

*Dr. Oeltesdorf*

Special Print from  
Investigations into Health and Nutrition in East Africa  
by H. Kraut/H.-D. Cremer [Eds.]

AFRIKA-STUDIEN Nr. 42

---

**INVESTIGATIONS IN NORTH EAST TANZANIA**

**The Nutrition Situation in the Pangani Basin**

by J. Kreysler, C. Schlage



**WELTFORUM VERLAG · MÜNCHEN**



Publication series "Afrika-Studien" edited by Ifo-Institut für Wirtschaftsforschung e. V., München, in connexion with

Prof. Dr. PETER VON BLANCKENBURG, Berlin

Prof. Dr. HEINRICH KRAUT, Dortmund

Prof. Dr. OTTO NEULOH, Saarbrücken

Prof. Dr. Dr. h. c. RUDOLF STUCKEN, Erlangen

Prof. Dr. HANS WILBRANDT, Göttingen

Prof. Dr. EMIL WOERMANN, Göttingen

*Editors in Chief:*

Dr. phil. WILHELM MARQUARDT, München

Afrika-Studienstelle im Ifo-Institut

Prof. Dr. HANS RUTHENBERG, Stuttgart-Hohenheim,  
Institut für Ausländische Landwirtschaft

Lit.112

## Investigations into Health and Nutrition in East Africa

with 132 tables and 70 figures

By

H. KRAUT / H.-D. CREMER (Eds.)

with contributions of

M. G. ATTEMS

W. POEPLAU

H. KASPER

H. J. SCHAEFER

W. KELLER

C. SCHLAGE

R. KORTE

P. THEERMANN

Y. KREYSLER

W. VALDER

E. MUSKAT



WELTFORUM VERLAG · MÜNCHEN

## **Contents**

A. Investigations in North East Tanzania . . . . .	13
by M. G. ATTEMS, W. KELLER, H. KRAUT, J. KREYSLER, W. POEPLAU, C. SCHLAGE	
I. Introduction and General Survey . . . . .	15
<i>by H. KRAUT</i>	
II. Nutrition and Health in Usambara . . . . .	25
<i>by W. POEPLAU, C. SCHLAGE, in co-operation with W. KELLER</i>	
III. Analysis of Some Important Foodstuffs of Usambara . . . . .	55
<i>by C. SCHLAGE</i>	
IV. Observations at a Local Market in Usambara . . . . .	71
<i>by C. SCHLAGE</i>	
V. The Nutrition Situation in the Pangani Basin . . . . .	85
<i>by J. KREYSLER, C. SCHLAGE</i>	
VI. The Shambala System of Agriculture (Usambara) . . . . .	179
<i>by M. G. ATTEMS</i>	
B. Investigations in Kenya . . . . .	219
by H. D. CREMER, H. KASPER, W. KELLER, R. KORTE, E. MUSKAT, H. J. SCHAEFER, P. THEERMANN, W. VALDER	
I. Introduction . . . . .	221
<i>by H. D. CREMER</i>	
II. A Contribution to Determine the Nutritional State of the People Living in the Central Province of Kenya . . . . .	227
<i>by H. KASPER, H. J. SCHAEFER, P. THEERMANN</i>	
III. Some Observations Regarding Economy, Diet and Nutritional Status of Kikuyu Farmers in Kenya . . . . .	241
<i>by W. KELLER, E. MUSKAT, E. VALDER</i>	
IV. The Nutritional and Health Status of the People Living on the Mwea- Tebere Irrigation Settlement . . . . .	267
<i>by R. KORTE</i>	

### **A. INVESTIGATIONS IN NORTH EAST TANZANIA**

by

M. G. ATTEMS, W. KELLER, H. KRAUT, J. KREYSLER,  
W. POEPLAU and C. SCHLAGE

Investigations into the problems of nutrition and agriculture in developing countries were carried out with a double purpose. They were intended to indicate ways in which these countries could use their own resources to eliminate food shortages and errors in nutrition and thus raise the standard of health and improve working efficiency. Since about 80% of the population is engaged in agriculture, there should have been an increase in the cultivation and sale of suitable cash crops in order to raise the general standard of living.

