THE UNIVERSITY OF CHICAGO

A STUDY OF THE NUTRITION AND HEALTH OF CHILDREN IN THE GOLD COAST

A Field and Laboratory Study

A DISSERTATION SUBMITTED TO

THE FACULTY OF THE DIVISION OF THE BIOLOGICAL SCIENCES

IN CANDIDACY FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

DEPARTMENT OF HOME ECONOMICS

By

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CHICAGO, ILLINOIS

DECEMBER 1954

PREFACE

The results of field and laboratory study into the food and physical status of certain groups of children living in the Gold Coast, British West Africa, are presented in this report. The main part of the study was carried out during ten months in 1951 and 1952. Further laboratory study was carried out in the United States during 1953.

The decision to carry out the study resulted from association in the Department of Anthropology, Northwestern University. The Department of Home Economics of the University of Chicago participated in the plan and provided equipment. In the Gold Coast, the study was sponsored by the Department of Chemistry of University College, Achimota, and was aided in terms of housing and initial arrangements by Kumasi College of Technology. Health examinations were obtained through the courtesy of physicians of the Department of Medicine and by a physician in private practice. Members of the Department of Agriculture and Social Welfare provided much information and help with certain phases of the study. Teachers provided information concerning food preparation. Advice on many phases of the study was obtained from members of the Nutrition Division of the Food and Agriculture Organization and from the Department of Nutrition of the London School of Hygiene and Tropical Medicine.

The study would have been impossible without the help of the many individuals who have contributed so generously of their time and resources.

First of all, I gratefully acknowledge the help of Dr. Thelma Porter of the University of Chicago in planning the study; her advice throughout; her efforts in obtaining laboratory equipment for use in the Gold Coast, and her help in preparing the manuscript.

I gratefully acknowledge also the part of Dr. Melville J. Herskovits of Northwestern University in bringing the plan to the attention of Dr. Kofi Busia of University College of the Gold Coast, in helping me to prepare for the study, and in writing of the final draft; the advice and counsel sought so frequently from Charlotte Chatfield and Dr. M. Autrey of Food and Agriculture Organization of the United Nations; the contribution of Margaret Grant and Dr. B. S. Platt in making their collection of material on diets in Africa available, the privilege of attending the class given for nurses and nutritionists going to the Colonies, and the advice in the preparation of the material; the interest and advice of Mrs. Chilver of the Colonial Office in London and Mrs. B. E. Wyatt, secretary of the International African Institute.

It is a privilege to thank again the many in the Gold Coast who have helped me. To name each of these would be to name a large percentage of the staff and faculty of University College and Kumasi College of Technology; to name as well a number of people connected with the Department of Social Welfare, the Department of Agriculture, the Department of Medicine, the faculty of Wesley College at Kumasi, various administrative officers,

and the many Africans, nameless to me, who supplied information and help in the markets, the fields, and on the roads.

Among those at University College, I make particular mention of the assistance received from David Balme, Principal, and Dr. Kofi Busia of the Department of Social Science since, without their approval and help, I should not have been able to have carried out the study; Dr. J. Graham of the Department of Chemistry since, without his help and the resources of his department, the chemical work carried out there would have been impossible; Reverend Noel Duckworth, Dean, for his aid with the study at Dome; Reverend G. C. Williamson for his arrangements with the faculty of Wesley College concerning accommodations during the first two weeks in Kumasi; Mrs. George Lawson (Rowena Jackson) for housing at the College and for help with the study of Gold Coast fish, and Professor Baughey for help with the classification of yams. At Achimota School, I am indebted to Janet Asare, Head Mistress of Housecraft, for her help with African foods; and to Dr. Michael Wilson, Director of the Clinic, and to his staff for the medical examinations of the children in Dome.

In Accra, I received much aid from Dr. Mark Edington of Medical Research Center in providing examinations for a number of children and making available the resources of the library. Also in Accra, Mrs. Peter du Sautoy helped greatly with initial suggestions concerning the importance of chemical determinations of fish of the area, and I am grateful for her interest throughout the study.

At Kumasi College, I wish to thank Elizabeth Sproat of the Department of Housecraft for her initial help with the study in Ayeduase and for her interest throughout; Lord Hemingford, acting Principal in 1951, and Dr. J. P. Andrews, Principal, for their continuing interest in my work and for providing housing at Kumasi College; A. M. Opoku for his early arrangements with the Chief of Ayeduase; and the many others there, including E. McGuire and Robert Pattison, who contributed more than they know. In Kumasi, I am particularly indebted to Dr. Susan Ofori Atta of the Maternity Clinic, Colonial Hospital, for the medical examinations of the children in Ayeduase.

I also wish to thank Dr. Oku Ampofo at Mampong, Akwapim, for permitting me to interview patients attending his clinic, for the clinical data of children who were patients there, and for providing housing for my interpreter-assistant during one week in Mampong; and to thank again my interpreter-assistant, Caroline Korentang, for her careful work and continuing loyalty. I acknowledge with deep gratitude the kindness and courtesy of the African families who permitted me to come into their homes.

Lastly, I gratefully acknowledge the aid of my father and mother, J. Vernon and Mary E. Woodard, and of my husband, Franklin R. Grant, in providing funds for travel and photographic records.

The conclusions reached and expressed in the following pages are entirely my own in that I do not know that those who have advised me would have arrived at similar conclusions.

