have mostly maize as staple food, like West Nile Region in Uganda; Rift Valley, Central and big parts of Eastern Region in Kenya, and a belt which stretches from Pare and Usambara mountains in the north over central parts to the south of Tanzania. Rice areas are the coasts plus the islands and some riverine areas like Tana in Kenya and Rufiji in Tanzania. Cassava plays in many parts an important role, mostly as reserve food. Meat and milk are only important amongst pastoral people like Masai, Samburu and Turkana, which are living in the dry steppe. The white areas which indicate lack of information are mostly scarcely populated.

The general custom is to have two main meals per day. Often is a breakfast omitted, and during planting and harvest times one main meal is not seldom. The women are responsible for both housework and fieldwork and the fields are scattered. The main dishes are cereal porridges or stews with plantains, which contain rather less fat and spices and seldom milk. As side dishes are commonly used legumes, green leaves, some other vegetables and few fish or meat. Fruits are not eaten commonly, mostly by children as snacks.

The almost general belief is, important as food are only the staple foods which fill the stomach. All other foods might be pleasant to eat, but they are not regarded as essential. The diet is more or less monotonous, especially amongst pastoral people. In food shortage times often the staple food is eaten only.

With too less meals the requirement is difficult to meet, an adult can eat from a cereal porridge with few fat hardly more than 1000 cal per meal. A too monotonous diet inhibits a balanced diet and creates malnourishment.

The diet patterns indicate possible shortages on protein, especially in plantain or starchy root areas, on calcium, vitamin B₂, and niacin (esp. in maize areas) for all except the pastoral people. Vitamin A and C seem to be too less in many parts, at least for the dry months.

The nutritional status surveys carried out in various parts (see Fig. 2) confirm what was stated up to here. Many children show retardation in development beginning with the weaning period, the adults have mostly a lower weight as Europeans. There is a calorie shortage, but not a severe one. The incidence of kwashiorkor or protein shortages is in the starchy food areas, as Buganda and Kilimanjaro, higher than in other areas. There are almost never reports of deficiency signs for vitamin D and vitamin C. For calcium as well, despite of a low intake. Rarely seen are vitamin B₁ signs. Vitamin A deficiency signs are stated mostly in dry areas like the Central Region of Tanzania. Most common deficiencies are those for vitamin B₂, niacin and for multiple vitamin B deficiencies. Quite high is the incidence of signs for iron deficiencies, despite of the reported and known high intake - but this is more related to high incidence of parasites and protein shortages. Iodine deficiency is common in the south of Tanzania (122) and in the areas from Kericho (Rift Valley) to Nyeri (Central Province) in Kenya (9).

The dietary surveys, which are summarized in Fig. 2 and Tables 5-7, complete the pictures. As well here it is difficult to give general valid information for bigger zones. The results are varying even in similar or nearby areas. That is due to technical difficulties, like the problem of correct recording or different sampling and different seasons, and due to real variance in the consumption.

The calorie intake is often below the recommended intake, but in several areas quite sufficient. The intake range - the variance from day to day - is quite narrow compared with experiences from European dietary surveys. The main reason is the more simple food pattern. A bulky carbohydrate-rich meal is the regular daily main food. It is the main source of almost all nutrients.

The lower calorie intake should be considered in relation to the general lower weight standard of the African population. Calorie intake is close related to weight standard. We saw this very nice in feeding trials with malnourished children in our rehabilitation centre.

The protein intake as well is quite often below the recommendations. A comparison between plantain areas (Tab. 5a) and areas with millet and legumes consumption (Tab. 5c) shows with 32-66 g to 54-93 g protein/day/head the expected higher

protein intake in millet areas. The animal protein intake is in almost every rural area with under 10g/day/head too low, except of course amongst pastoral people like Karamoja (Uganda) - their meals can give somebody 220 g animal protein per meal (88) - or the Masai, who eat between 150-300 g animal protein/day/adult (158).

The calcium intake is mostly below the requirement, but nutritional status surveys reveal very seldom deficiency signs. Means that the requirement is too high, is the intake by water considered - 1 litre water contains approx. 150 mg Ca - or is the population adapted to low intakes - indicated by lower growth of the children. An old comparison done by Gilks and Orr (158) between Kikuyu and Masai would lead us to the last suggestion. The Masai have an intake of 2.000 mg/day and are the taller people in all ages.

The iron intake is more as sufficient in all areas, and reaches values higher than 30 mg per day.

The intakes of the vitamins A and C are differing widely, depending on area and season. Mostly the requirement is fulfilled, but attention has to be put on the following aspects. Carotenes from vegetables and fruits are often the sole source of vitamin A and the low fat content of the diet may disturb the re-sorption of carotene. Due to extensive long cooking, the vitamin losses might be very high, especially regarding vitamin C. In dry areas the intake is low at least for several months per year.