Developing countries lie predominantly in the tropical and subtropical zones and differ from the countries in the temperate zones in many ways, in particular by their great contrasts in climatic conditions, namely the abruptness of the changes from rainy to dry weather, and the great range of transitions from arid to humid climate. It is characteristic of many of these countries that there are great variations in the cultivation possibilities of agricultural produce. There are also variations in the harvest, the living standards and the consumption habits, all in close proximity to one another. The advice, generally held to be good, to increase consumption of animal products, to expand cultivation of plants with high protein content, to develop agricultural export articles in order to improve the balance of foreign currency, is generally not followed or when followed, without effect. Those who have gained practical knowledge over a long period of time in a given area, recognise that the problems are many-sided and that frequently, within a distance of only a few miles, such varying conditions prevail that quite different advices must be offered. There is nothing more inimical to the success of development schemes than to apply measures in places where they are not suitable. To be able to point out that the measures were very successful in one place is far less impressive than the obvious lack of success in another. When writing an account of scientific studies in developing countries, it is absolutely essential to state exactly in which spot, at what time, and for how long the investigations took place. It should also be noted where the conclusions drawn from such a study are applicable. Any advice which is offered should also pertain to a specific area. The change in climatic conditions from one year to another is often so great that only investigations on the spot, and spread over several years, can lead to reliable results. Finally, it should be pointed out that the complexity of human life necessitates other studies focused on complementary branches of knowledge which are performed in

the same area. This is the only way to obtain a complete picture of the situation avoiding wrong conclusions.

In accordance with recommendations of an WHO Expert Committee on Nutrition (1963) the surveys consisted of the following:

- A collection of background information concerning Tanzania in general and the survey areas in particular.
- Vital and health statistics including incidence studies of intestinal parasites and malaria.
- Questionnaire surveys which obtained more detailed background information, birth plus mortality rates, habits of child care, and nutrition.
- Food consumption surveys.
- Anthropometric measurements.
- Clinical assessments of the nutritional status.
- Biochemical assessments of the nutritional status.

None of these methods alone would have provided sufficient information. Only the combination of essential dietary, anthropometric, clinical and biochemical data plus thorough background information including studies of environmental and social factors and consideration of such vital statistics as morbidity and mortality rates, made possible full appreciation of the public health situation.

The surveys also provided a valuable opportunity for the critical testing of new biochemical and other methods recommended for the assessment of the nutritional status.

In 1961, Wolfgang KELLER, M. D., from the Max-Planck-Institut für Ernährungsphysiologie in Dortmund, did the preparatory work for the establishment of an experimental station in Bumbuli. He has given us much valuable advice and cooperation in the planning of our studies. We take this opportunity to express our sincere thanks to him.

We are also most indebted to the personnel of Bumbuli Hospital and in particular to its former Director, Professor Otto WALTER, M. D., for the valuable encouragement and advice given to us in our work.

In Uganda and also in Kenya and Tanzania where the research was not so detailed, investigations have already been made on the nutritional conditions of the population concentrating on young children. Some comments on food consumption have also been given. Up to now, however, there were very few studies dealing with family consumption combined with a description of the health conditions of all age-groups within the population. With the help of the Fritz Thyssen-Foundation, a research station called "Max Planck Nutrition Research Unit", was erected in Bumbuli (Usambara). Its first task (1964-1966) was to determine the state of health and nutrition of the population as a whole. This study was based on dietary observations made throughout the year on a selected number of families from Bumbuli and the neighbouring villages together with anthropometric, clinical and biochemical

investigations. These results were compared with another survey carried out in N. E. Tanzania. Our aim was to find out to what extent the conclusions drawn from Bumbuli would apply to other areas. Dipl.-Ing. M. G. ATTEMS, an agriculturist, sent out by the IFO-Institute, carried out a year's investigation into the agricultural conditions of Bumbuli and the surrounding area. Working in cooperation with him, we tried to find ways to improve the nutritional status significantly.

In 1966/67, in 8 areas between Kilimanjaro and Usambara, a study of nutrition was carried out on certain families who had already been selected by a group of the F.A.O. for a sociological study. Both investigations were done with the cooperation of the Tanzanian Government. The aim of both was to determine the living conditions of groups of the population who were under consideration for resettlement in the irrigated areas of the Pangani-project. Beyond this, there was the chance to find out whether certain shortages of foodstuffs existing were greater among the people of the plains than among the neighbouring hill-folk who were of comparable ethnic origin.