Faye W. Grant

Evanston, Illinois
October 1954

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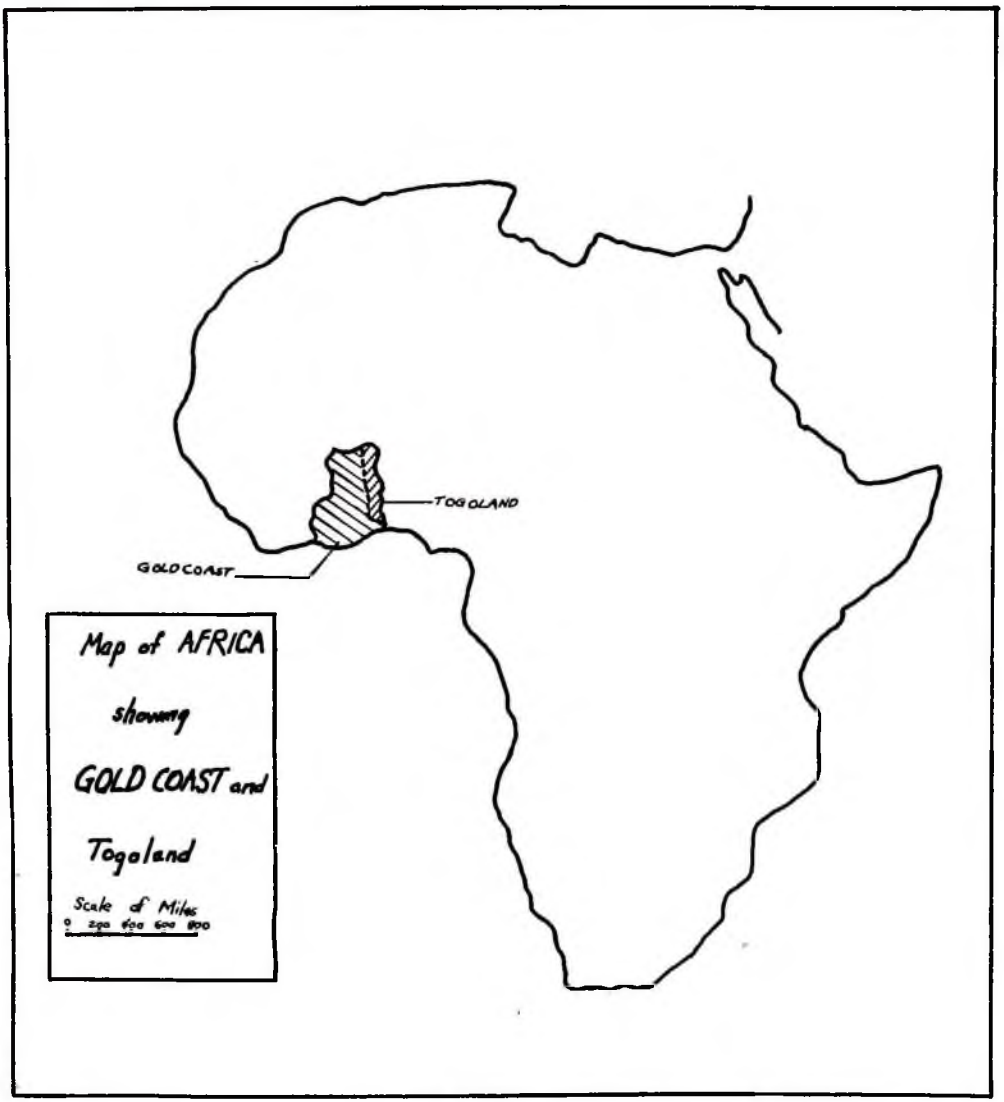
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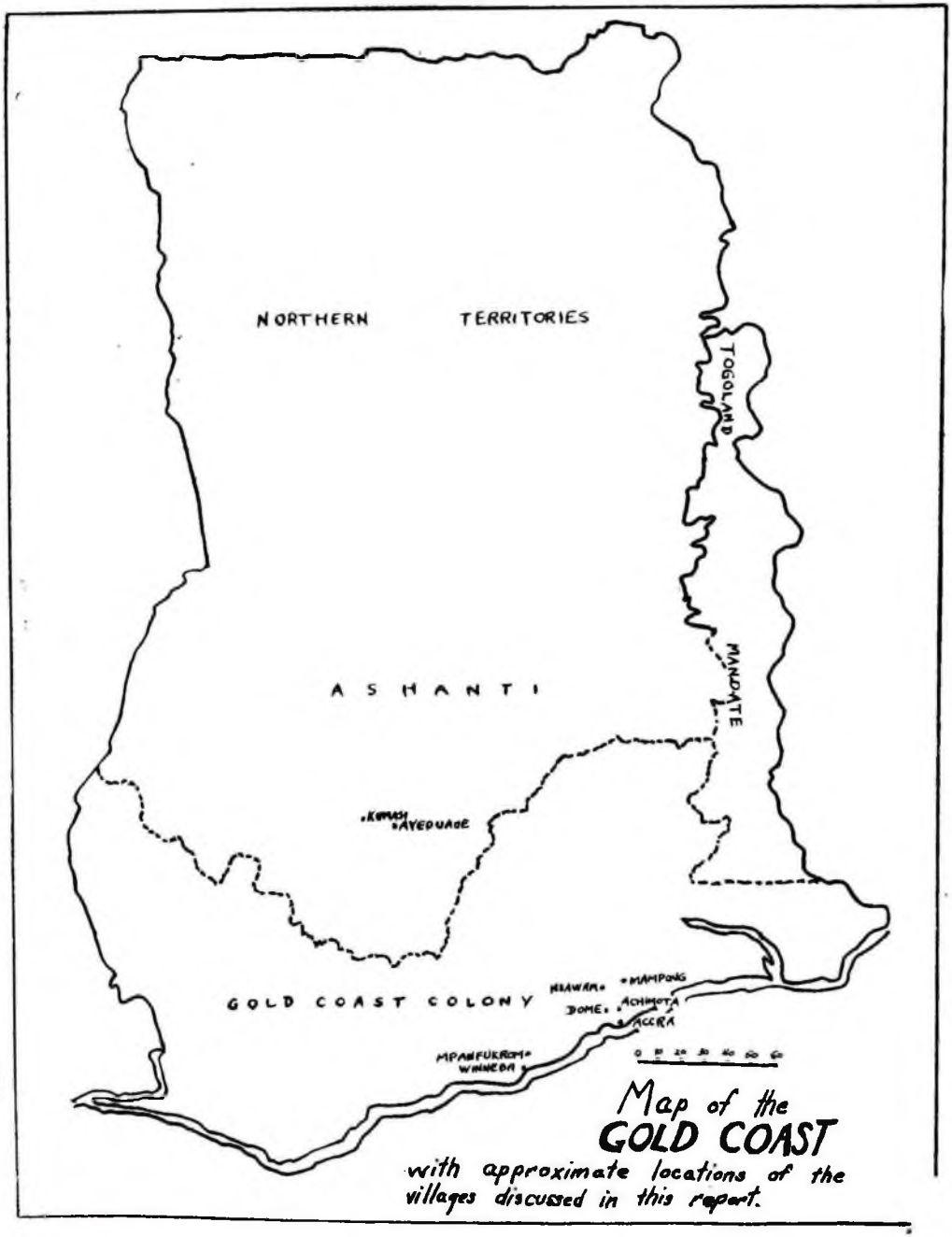

Map of the
GOLD COAST
with approximate locations of the villages discussed in this report.

INTRODUCTION

Despite wide interest in the nutrition and health of children in underdeveloped areas of the world, countries in Africa have been neglected by individuals and groups in the United States as sites for dietary and health studies. Reasons for this doubtless lie elsewhere than in a lack of interest. Such study not only offers the possibility of providing information needed by the indigenous population, but also information concerning the nutritive needs of children in relation to conditions in such areas.

The present investigation was undertaken to study quantitatively the diet of certain groups of children in the Gold Coast, West Africa, in relation to their physical status and the environment of the area.

The Gold Coast, as a British Crown Colony with a large degree of self-government, has had an important place during recent years in news of the African continent. It has become the first African Colony to have an all-African Legislative Assembly and all-African Cabinet. The country has been of special interest because of the extensive development of the cocoa and mining industries that has taken place during this century. Indeed, the Gold Coast is not considered underdeveloped in relation to many countries. But since much of the development has taken place so recently, all facets of life have not kept pace. Some 88 to 90 per cent of the population is nonliterate, and few of the people know even the rudiments of child nutrition.

Certain aspects of the nutrition and health of children in the country have been publicized by Food and Agriculture and World Health Organizations (1). The general nature of the diet and physical status of certain segments of the population have been studied and described. Twenty years ago, Williams (2) reported on the diet and health of children treated at a hospital on the coast for a condition associated with a diet of maize. As is well known to many, when the condition was found to occur among children who received staples other than maize, this author (3) referred to it as "kwashiorkor". Recently (4) she has reviewed her experiences with this disease.