Cereals are the main sources for the B-vitamins. In almost all areas the intake of vitamin B₁ is very good. The intake for niacin falls only in several maize areas below 10 mg per day (see Fig. 5d,e). A general problem is the intake of vitamin B₂, which is too often only about 50 % of the requirement. Sufficient high intake is reported only from some millet areas and from people who eat more meat or legumes as normal.

The few results of dietary surveys amongst children (see Table 6) show that especially the younger children get too less protein and calories.

The nutrition of labourers is quite satisfactory according the two investigations cited in Table 7.

Institutional diets are not discussed since they depend on decisions made by medical staff and nutritionists and not by the general population.

The given information of food intakes shows that there is just enough food available for the East African population. Maldistributions are the cause for the shown problems. The nutrition is not yet optimal. Feeding trials - giving a well balanced diet - reveal very often an improvement of weight, learning and working capacity, etc. compared to the customary diet (108, 113, 122, 158).

Which factors have an influence to the insufficient food patterns? To my opinion one of the most important reasons is the general attitude and the ignorance about food of the population.

Generally are only such foods regarded as good and important, which fill the stomach up and keep satisfied for a long time. This major crops - cereals and starchy foods - have often the same name as the general word for food, as examples are given: "matoke" amongst the Baganda (97) or "chakuria" amongst the Hadigo (74). The side-dishes like legumes, leaves, meat, fish, etc. are liked, but there is not much struggle for them, because they are not regarded as necessary. Fruits are not considered as a food.

The Africans like their children, but since they do not know about proper feeding, the young children are in danger. They are filled up with the carbohydrate-rich staples and get too less protein.

The old traditions hinder an optimal use of the available resources. The applied agricultural methods are insufficient, there is less knowledge about soil conservation and maintenance, the land is fragmented, the manpower not used properly, the cattle is still more bank account as food source, taboos prevent the use of some foodstuffs, too less care is taken on good food storage - the favourable climate may be one reason for it. There is less trust in what human being can afford and more belief in the fate. There is too less demand for a change.

The different characters of the land zones influence strongly the whole life. The majority of the population is living in the most favoured areas, where the climate and the soil are good. Three quarters of the population of Kenya are living

in the Rift Valley and Central Regions, which cover one quarter of the area of Kenya. The high density results dangerous low acreage of cultivated land per family. There are only 45 % of the population between 16 and 45 years, and since mostly women are responsible for the work, only less than one third of the population takes care for the food for all.

The food pattern did change in the last decades without doubt. But we know only very few "baseline" data from former times. A comparison is very difficult - the knowledge about nutrition has increased tremendously in the same time. Low incidences of vitamin deficiencies, goitre or protein-calorie malnutrition in former times and higher values today, have not to mean the situation became worse.

The first Europeans report that the Africans had a quite good diet. Livingstone was surprised to see the variety of foods eaten by the Wagogo in Central Tanzania (179). Several good habits were used - plenty of green leaves were eaten, salt was prepared from leaves, millet was much more common (91). But food shortages were already common in former times, too. The general lines of changes are the following (1, 14, 28, 118, 124, 147): Millet and sorghum are diminishing, maize and cassava are increasing; instead of wild leaves more European vegetables are used; the thin porridge - uji - for breakfast is often replaced by tea; more foods are bought; the food taboos are disappearing.

What are reasons for changes?

Without doubt the major reason was the influence coming from outside. Arabs and Europeans brought new ideas, methods, crops, religions, employments, health facilities, etc. They disturbed the ecological balance. The deathrate decreased, the population concentrated around estates or towns, money and taxes were introduced, new ethics were established, roads were built, epidemic diseases were eradicated, etc.

Now I will try to correlate some single factors with the food intake. The real occurring change is always the result of all these factors, but with varying weight in different areas and amongst different groups.

1. Population and land pressure

The population is increasing quicker as the attitude of people is changing or traditions are altered. More people

need more food. At first the people try to use simple more land, instead of improving methods. This was shown quite good for the Sukumaland (124) in Tanzania. It leads to quicker crop rotation and overgrazing, and at the end exhausting of the soil and lower yields. The next reaction is mostly to change to higher yielding and less labour-intensive crops, but they are mostly less nutritious, as example from millet the way goes to maize and cassava. The food available per person becomes less on amount and quality. Improving agricultural methods, like interplanting, use of fertilizer need the longest time. But where the pressure came more slowly, the people were able to adopt very well. Examples for this are the Wasukuma, living on an island in Lake Victoria - Wakara (125), and people in Zanzibar (216).

Up to a certain level, which is depending on conditions in the concerning area, increasing population brings only very few change, because there is a reserve of land. Therefore often no influence of higher population density to diet is reported (9, 14, 17, 19). But the trend is dangerous - several reports show already decreasing nutrient intake with higher density (28, 30, 48, 91, 99, 103, 112e, 124, 125, 126, 172, 188).