Investigations could be made over an area in which a border line existed with regard to the different food habits in East Africa. For example, the diet in Usambara is based principally on maize. The diet of the people living on the slopes of Kilimanjaro is mainly bananas. We found it necessary to study the composition of the local foodstuffs eaten, and to determine if possible, any losses which were caused by the local methods of preparation. The market in Bumbuli served as an example for our study on seasonal variations in the market demand for some important foodstuffs. The focal point of the first enquiries was the village of Bumbuli, which lies in the south-eastern part of West Usambara at an altitude of 1,200 or 1,300 metres above sea-level. It is connected with the main road between the port of Tanga and Moshi at the foot of Mount Kilimanjaro by the Bumbuli-Soni-Mombo road. Bumbuli has a population of some 300 families who belong to the Shambala tribe (Bantu group). They live in two distinct parts of the dwelling area. There is the old part (referred to later as Bumbuli A) where about 130 families live. Here more Moslems live than Christians. Then there is the new part (Bumbuli B) which is predominantly Christian, where the market place and most of the shops are located.

The villages of Funta, Mayo, Mulungui and Soni all lie within 15 miles off Bumbuli in the Usambara hills and all of them are roughly at the same altitude as Bumbuli. They are also inhabited by the Shambala and have similar living and eating habits. In Soni, enquiries were made only of vegetable growers whose produce goes via the Soni market as far as Tanga and Dar-es-Salaam. We studied the question of whether their higher incomes affected the standard of nutrition and health of the population of the area.

For a further comparison, we chose the two coastal villages of Maranzara

and Chakichani near Tanga. These belong to the area of the Digo tribe (Bantu). The average diet here is different from that in West Usambara. Here in the coastal area, the coconut palm grows and sea-fishing is practiced.

The village of Leguruki (1,200 m above sea-level) lies between Mount Kilimanjaro and Meru. It is populated by the Meru tribe (Bantu) who are engaged in animal husbandry and agriculture. They have a satisfactory water supply. Living conditions here are worse than in the Shambala and Digo tribes. In the Pare hills west of Usambara, we studied the nutrition and the state of health of five Pare families (Bantu) in the higher income bracket. In Irene (Usambara) there is an orphanage supervised by doctors of the Bumbuli hospital. Here we were able to examine the children.

For the second nutrition study in connection with the Pangani irrigation project, places were chosen which were considered to be characteristic of the particular area. We also differentiated between the hilly country and the lowlands so that we had four pairs of survey areas.

Kilimanjaro-area: Highland: Kilema, Kirua-Vunjo, inhabited by Chagga  
Lowland: Kahe, inhabited by several tribes

North-Pare-area: Highland: Usangi, Ugweno, inhabited by Pare  
Lowland: Mwanga, inhabited by Pare

South-Pare-area: Highland: Mamba, Bombo, inhabited by Pare  
Lowland: Makanya, Hedaru, inhabited by Pare and Masai

Usambara-area: Highland: Lushoto, Gare, inhabited by Shambala  
Lowland: Mkomazi, inhabited by several tribes.

The outstanding feature of the population (in relation to nourishment) in West Usambara is that from the age of 4 to 6 months, the development of most of the children falls more and more below the European and North American standards. Well-nourished Bantu children, however, sometimes fully reach western standards. The reason for this lies in the fact that once the mother's milk fails to satisfy the child's needs, his extra feedings are quite insufficient. On the average, children of about two years of age who live in the villages where we worked came up to the standards of height and weight of 9-months-old western babies. It was nearly always a case of general under-nourishment rather than a one-sided lack of proteins. Nevertheless, the main cause of the widespread under-nourishment of children certainly lay in the lack of protein-rich food.

The averages of height and weight remained under the normal limits right up to school age. They improved, however, during the school years, and by the time the children were 16 their weights approached western standards. This is particularly true for girls. There is a uniform lack of weight and height

which is observed very frequently in the following age categories. Adults are generally about 8 cm shorter than European people. Even their weight is much less than that of Europeans of the same height. This is attuned retarded growth.

The extent to which the food requirements of the Shambala were met is shown, in round figures, as follows:

Protein	60 to 90%
Calcium	20 to 45%
Vitamin A	20 to 60%
Vitamin B <sub>2</sub>	20 to 60%
Niacin	60 to 80%

When the protein requirement is met by only 60%, there is a state of considerable under-nourishment. An improvement in the protein supply should, therefore, be the first aim of nutrition development. Since animal production is depending on many conditions, it would appear that the most expedient way to improve nutrition standards would be to cultivate more legumes. We found out that a small amount of beans (*Phaseolus vulgaris*) without skins, mixed with maize porridge could be digested without difficulty by children 6 or 9 months old. Increasing amounts of up to 60 g per day for children up to school age would really improve their protein supply. During the days of antiquity in the Mediterranean area, the grain legume (*cicer arietinum*) was always a regular part of the food of the less prosperous population.