Somewhat later Russell (5) described the diet in the forest zone of the country as without milk except mother's and with low content of protein after weaning, and a relatively high content of carbohydrate derived from foods of poor nutritional quality, as cassava, plantain and coco-yam. In addition, the children suffered from malaria and worm infestation. More recently, Coulbourne, Edington and Hughes (6) studied a rural community and reported that, as in other parts of the country, a large percentage of the calories was derived from maize and cassava. Clinical examinations suggested deficiencies of B-complex vitamins and of ascorbic acid, with the greatest incidence of these signs in children from one to five years of age. Malarial and intestinal parasites were common. The population was anemic in terms of usual standards. None of these reports included quantitative dietary study.

CHAPTER I.

BACKGROUND OF THE STUDY

The Country and the Scope of the Study

Despite the small size of the Gold Coast (about 92,000 sq.mi.), there are three distinct geographical zones, which include a coastal plain, a tropical forest, and a northern savannah land. Several ethnic groups are represented as well, including the Fanti, Ga and Ewe near the coast, the Ashanti in the forest, and Gurunsi, Dagomba and Mamprusi of the savannah land. Quantitative dietary study was carried out in the coastal and forest zones. Families from the savannah land have migrated to the coastal zone so that children from these groups were included as well as those from groups who are indigenous.

The most intensive part of the dietary study was carried out during a period of approximately three months in Ayeduase, a traditional village in the heart of the forest. This village offered the possibility to become familiar with general practices and procedures that are more or less typical of the area as a whole. Later, approximately seven months were spent in the coastal zone, during which study was carried out in (a) four families in Dome, a small heterogenous village of laborers; (b) a moderately well-to-do family in Accra, the capital; (c) three families in Mampong, a relatively large village on the edge of the forest zone but within driving

distance of the coast, and (d) in a laboratory at University College of the Gold Coast at Achimota. Also during this time a study was made of the school children in Dome and three days were spent in observation of the work of Mass Education and Community Development at Mpamfukrom, where a class in child care was one of the many projects. Preceding study in Mampong, twenty-five women were interviewed who were attending a clinic there for advice concerning their children. Forty-three women were interviewed individually in Ayeduase and Dome.

Even though the products of the mines and forests are important economically, the country is principally agricultural. With exception of meat, the country largely produces its own food. Because of the tsetse fly, livestock farming is not extensive except in the northern savannah zone. However, conditions are said to have improved during the past few years. In 1951, the total meat ration had increased from just over 5 lb. per person per year to 10 lb. (7). A recent estimate by Jackson (8) places the annual production of fish, including river fish, at about 60,000 tons. With the population near 4,000,000, this is approximately 33 lb. per person per year. Distribution is unequal because of poor transportation and differences in income. Then, too, in appraising the supply of flesh food, refuse must be considered.

Various tubers, grains, legumes, succulent vegetables and fruits are raised. Because of rainfall the crops of each zone differ somewhat.

Description of the Communities

Ayeduase

Ayeduase is typical of small villages in the forest area, lying behind the coastal plain. The elevation is approximately 900 ft. With the annual mean rainfall at least 60 in. and the mean temperature 78° F. (25.6°C.), climatic conditions are favorable for a large number of crops, including coco-yams, cassava, yams and plantain as the staples. A small amount of corn (maize) is raised also. Small clearings in the forest are suitable for lima beans and sword beans, but in general these are too shady and moist for the cultivation of peanuts, though a few are raised. Garden eggs (a small eggplant), peppers, onions and a few tomatoes are the principal succulent vegetables planted. However, the leaf of the most common coco-yam plant (Xanthosoma saggitifolium) grows prolifically and is used as a green. Oranges, pineapples and pawpaws (papayas) are available during two seasons. Bananas are to be had the year around. Coconut and palm trees grow in the area, and the nuts of the latter are important in the diet.

A census taken as part of the study showed the population to be 415. Approximately 51 per cent were under sixteen years of age. As in all non-literate groups, many did not know their true age. In this village a few of the ages are probably reasonably accurate, as they were given in terms of a well known event in the area, such as an earthquake or the construction of the school or a church. The people speak Twi, one of the Akan languages. At the time, approximately 5 per cent knew a few words of English,

and three young men had learned to use English in schools in the nearby city of Kumasi. A primary school had been opened in the village fifteen years earlier, and at the time of the study 100 of the 115 children from six to fifteen years of age were enrolled. The young mothers in the homes where study was made had attended for a few years, as had the young mothers interviewed. Even so, they were nonliterate as instruction during the early years had not been rigorous and had all been in the vernacular.

The village is on the fringe of the country where cocoa is grown extensively, but it is not one of the prosperous, expanding villages where standards of living have been altered extensively by such trade. Eighteen of the men owned cocoa farms in other areas. During the previous year one of the leading citizens (and head of the first household studied) received £480 ($1344) for his share of cocoa harvested by his tenant farmers from three farms. But as only six men owned more than one such farm, there is probably a wide gap between some of the incomes. Twenty-one were employed as laborers, with incomes of about £60 ($168) per year.* Four men ran food and sundry shops, and one was a blacksmith. With the exception of the Chief, occupied with the affairs of the village, all other males were unemployed.

The women are food farmers who produce food for home consumption and some surplus for sale. Because of the rigorousness of this with the aboriginal methods employed, homemaking tends to be secondary for some of them.

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*The Government has recently established a minimum wage of 5d (70 cents) per day for nonskilled laborers, so that the yearly income for full employment is now about £90 ($252).

The younger women farm to a lesser extent than those estimated to be between 30 and 45 years of age. However, independence is a tradition of the Ashanti women, and it is doubtful if any consider the work of the home as a full time activity.

The village is connected with Kumasi, the city five miles distant, by lorry service though most of the villagers walk back and forth. The nearest medical aid is in Kumasi, but traditional remedies were commonly used, often in connection with tonics and laxatives purchased in the city or local shop. At the time of study, plans were under way to open a dispensary at the new nearby Institute of Technology where facilities would be provided for the villagers. Also during the study, a unit of the Mass Education Division of the Department of Social Welfare came to work in a village nearby so that the isolation of the area is coming to an end. Even though most of them had had little or no direct contact with Europeans until the year, a few of them had visited clinics at the Colonial Hospital or maternal welfare clinics in the city so that they were aware of some of the health practices recommended by Europeans. A number of the younger women utilized the services of a medically trained midwife in the city. The husbands of six young women were literates in other parts of the country, one as far distant as a coastal city over 100 miles distant. With these various contacts and visits to husbands and relatives in other areas, the isolation of this forest village is rapidly coming to an end.

The houses of the village are built of blocks of sun-dried clay known locally as "swish". Construction is around a square or rectangular court-

yard. In the four households studied, from three to seven rooms opened off the courtyards. Only the Chief's house had two stories. Interior walls are of plaster or mud. Clay hearths used for cooking are built on the floors of the open courtyards or in small partially covered areas, so that fires are possible when it rains. Small braziers are also used in these covered areas in case of rain. The courtyards are the center of all activities in the households, as the rooms are used principally as sleeping quarters.