2. Family size

If a family is bigger it needs more food, but there are more people who can look for it. Especially in rural areas these two factors are equal and no correlation between nutrition and family size is confirmed (30, 103, 124, 188). In denser populated areas (192, 193, 194, 216) and in towns (39) there is the tendency that the food intake decreases with increasing number of dependents in the family.

3. Wealth

Wealth is determined by size of land, number of cattle and cash-income from crops or employment.

Normally one would expect more money leads to better food or at least to more variety, and one can find this relation (16, 102, 110, 130, 183, 186). But not always the relation is in this simple way. In rural areas where the traditions are firm there has to be a big difference before the diet differs, like the difference between

a chief and a farmer (124). In the initial phase of increasing wealth, first other desires than better food (112f) will be satisfied. Due to ignorance about their nutritional situation, it is most likely that people spend the money first for savings - buying cattle, for more land -, and some prestige values - iron roofings, radio, etc. -, or for resting - they employ other people. Lack of knowledge may prevent them to expend their money properly, wealth will be shown by drinking tea with sugar instead of uji for the breakfast, buying soda waters, white bread, tinned milk, etc. A breakfast with tea, sugar, bread and few milk costs about 20 % of the daily food expenditure, and gives only 230 calories and 2.8 g protein or 10 % of the daily intake (146, 193). Valuable foods like milk, egg, legumes - are sold in order to get money and low valuable food is consumed (42, 125, 188, 193). There is obviously a transition time with no difference between the nutrition of different earning people (9, 30, 103, 111, 112b, 112e, 112g, 112h, 123, 144, 151, 191).

There is the tendency to spend a higher percentage of the total expenditure for food if the income is smaller. It is necessary to maintain a minimum calorie level. Is the income increasing the amount spent for food is increased, too, but the percentage becomes less; more cereals and protein-rich foods are consumed and less starchy foods (102). The correlation between income and protein-intake is closer as between income and calorie-intake (27). For food 60-85 % of the income are expended in rural areas and in towns 55-70 % (102).

A certain level on income and knowledge is needed till a higher income warrants improved nutrition.

4. Food price

Due to the marked seasons, high percentage of expenditure for food, small percentage of foods on markets - there is always a big variation in food prices (102, 112d, 147). It is to observe a certain price hierarchy in the foods. Cassava and maize are the cheapest calorie providers, the next group is plantain, coconut, potato, groundnut and sugar, lying between the following group with rice and bread, which is 1.5 to 5 times more expensive than the first group. Meat is 8 to 18 times more expensive than

maize and fishes, vegetables, and fruits even more - if the price per calorie-unit is considered. The relation between these classes remains quite stable (102).

Goes the price up, cheaper foods are bought, the nutrition becomes worse and vice versa (102). Good prices given to farmers encourage of course the production (200), but may lead that more land and attention is used for that cash crop, which is sold and it is bought more cheaper food for the consumption at home (102, 125, 162, 193).

5. Environment — infrastructure

Is the soil fertile and the climate favourable then the situation at whole is better of course. Villages near the sea or at rivers have due to higher fish consumption mostly a more regular animal protein intake (17, 33, 65, 97, 112b, 114, 139, 162, 188, 189). But the area of influence is rather small, unless there are good communications. Half a day walk or 10 to 20 miles away from the water, the fish consumption is not higher as elsewhere (39, 123, 162, 188, 189).

There is a very big impact of improved infrastructure on nutrition (110, 162). Where the traffic passes through or areas close to big towns - there is trade, money, exchange of ideas, employment, etc. Our investigations in the Pangani-basin in northern Tanzania showed that the people living in the dry lowlands close to the main road Dar es Salaam - Nairobi are better nourished as their relatives in the neighbored fertile highlands (112e).

6. Rural and urban areas

People living in towns are much more exposed new impressions, the change in dietary habits is accelerated. On the other hand dangers are existing, like under-employment and adoption of wrong ideals. They live from their earned money, they have to buy their foods. The percentage of homegardens and food supply from at home is decreasing. The towns become overcrowded, the annual increase of the urban population is 6 % and more. The house rents are increasing, many people can afford only the cheapest foods. The danger of adopting the "European way of life" is a well known fact. Symbols for it are white bread, highly refined cereals, bottle-feeding, soda waters, etc. (38, 95, 97, 116, 203, 204, 205, 207, 210).

A good acceptance is revealed by a rather constant - from the level of income independent - consumption (102). Comparisons of rural and urban people of the same tribe can show the worse conditions in town (98, 162). The town people will go back at least for visits in their villages, this will influence their relatives (93), for instance it is reported an increase of bottle-feeding in rural areas around Mount Kenya (6).