The small amount of calcium consumed is noteworthy. It is, of course, well known that the body can become accustomed to a considerable degree of under-average supply. But it is still surprising that, with an intake of only one third of the recommended amount, no clinical signs of the lack of calcium were observed.

The situation is the same concerning vitamin A. The average intake is half (or even less) of the amount recommended. This holds true even when one takes into consideration the fact that during and after the rainy periods the consumption of wild vegetables and cassava leaves (both rich in carotene) is much higher than in the dry periods. In many families, there is no intake of retinol. Signs of a lack of vitamin A were not observed. But it should be pointed out that early symptoms (e.g. hemeralopy) cannot be diagnosed by means of simple clinical examinations.

In contrast to South-East Asia, the supply of B<sub>1</sub> is sufficient. But the supply of vitamin B<sub>2</sub> and niacin is critical. We have a good knowledge of the B<sub>2</sub> requirements because any excessive intake of it can be measured in the urine. The intake in Usambara was never found to exceed 70% of the requirements, and it was often much lower. The requirement of niacin is not known with certainty. Niacin is partly obtained from tryptophan.

To be sure, the intake in Usambara is well below the requirement. It is, therefore, quite understandable that signs of an insufficiency of these vitamins, such as atrophy of papillae of the tongue or splitting of the corners of the mouth, were often observed. In Usambara this amounted to only 2% of the cases examined, but in Mulungui, where the supply is at its lowest, such signs were observed in 14% of the people. Here again, greater consumption of legumes would bring about a marked improvement, as its niacin content is higher than in the basic foodstuffs. Only singular cases of fluorosis of the teeth were found in Usambara. This was to be expected in view of the small fluorine content of the water. Two water analyses showed 5 p.p.m. respectively 10 p.p.m.<sup>1</sup>. On the other hand, in Leguruki, near Mount Meru, there were many cases of fluorosis due to the well known high content of fluorine in some waters of this volcanic area.

The investigations in other areas of North East Tanzania were of too short a duration to allow a firm judgement of the nutrition of the population. It is, however, certain that the composition of the diet in Leguruki, near Mount Meru, and in the coastal area, is quite different from that in Usambara. Here we found that only 13–15% of the protein intake was of animal origin (mostly in the form of meat). In Leguruki, it was 24% among the few families investigated, and of that 15% was from milk. The main food in both areas was maize and bananas. In the coastal villages of Maranzara and Chakichani, the basic food was cassava and fish. The proportion of animal protein was considerably higher than in Usambara. In Chakichani, on the coast, it accounted for 54% of the protein intake, and in Maranzara, 10 miles inland, it was 27%.

In Leguruki, the physical development of the infants was considerably better than in Usambara. This was probably due to the higher milk consumption. In the coastal villages the situation was somewhat worse than in Usambara because the infants got no fish. In addition, cassava, known for its very low protein content, is the staple.

Our agricultural investigations in Usambara led to the following conclusions. According to the degree of commercialisation of the small farms, three development stages can be distinguished: Subsistence holdings, partly commercialised, and half-commercialised holdings. In Mulungui subsistence economy prevails the degree of commercialisation being 4% only (figures based on the share in sales of the raw produce from the worked fields). On the average, each holding produces a yearly income of 240 E. A. shs. In Bumbuli, the gross income from a small-holding commercialised to 15% was 900 shs. on the average. The income came principally from non-agricultural work (hospital employees, shop keepers, etc.). The holdings of the vegetable

growers whom we investigated near Soni, were half commercialised. The average income per holding was 2,015 E. A. shs.