The people are clean about their persons and baths are frequent. Children and young men bathe in a nearby stream, while infants are bathed in the courtyard. Adults bathe from pails in their rooms. As is almost inevitable in areas with much activity and many persons, the courtyards are often disorderly. In many households, dogs and a chicken or two add to the disorder. Older people, remembering earlier days, reported that formerly the women were more fastidious housekeepers than at present. They believe the present state represents an aspect of the decay of their traditions.

Cylinders which hold rain water during some seasons are allowed to stand open in the courtyards. Most of the water for cooking and drinking is obtained from an open pool situated about one-sixteenth of a mile from the village in a densely wooded area. There are five pit latrines, three for men and two for women. None of these is privately owned. None of these villagers was observed to use the roads and paths of the village for toilet purposes.

There were forty-two households in the village with an average of 9.9 persons per household. Relations in the households are more complex than

those in presentday western society. The matrilineal system of descent is responsible for this. Traditionally, inheritance is on the mother's side so that the mother's brother has a more important place in the lives of the children than has the father. The system is still in effect to an extent, and in a household the head's sister's children may be present as well as his own. Indeed, others of the line may be present also. Then a married daughter returns to the home of her mother during pregnancy and remains until after the birth of the baby. Finally, polygamy is practiced to some extent, so that more than one wife may be present with others living nearby.

In these large households the care of children after infancy seems less personal than where there are only the parents to assume the care, but all children appear to be important. Where care is inadequate in terms of western standards, it appears to be related to ignorance rather than to indifference. With farming and selling occupying the attention of many women, the daily care of young children may be partly in the hands of girls who are only a little older than those in their care.

Dome

Dome, the second site of study, lies on the coast plain, approximately 8 miles inland. The soil of the zone is considered to be fairly good, but rainfall is insufficient for some of the crops that are raised in the forest zone. The yearly average for this area is about 33 inches. Cassava and corn, the main staples, are raised as well as small garden vegetables. Fruits are available after the onset of the two rainy seasons. There are many palm trees in the zone and palm nuts are plentiful.

At the time of study the population of Dome was found to be 204, with approximately 44 per cent under sixteen years of age. The school master had a record of the birth dates of all the children enrolled, including those from surrounding villages. Several vernaculars are spoken in the village as four groups are represented there. With but two known exceptions, the adults of the village are nonliterate.

The men are principally occupied as nonskilled and semiskilled laborers, and at the time of the study, the average yearly income was taken to be approximately £70 ($196). The women raise some cassava and peppers on land surrounding the village. Some of them add to the family income by peddling firewood or herbs, and a few sell food that they purchase from nearby farmers. In general, these women are less actively engaged than those in Ayeduase so that they are with their children more.

Despite the fact that the village lies nearly one mile from the main road, the villagers are not isolated. A railway passes to one side of the village and several trains stop each day. A foot path connects the village with University College of the Gold Coast and with Achimota School. Although economically these people are not as well off as the cocoa farmers in Ayeduase, they have potential advantages not available yet for these people. Competent medical service and a well established clinic are available at Achimota School and, as many of the men are employed there or at the nearby College, the services of the clinic are available to these people. The Students Welfare Association attempts to help the women with their problems. The school and church are sponsored by the Dean of University College. Despite the surroundings, the women do not seem to be as forward looking as the younger

women in Ayeduase. In general, they appeared somewhat suspicious of innovations.

The houses are similar to those in the forest, though many of them are smaller and lack the inner courtyard. In any case, cooking and other household activities are carried on in open spaces outside. Organization of these areas seemed somewhat better, but possessions were fewer, as these are not the original homes of these families.

As in the forest, the people appear to be very clean. Baths are taken daily or twice daily by the villagers in water obtained from an open pool. Many people obtain drinking water from the steam engines of the trains that stop in the station; thus one source of intestinal parasites is eliminated for those who utilize this water. Public latrines are provided as in Ayeduase.

There were thirty-six households in the village with an average of 5.7 persons per household. As these people are migrants from different cultural groups, no particular pattern of household organization was apparent. Various relatives were found living in the same household, though in no case was more than one wife present.

Accra and Mampong

Mampong, in a region where the altitude is near 1400 feet, on the edge of the forest zone, has an annual rainfall somewhere between that on the coast and in the heart of the forest. Crops are essentially the same as in Ayeduase, though the palm trees grow more abundantly so that more nuts are available.

Aside from the interviews in the clinic there and nine days of quantitative study, detailed study was not carried out in this village. The population was said to be 3781 (1949 figure). The people speak Twi, though the vernacular is slightly different than in Ayeduase. The majority of the villagers are nonliterate, but the village has had long contact with the coast. Many villagers are said to have one or more relatives with a degree of literacy who are employed in Accra or the area. The villagers are occupied as farmers, shopkeepers, drivers and laborers for the most part. In terms of dress and deportment, the people appear to be more sophisticated than those in the villages described previously. These people are in no way isolated. The village is situated on a main road and there is lorry service to the coast and other nearby villages. They are fortunate in having the Ampofu Clinic, which is headed by a native of the village who understands their needs.

Accra has a heterogenous population of 150,000. It is a city of many contrasts, among which are literates with noteworthy achievements to their credit and nonliterates entirely lacking in formal education; the rich and the poor; spacious houses of European style and quarters with large families occupying one room. Only one family of moderately well-to-do Fanti was studied. Their house is of European style and moderately large. Traditional atmosphere is retained to an extent by use of outbuildings to surround a central space at the rear which simulates the courtyards in the villages. Piped water and sewage disposal contribute to a more favorable environment than in the villages. Netting is used at some of the sleeping room windows,

and a malarial prophylactic is used during the rainy seasons by most of the group. The adults have received formal education and hold or have held responsible positions. Activities of the home are well organized; the household is orderly and neat, and meals are prepared regularly. The traditional pattern of living is retained to an extent, but it is modified by such European customs as the people think desirable.

Procedures and Methods

Initial Preparation and Arrangements

Preparation for the study was begun approximately two years before it was actually commenced. As the study was to be made without the assistance of others, it was necessary for the writer to study in advance various aspects of the country. This study included the cultures of the area, economic structure, former and current political organizations, and special technics of field study in underdeveloped communities. While it was impossible to obtain instruction in the languages of the area, with the aid of an instructor and a dictionary, many of the terms used in the households in the forest village were learned, as well as a few phrases of courtesy. A short course on foods of areas similar to the Gold Coast was helpful.*

Initial arrangements in the Gold Coast included the choice of an interpreter-assistant. A young woman was selected** who spoke the vernaculars of the groups to be studied. She had no special knowledge of nutrition. Her general education, experience with the public, personality and interest

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*By the courtesy of Margaret Grant of the London School of Hygiene and Tropical Medicine.

** Miss Caroline Korentang of Accra.

in the study were the bases for the choice. The general plan, procedures for collection of the data, and the objectives were explained to her during four weeks prior to the quantitative study.