On the other hand by urbanization taboos and restrictions are breaking down quicker, people get accustomed to new foods and the food supply is more regularly and varied. The nutrition in town is better for many (4, 9, 37, 90, 106, 114, 139, 156, 186), but not for all.

The original food pattern in town is seldom complete changed. The different tribes keep in some way their pattern, that was shown by investigations in Kampala (102, 204, 205). The consumption of the staple foods in town is reflecting the situation of its surrounding areas (102).

7. Pressure conditions

Under this heading I list conditions like seasonal shortages, famines (9, 114, 116), epidemics, wars (3, 200), expulsions (8), resettlements (208), etc. They bring a quick change. Food shortages lead often to more planting in the next season (200, 216), during the shortage time more of the reserve foods are eaten like cassava. The foods introduced under these conditions like maize or dried milk as relief foods, rice in new settlements, might become adopted. But if the situation is relieved, the former food pattern is used again most likely.

These not wanted changes by emergencies lead to a change to the worse mostly (208), a striking example is the fate of the Wangoni in south of Tanzania, who had to change from a pastoral to an agricultural life (113, 171, 172).

8. Influences by government

Governments are able to influence directly the food pattern and the nutrient intake. Cassava as reserve food was introduced in many areas by law (34, 93, 180). There are possibilities for enriching cereals or iodizing salts. The consumption of good foodstuffs can be encouraged by price control. School feeding programs and canteens for

labourers provide these groups better nutrition, because normally pupils or workers get their first proper meal when they will come back at home in the late afternoon (12, 154).

In addition there are all these possibilities for an indirect influence, like resettlements, irrigation schemes, road building, education, applied nutrition schemes, etc. Some applied nutrition schemes were evaluated, but the follow-up was done after one or two years, a too short time to see beneficial effects on the nutrition (21, 171, 189, 190).

9. Food preferences and attitudes

Rather less is known about food acceptance and taste preferences amongst the Africans. Only some general impressions are reported, like the rather limited use of spices, sometimes rice is not liked because of the early hunger feeling after the meal (112i), white flours are better accepted than coloured ones, and quantity seems to be more important than quality. The preference for food is rooted in the history of the tribes, their social life and their environments. People want to keep their traditional food (177); has someone to change he chooses a similar staple. The Baganda, who are eating plantains, change easier to potatoes, tribes who eat commonly millet accept maize better (102, 204). Some food habits are introduced by a negative reflection, for instance: The pastoral Bahima, who are not high regarded by the Baganda, drink milk, therefore milk has not a good acceptance amongst the Baganda (97). A similar "snob prohibition" we find amongst the Masukuma with the goat's milk (124). More common is the opposite - easy acceptance by a high prestige value of the food, mostly connected with wealth. There is the danger of bad acceptance of a good and cheap food by getting the image of a food for the poor. Food preferences are determined by religion as well (73). Fasting months for the Moslems have a big influence on food intake (49, 216); special foods are forbidden and feasts bring higher consumptions. Aesthetic values can have influence - the Kikuyu like stout women and the nutritional status of the Kikuyu women is better than that of the men (150, 165). The food availability depends on the family status of a person. Mostly the father has the first choice, the mother and the children come later. They have different taboos and restrictions. This is disappearing, but still important enough to hinder quick acceptance of former restricted food.

10. Education

Education is needed for a quicker and more undisturbed change of traditions and customs. A better chance for education have the younger people and the people living in towns. With education the chance for employment is increased considerably. Therefore a comparison between groups with different educational level is in some way already done by the comparison of rural and urban areas and people with different income level respectively. Educated people eat more, and more varied generally (2), but the quality is not improved necessarily (203). There is, like with money, a certain rather high level of education necessary till the relation - more education, better nutrition - works. In the transition phase there is the already previous mentioned danger to accept some low-valuable foods and to neglect some good traditional food habits, like eating green leaves (188, 203), and with higher education breastfeeding is declining more and more (153, 204, 205).

These and certainly some more factors, which I may have forgotten to mention, influence a change of food habits and here-with the food intake. As economics food intake is determined by a feed-back mechanism of availability and demand. Factors like environment, population density, cash income, etc. govern the availability. They can be influenced by practical help - improvement of agricultural methods, irrigation schemes, re-settlements, road building, etc. But in the same instance the demand has to be guided to the goal - education, change of attitudes and food preferences means that. Only an interaction of these both factors guarantee an optimal success. It is important to consider the special conditions of the target area - in each area the single factors for change have a different importance and are changing during different development stages.

The today's condition is a mixture of broken traditions and new accepted habits, with plenty of confusion and disturbances. There is improvement and beginning understanding of the problems by the people themselves, but the development is not going on a single and ideal straight road, since human beings are involved, which cannot be simple programmed like a computer.