Commercialisation constitutes a large step forward in agricultural development. It stimulates the interest in improving the yield in order to get a higher income from the same piece of land. The fact that agriculture has developed into a half-commercialised form of the economy in the Soni area of Usambara has certain socio-psychological aspects, but more important, it has four agro-economic causes:

- The relative seclusion and inaccessibility of the Usambara hills which prevent all but the vegetable growers in Soni from marketing their produce in the large towns.
- The increasing partition of the land due to the rapidly growing population. This has led to a reduction in size of the agricultural plots, and thus works against a planned agriculture. The maintenance of traditional agricultural methods has led to the soil being on the verge of exhaustion. Reduced yields and increasing soil erosion are the accompanying results.
- The indefinite occupation or ownership conditions. There are tribal lands and family lands upon which the temporary occupier has certain rights including inheritance. There is no desire to invest manpower or money to improve the soil. No fertilizers are used.
- The excessive number of cattle are maintained less on account of their yield than for the prestige of ownership. They are used as capital instead of money. The cows graze freely on all grassland as well as harvested fields. The farmer has no interest in preserving the pasture land because of excessive communal grazing. Preservation would only be possible if the number of stock were reduced.

One remarkable point is the unsatisfactory relation between income and nutrition. In Soni, where the income is greater, people eat a little more (better calorie intake), but the composition of the diet (with insufficient protein, vitamin and mineral content) remains for the most part unchanged. Thus, it is not possible to say that differences in the state of nutrition and health were dependent on social standing. The supposition that an increase in income automatically brings about an improvement in nutrition is inaccurate. Answers to questions put to the families as to what things they wanted and would buy if they had a higher income, showed that other improvements in living standards took preference over improvements in nutrition. If they had more money, it would first be spent on housing, then on the purchase of land, and thirdly for their children's education. School fees and school clothes are beyond the reach of poorer families. Beyond this, they wanted to raise their agricultural production by investing, as in Soni, in the purchase of seeds. Therefore, we assume that the increase of income for the vegetable growers in Soni was neither big enough nor of a long enough duration to

<sup>1</sup> We are indebted to TWIN CITY TESTING and ENGINEERING LABORATORY, INC. St. Paul, Minn., USA, for the quantitative determination of fluorine in two water samples.

bring about a change in the eating habits to which they had grown so accustomed.

In many cases, this attachment to the old forms of nutrition was due to ignorance of the importance and necessity of nutrition. Over and above the recommendation of increasing the agricultural production, there should be a comprehensive program for nutrition education. There should also be particular instruction for mothers concerning proper food for babies and infants.

The second enquiry on nutrition (the Pangani Survey) showed interesting differences between the hill population and the people in the lowlands. The vitamin C content in the blood of the hill-dwellers is considerably higher than in that of the lowland inhabitants. The reason for this is that there are greater quantities of fruits and vegetables on hand all the year around in the green hill-country, but the plains remain dry for most of the year. On the other hand, the dryness of the soil in the plains decreases the propagation of worm parasites. This was demonstrated by the fact that there was a smaller degree of infection amongst the people of the plains.

It was surprising that the results of almost all studies revealed a poorer nutritional status among the inhabitants of the mountains (Kilimanjaro, Pare, Usambara) in comparison to the population groups in the plains.

The Chagga, supposedly the most highly developed tribal group in this region, were slightly better than the Pare or Shambala in many respects. Their higher nutritional standard was due to their intensive and long standing coffee cultivation as well as their good sense of social priorities.

We were able to show that population density was somewhat related to intestinal worm infection. Other investigations showed similar correlations. It seems as if the nutritional status of all these population groups developed inversely proportional to the population density.

Although the analyses of foodstuffs showed only minor differences from the data given in the food composition tables, these differences became important in calculating the nutrient intakes especially with respect to foodstuffs in common use like maize. We found that maize had a somewhat higher water content and a lower protein content. Fresh cassava roots and sweet potatoes showed a definitely higher content of Vitamin C. A study of the local preparation of maize showed the inexcusably high loss of 40% of the total weight. There was an almost complete loss of the germs which resulted in a low fat content in flour. Accordingly, there was a loss of carotene in processing yellow maize. This loss coupled with the already poor supply of vitamin A must be regarded as very serious. If only the maize were ground in a simple hammer mill instead of being stamped in a wooden mortar, all these losses could be avoided.

The market study showed that maize, cassava, pawpaw, and dried fish were sold practically all year around with very little variation in price. There were, however, considerable price variations for mangoes because its

season is so short (December to January). The supply of oranges, tomatoes, onions, and green beans is also seasonally limited. Dried beans, pineapples, and lemons are always available but with considerable variation in supply and price.

Meat is not on sale in the market but in special shops. There are several kinds of preserved fish in the market. The popular smoked fish is twice as expensive as salt fish. But the protein level in salted fish is still much higher than that in vegetable protein. So from this point of view as well, the increased use of vegetable protein has to be stressed in order to fill the gap in this most important nutrient.