Choice of the Villages and Subjects

Ayeduase and Dome were chosen as the major villages of study at the suggestion of the people at University College. Each village provided desirable contrasts already described, together with the possibility for initial contacts and for living quarters nearby. Study at Mampong was at the invitation of the head of the Ampofu Clinic there. Dietary study in homes of three children who were patients offered the possibility of comparisons with children in other areas not receiving medical attention. The well-to-do family in Accra was studied because of the willingness of the women there to cooperate, the interpreter having arranged a number of introductions with people of similar social and economic status. This group provided a contrast for those in less fortunate village families as food preparation followed the traditional pattern.

Before study in the forest zone was commenced, the District Commissioner of the area and the Chief Medical Officer were consulted, as were various physicians in the Medical Department. Finally, it was necessary to obtain the consent of the Ayeduase Chief (the Ayeduasehene). This was accomplished with the help of the faculty of nearby Kumasi Institute of Technology. Village etiquette required several visits back and forth and the exchange of small gifts before all arrangements were completed. The initial arrangements observed in Ayeduase were not necessary in other areas. In Dome, the plan was approved by the Dean of University College and the director of the clinic

at Achimota School nearby. Arrangements to visit the Mass Education Unit at Mpamfukrom were made through the help of the Department of Social Welfare.*

To further cooperation, the initial selection of the households in Ayeduase was left to the Chief and his Elders, with the request that the groups chosen represent different levels in the village, if possible. The choice did not include a family of any of the laborers. However, it became evident that there were differences between the incomes of the groups. Then, too, in this society the women are responsible for much of the food supply. There was no doubt that the Chief understood one requirement and hazard of the dietary study even though he had not previously heard of such study. He advised the heads of the groups selected that there were to be no changes in the kind of food prepared in an effort to impress the investigator with their riches. This insight into the problem and the unsolicited advice indicates how utilization of the proper channels of local authority help to attain the purpose of the research and facilitate the work of the investigator.

All children in the four households selected were included, if they were permanent members of the group for at least the duration of the study. Twenty-two children and one infant fell into this category; two were absent during the middle period of study, and one child died during the last week of study. Others remained with the study throughout.

In Dome, the choice of the households was made with the assistance of the school master who explained the purpose of the study to the women of

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* The author is indebted to R. Prosser, Chief Mass Education Officer, and K. Pickering, Senior Mass Education Officer, for these arrangements.

the village. Four families were selected at random who were willing to cooperate. Including three children not yet weaned, sixteen children were members of these groups. The dietary survey made of the school children in Dome included thirty-six of the fifty-nine children enrolled. All children enrolled were included for clinical and laboratory examinations.

All nine young people present as permanent members of the family in Accra were chosen for study.

Methods of Obtaining Background Information

General information concerning the population of Ayeduase and Dome was obtained by a door-to-door survey, in which the author was assisted by the interpreter and assistants from University College. As the women were somewhat shy at first, this phase of study was not made until considerable time had been spent in becoming acquainted. Other background information was obtained during informal visits in the households, on the roads and at the farms.

Information on incomes was obtained during conversations and by the wholesale price of food as obtained during trips to the markets in the company of an assistant from the Department of Agriculture; from the weights of baskets prepared for market and statements concerning the approximate number of baskets sold each year; by determining the cost of local transport of food (where this service was used), and by estimates of the amount of hired labor used. Retail prices of food were obtained by recording prices paid by the women for small purchases, and by visits to the markets, shops and stands.

Many data concerning foods and plants were obtained from the Department of Agriculture. In Ayeduase, an assistant from the Department often came to identify plants. Further help in classifying plants was obtained from botanists at University College.

Collection of Dietary Data

Before the investigation was commenced, much information concerning food preparation was obtained from domestic science teachers in the schools. Later this information was compared with first hand observations in the households.

During quantitative study, the food to be eaten by the children or in which they were to share was weighed after preparation for cooking. Where necessary, the weight of the cooked dishes was taken as well. Finally, the amount of cooked food served to the children was weighed. This method corresponds somewhat to that discussed by Norris (9) for Combined Family and Individual Inquiries. It differed in that (a) total consumption of the families was not always considered, and, (b) in many cases the intake of individual children was not learned. The local custom in the traditional villages of serving food for two or more children in a common vessel made it necessary to consider the totals provided, though a few individual data were obtained.

In most cases, the first weights represented raw edible portions, though most of the vegetables used in soup and stew required a second weighing or the application of correction figure. According to local custom, such vegetables as tomatoes, peppers and garden eggs are cooked whole until soft, then are drained and pounded to a paste before addition to soup stock. During

the pounding, seeds and skin are discarded. Palm nuts, which are extracted for soup and stew, are boiled to soften. The edible portion is then extracted by a long process of pounding, washing with warm water, squeezing and straining. In this case the water used for extraction was weighed before being poured over the nuts and after the extraction. The increase in the weight represented the extracted portion.

Meat was weighed after loose connective tissue and bone had been removed. The larger cured fish were weighed after the scales, dry skin and intestines were removed. Very small fish, purchased after cooking, and small cured fish weighing from 3 to 10 Gm. are consumed whole and so were weighed in this state. Some coastal families removed the heads of large fish as a part of the preparation for cooking.

There were exceptions to the above procedures of obtaining raw edible portions. Pig's feet were weighed as purchased and deductions applied for waste. The edible portion of land snails was taken after parboiling when the meat was removed before addition to soup. The raw weights were arrived at by applying a correction figure for shrinkage. The raw portions of foods purchased ready to eat were calculated by applying suitable figures for changes in weight determined in the laboratory.

Fermented corn dough is the starting point for many dishes used by coastal groups. The housewife often purchases it in this state and then completes the preparation, or she may purchase the ready-to-eat food, such as the boiled dough balls ("kenkey")or the strained gruel ("akasa"). These dishes and others were expressed in terms of the raw, fermented dough.

Data were recorded in notebooks and then transferred to data sheets which provided for the following entries (and others not pertinent to this report): weight as prepared for the first period of cooking; weight of the composite dish; weight of food served to the children; raw edible portion represented by weight served; percentage refuse; estimated AP (or as-picked) weight; cost or value;preparation time; cooking time. The data were examined frequently by the writer and the interpreter so that discrepancies, if they appeared, could be checked.

During periods of quantitative study, the households were under observation by eight o'clock in the morning so that food provided before school could be determined. As food preparation went on at various times during the morning, it was usually necessary to remain until after the noon meal had been served. The households were observed again from three o'clock in the afternoon until after the evening meal had been served. In each case the women cooperated by holding food prepared for cooking until after it had been weighed. Because of the number of women present and irregularity in the preparations in some households only one group was studied at a time.

Laboratory Determinations

Some entries were not completed until after laboratory work had been carried out. This was the case with fish and products from fermented corn dough. It was necessary to determine an average for the moisture absorbed by the cured fish during cooking (being very dry, these fish gain weight rather than lose it), and to determine also the weights of different parts of the refuse. Moisture determinations were made of the corn products at different stages.

As an aid to the calculation of the nutritive values, analyses of proximate composition (moisture, ash, fat, protein and carbohydrate by difference) were made for a number of foods of which the following were the most important: fermented corn dough; fermented corn dough balls ("kenkey"); edible portion of two species of smoked herrings; smoked mud or cat fish; a small perch-like fish sold in the markets after frying or salting ("didee"), and imported salt fish.

Calcium determinations were carried out on the above foods and on raw and cooked cassava (sweet variety), a mixture of cooked plantain and cassava, coco-yam leaves (X. saggitifolium only), and on the diet of one child.

Ascorbic acid was determined in both the bitter and sweet varieties of cassava, raw, cooked and after pounding to the state known as "fufu"; and in plantain raw, cooked and after pounding.

Suitable methods were followed for each determination. With the exception of most of the nitrogens, all methods were those given by the Official Agricultural Chemists (10) for similar materials. Most of the nitrogen determinations were done by use of the semi-micro method described by Cole and Parks (11). This work was commenced at University College in the Gold Coast and completed at the University of Chicago. All food sent to the United States was wrapped in aluminum foil, boxed and sent by air parcel post.

Health Examinations

Heights and weights of children in Ayeduase were taken during the first period of study and again approximately seven months later. The children wore no clothing except shorts or a thin strip of cotton cloth. Medical examinations were obtained during the first period of study. The children were taken in small groups to the Colonial Hospital in Kumasi where they were examined for the gross signs of malnutrition and for other abnormalities. Laboratory examinations included determinations of hemoglobin, red blood cells, blood films for malarial parasites, and stool specimens for the presence of intestinal parasites. Where indicated, white blood cell counts were made and urinalysis performed. Similar examinations were obtained for the children in Dome and Accra. However, all clothing worn by the Dome groups was removed before the weights were taken. Clinical examinations and histories were obtained for sixteen children attending the clinic at Mampong and laboratory examinations for seven of these. All hemoglobin determinations in Ayeduase were by visual colorimetry; those in the coastal zone were by visual colorimetry and by means of photoelectric colorimeter.

Analysis of Data

Because of marked differences in one of the groups in Ayeduase, all dietary data there were analyzed in terms of averages per child per day in each household, assuming that the children shared the food served to them equally. As the data were collected during three periods, the average for each group was obtained by taking the sum of each item for the three periods and dividing by the number of days and the number of children. This avoided

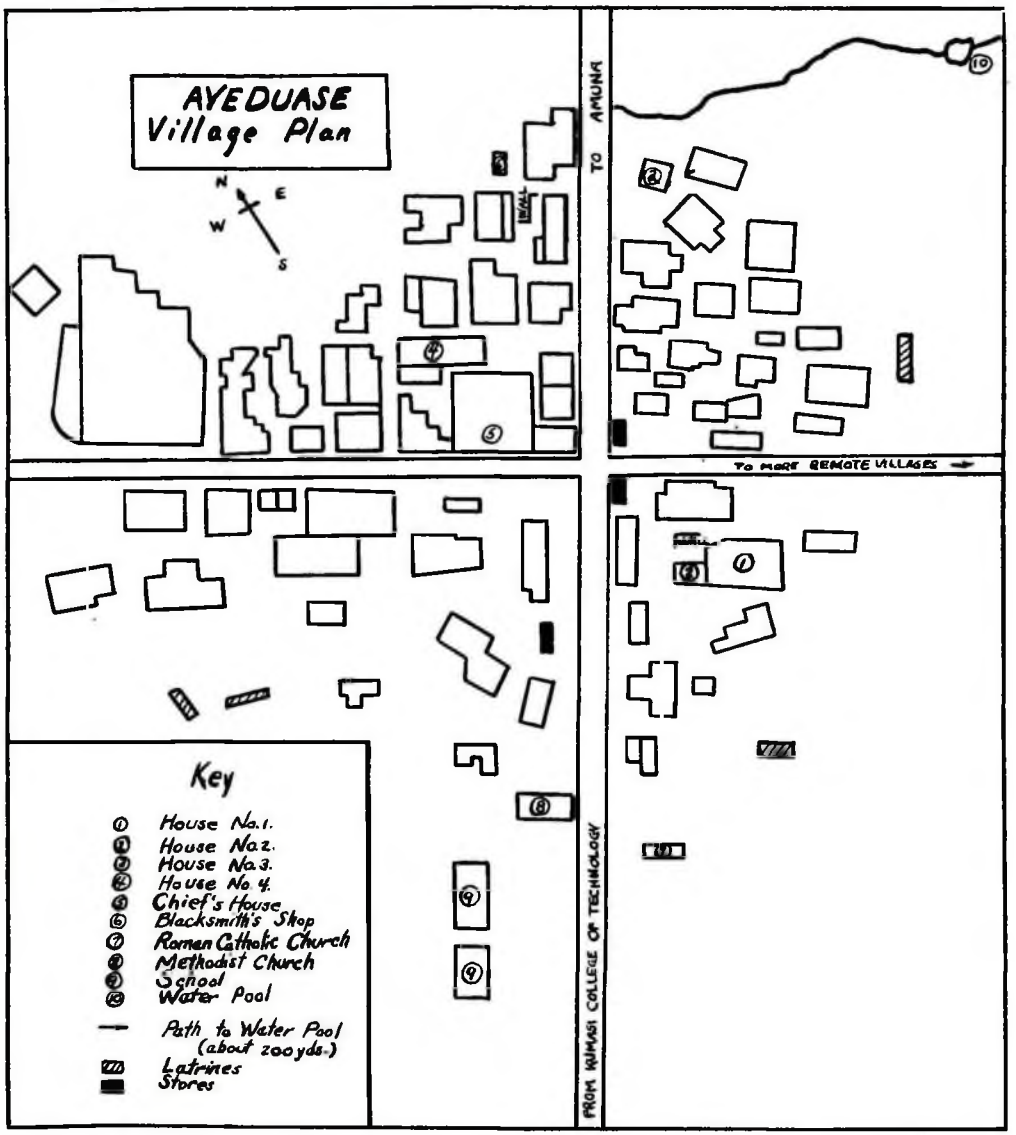
weighing the average in terms of a particular period. In Dome and Mampong, where differences were less pronounced, all groups were considered together. The data from the well-to-do home in Accra were also considered as an average per child. Considerable individual data were obtained in Accra so that the average amount of food could be compared. In the villages, sufficient individual data were obtained so that a general picture of the intake of different age groups was obtained.

Tables from the following sources were consulted in arriving at the nutritive values: Platt (12); Nicholls (13); Wu Leung, Pecot and Watt (14); Merrill and Watt (15). Values determined in the laboratory were also used. Energy values were calculated by the usual factors of 4, 9 and 4 for protein, fat and carbohydrate respectively. The validity of this may be questioned. However, the values were first calculated as recommended by the Food and Agriculture Organization (16). In case of the particular diets, the differences obtained by the two methods was not great. The former method made the percentage of the total derived from each nutrient clearer; moreover, specific work has not been done either on most of the items of the diet in the Gold Coast or on their value to those consuming them.

Red peppers and lima beans were judged to be moderately mature. The vitamin A value and the ascorbic acid given for the fresh state of these foods was adjusted as recommended by Platt (12). Deductions were not made for possible cooking losses. The extent of the losses of ascorbic acid in cassava and plantain were suggested by results in the laboratory, as were those occurring in the calcium content of the raw foods.

Comparisons of the nutritive values of the diet with allowances and requirements were made with caution. Investigations have not been made

of the utilization of food by children in the Gold Coast, and few have been made for groups ingesting similar diets in other areas. It is possible that adaptations to the prevailing diet have taken place. It is also possible that the presence of malaria and other parasites brings about a kind of permanent state of stress so that the nutritive needs of these children are greater than those not so afflicted.


AYEDUASE
Village Plan
N
E
W
S
TO AMUNA
To more REMOTE VILLAGES
FROM KUMASI COLLEGE OF TECHNOLOGY
Key
House No.1.
House No.2.
House No.3.
House No.4.
Chief's House
Blacksmith's Shop
Roman Catholic Church
Methodist Church
School
Water Pool
Path to Water Pool (about 200yds.)
Latrines
Stores

CHAPTER II.

IN THE TRADITIONAL FOREST VILLAGE OF AYEDUASE

The Families and the Extent of Study in Each

Each of the four households in which study was made bore a resemblance to the traditional pattern previously described. They were large (with an average of 9.2 persons, including 5.6 children); the members were less closely related than is usual in western families, and in one there were two wives with two others living nearby. Adult daughters and the father's sister's daughters were present for extended visits or for the birth of babies. Approximately one-third of the children were present without their parents.

Economically the first group was the most prosperous. The head was an absentee owner of three cocoa farms from which in the previous year he had obtained £480 ($1344). Four wives raised all of the food used by the family except flesh food, which is traditionally provided by the head. The eldest wife, who raised considerable surplus for sale, had an annual income estimated at £95 ($266). The head of the second group owned only one cocoa farm and his one wife farmed fewer plots of ground than the wives of the first group. The income of the head was not learned, but the wife earned approximately £50 ($140) from the sale of cassava during the year. A woman was head of the third group. Her income was derived from the sale of cassava

from about one acre of ground and from the sale of firewood, but she was industrious and provided relatively well for her group. The head of the fourth group also owned one cocoa farm, but the general level of living was lower in this household. The activities of the one wife were interrupted by frequent pregnancies which seemed to affect her more adversely than is common with these women.

There was some division of labor between the women in the first household and, relative to the other groups, activities of the household were orderly and meals were served with some regularity. Meals were less regular in the other households, though older children in the third group increased the efficiency there somewhat.

Quantitative dietary study was carried out for an average of ten days in each household. During the first period, from five to eight days were spent with each group, this period coinciding with the end of the season of "small" rains and the beginning of a dry season in 1951. During the second period, which fell past the middle of the longest dry period in 1952, three days were spent in each household. The diets were weighed again during one day with each group in the middle of the major rainy season of that year. The remainder of the fourteen weeks of study in this area was spent in the collection of the health data and the general information.

The distribution of the children and their ages may be seen in Table 6. Aside from one infant, present from the beginning, the children ranged in age from 2 to 15 years.

Practices and Attitudes of the Women

All children in the four groups had been delivered by traditional midwives. Three of the younger women had visited maternity clinics in nearby Kumasi but had not returned; they could give no special reason for not returning. Two of the women were married to men with some formal education in other parts of the country. These men had apparently made an effort to convert the women to European customs. Despite this, the women seemed to cling to the ways of the village and to almost resent the fact that their husbands wanted them to change. The failure to return to the clinic may have been related to the experiences with the husbands. Another young woman of these groups had not visited the maternity clinic as her mother was known as a particularly skilled midwife, familiar also with the needs of pregnant women.

Information obtained from twenty-five young mothers and young pregnant women of the village and immediate area suggests that the four women were not completely typical. As shown in Table 1, a number of these women utilized the health services in the city. Of 22 who had visited maternity clinics, all had returned when advised to do so.

None of the women, including those in the four households, considered any particular food unsuitable for use during pregnancy. With the exception of the daily use of oranges by 14 women, the diets of all were said to be the same during pregnancy as at other times. All the women in the four households and more than half of the others drank palm wine during pregnancy.

TABLE 1.

RESPONSES TO INQUIRIES CONCERNING DIET DURING PREGNANCY AND OTHER PRACTICES OBTAINED FROM TWENTY FIVE YOUNG WOMEN IN OR NEAR AYEDUASE

Inquiry	Responses		
	Positive	Negative	None
Are any foods forbidden?	0	25	
Does your appetite for certain foods increase?	2	21	2
Do you eat more food?	10	15	
Do you eat the same kind and amount of food?	11	14	
Do you eat oranges daily?	14	11	
Do you eat oranges now and then?	7	4	
Do you drink palm wine?	14	10	1
If a relative dies, do you fast from one to several days?	19	6	
Will a village midwife deliver your baby?*	14	11	
Will a medically trained midwife in the city deliver your baby?*	11	14	
Do you visit an antenatal clinic in the city?	22	3	
Do you visit a child welfare clinic in the city?	15	8	2

*Past tense inferred for the mothers who had given birth to babies.

Nearly all of the entire group fasted from one to several days if a relative died.

As shown in Table 6, the women in the four households had given supplementary food between the ages of 5 1/2 and 14 months. All of the twenty-five women expected to give or had given supplementary food well before the age of 12 months. The older mothers in the four homes had used boiled roots and plantain as the first food, while the younger had given corn dough gruel (akasa) as the most common food. None of them had used fruit before weaning. Mothers who utilized the health services in the city gave orange juice to infants at eight or nine weeks of age. Soup was given by most women before the age of one year. Often the replies concerning a certain food were in terms of a developmental stage, such as when the baby sat alone or crawled or, where meat was concerned, when there were teeth for chewing.

There was a wide range in the ages when the children in the four households had been weaned, with the earliest age 7 months and the oldest 8 years. The younger women weaned their babies sooner than the older women. Pregnancy was the reason given most frequently by the younger women, while farm work was the reason given most often by the older women.

The women of the area were aware that children often wane at the time of weaning. They attributed this to the effects of another pregnancy, saying that the child is affected adversely by heat from the body of the pregnant mother or that the child's spirit is crushed by the unborn child. They knew also that the children are often infested with worms. Some of them

used a drug for the infestation, although in general the condition did not seem to be taken seriously. One woman laughed when questioned, saying that every living person has worms. Most of them used quinine for acute malaria. In addition, all of the women in the four households utilized the services of the traditional doctor at times. It was considered that certain sicknesses could not be treated successfully by other means.

The general impression given by the older women in the four groups and by three of the younger women as well was that the ills of children are very sad but are nonetheless inevitable. They listened attentively to all that was said concerning child care, but with more amusement than conviction. Amusement and skepticism appeared to be lacking in the attitudes of the twenty-five women. However, these women were probably four or five years younger than the youngest of the former groups. Only three of them had more than one child, and six of them were pregnant for the first time.

The Food in the Village: Its Preparation and Service

The foods raised by the women on the farms surrounding the village have already been discussed. Smoked fish is the most important source of animal protein. The most popular fish in the village is a small cat fish ("adwena"), though smoked herrings ("antebo" and "krankrama") and burrito ("boi") were identified as well. In addition, a small amount of salt fish was used almost daily to flavor soup.

With the exception of a few chickens and turkeys, livestock is not kept in the village. Fresh beef, mutton and pork are brought in from Kumasi

but are used in exceedingly small amounts. Some wild meat is caught in the forest. In the families studied, about one small antelope represented the catch for a month. This was divided between various segments of the family. The use of poultry was not observed during over three months in the village and, while chickens were kept, eggs were available but were not used as regular items of the diet. A large basket holding about three dozen eggs was one of the gifts given to a young girl for her puberty celebration. These would be eaten by the girl and her young friends during the week of celebration which followed. The use of eggs was reported for other ceremonial occasions. However, there does not seem to be any taboo concerning the use of eggs at ordinary times.

Of the staples in the diet (cassava, coco-yam, plantain and yam), only the supply of yam does not last throughout the year. (There is a large surplus of cassava for sale.) As a result of two rainy seasons and several plantings during the year, the village is never without some succulent vegetables, though garden eggs are the most common. Most of the onions, tomatoes and fruit are sold.

Palm nuts are available during the rainy seasons and there are a few nuts from the tops of the trees in the dry weather. Ayeduase, however, is not in the heart of the palm tree area. Lima beans are available from the farms or the village shops throughout the year. Coco-yam leaf is available during about two-thirds of the year.

There is little variety in the type of meals served. Tubers and plantain are served after boiling and pounding for 30 to 45 minutes. The mass resulting from the pounding is known throughout as "fufu" (Figs. 1 and 2).

Figure 1.
Pounding Palm Nuts for Soup

Figure 2.
Pounding Tubers for Fufu

The boiled staples may be eaten plain or with a few grams of vegetable stew which may contain from 10 to 20 Gm. of salt fish. A small amount of red palm oil may also be added to the vegetable stew served with the boiled staples. Fufu is always served with soup or a thin stew. The first meal of the day more often consists of boiled staples and vegetable stew, with fufu and soup reserved for the main meal in the late afternoon. If the head of the house is at home and there are women present also, the pounded dish may be served at an earlier meal also.

All vegetables and flesh foods are prepared as soup or stew. The treatment of vegetables has been discussed previously. Garden egg and coco-yam leaf soup are the most common. Palm nut soup is served weekly and peanut soup monthly or fortnightly. Fish and meat are frequently combined in soup.

In addition to the foods prepared in the households, cooked foods such as corn dough gruel, boiled rice, boiled staples and fried plantain are for sale at corner stands. A bread prepared from unenriched white flour, palm wine (as the leavening agent), and sugar is for sale often but was not used extensively by the families studied.

Cooking equipment is simple. Every family in the village owned pots of local clay or swish. Forty-one families used iron pots also, particularly for boiling the staples. Twenty-five families used aluminum pots. Strainers were made from calabashes in which holes had been punched or were of the commercial tin type. Every family owned two types of wooden mortars and pestles, and flat clay dishes for rubbing or pounding the parboiled

vegetables for soup. There was an odd collection of enamel pans for holding food to be eaten, and calabashes and cigarette tins for measuring.

As a rule, two or more persons of the same sex eat from the same vessel. An adult daughter may eat with her mother, and the head may eat with his brother or with an esteemed friend or relative. Older children usually eat together, but a younger child may share their food. A favored child may be served alone, and any child may have an occasional meal alone. All eating is done with the fingers, but even the children are deft and eating is not untidy. Children are served by their elders before anyone eats. The more fastidious rinse their fingers in small bowls placed beside them before starting to eat.

Total Food Consumption in the Households

Because women of the households frequently eat meals while at the farms or during trips to the market, the total consumption of the families was not learned, except for an occasional day. Other difficulties arose from the fact that food was at times sent in to the homes by segments of the families living in other households. Then, too, food was sent out at times and it was not always possible to weigh the amount sent. Depending upon the size of the group, from 5,000 to 15,000 Gm. of raw edible tubers and plantain were prepared per family per day. On certain days it was evident that after the portions eaten by the children were subtracted, there remained from 1200 to 1600 Gm. per adult per day. The total amount of raw edible fish and meat prepared per family per day ranged from 115 to 800 Gm. This amount pro-

vided from 55 to 75 Gm. of flesh food per adult per day. In addition, the average adult diet in the four groups provided from 15 to 30 Gm. of lima beans, 40 to 50 Gm. of other vegetables, and from 5 to 12 Gm. of oil. Such diets provide about 1600 to 2100 calories and, because of the low moisture content of the cured fish, about 45 to 60 Gm. of protein.

The amount of staple foods per adult per meal varied little in the four households. There were more meals per day in the more prosperous household, but this seemed to be related more to the number of responsible women present than to a greater supply of staples. Yams, the choicest staple of the area, were not used in the fourth household. In the first household there was approximately one-fourth more flesh food per day than in the others. Peanuts, a luxury in relation to lima beans (9d. per lb. in comparison with about 4d.lb.,or 10 cents in comparison with about 5 cents), were used in slightly larger amounts in one of the poorer households.

As a result of the door-to-door survey, it was learned that an average of 2s.11d. (about 41 cents) was spent per family of the village per day for flesh foods. At the prices in 1952, this would have purchased approximately 1 pound of smoked fish or about 2/3 pounds of fish and 2 ounces of beef. If children under six years of age are eliminated, the average amount of flesh food per person per day would have been about 60 Gm. Refuse would have decreased this somewhat but it would have been increased by an occasional catch of bush meat.

Results of the Laboratory Determinations

The results of the determinations carried out on some of the important items of the diet in the forest and coastal zones are given in Tables 2 and 3. As may be seen, the cured fish is a concentrated source of protein and calcium. The small perch-like fish eaten whole is a superior source of calcium. On the moisture-free basis, the corn meal, derived from the fermented dough and the fermented dough balls, had the following percentage composition: ash 1.56; protein 9.8; fat 4.4; carbohydrate 84.2. This is comparable with the values for whole, unbolted meal. As fruit is not used regularly, it is of interest that cassava and plantain retain ascorbic acid after boiling and pounding. Based upon the results for the cassava and the leaves, it would seem that from 78 to 80 per cent of the original calcium content is retained after cooking. This is borne out further by the results of calcium determinations carried out on aliquots of cooked mixture representing the food consumed by one child during one day. In this case, the actual content was 21 per cent lower than that calculated for the raw foods.

Determinations were made in order to arrive at the fat content of the palm nut soup. Interms of the gain in weight of the warm water used for washing and extraction, about 15 per cent of the nut is used in the soup. The fat content of two samples of soup made from the extract was 11.8 per cent. From the reduction in the volume of the soup, it was apparent that a portion of the pericarp had been extracted as well as oil, as otherwise the fat content of the soup would have been higher. Fat content of a sample of soup prepared by a coastal woman was found to be 9 per cent (though it was

TABLE 2.

CONSTITUENTS DETERMINED IN THE EDIBLE PORTIONS OF FISH AND CORN MEAL DOUGH BALLS*

Food	Number of Samples	Constituent (Gm/100 Gm)					
		Moisture	Ash	Protein	Fat	Carbohydrate	Calcium
Herring, smoked** (antebo and Krankrama)	5	16.3	6.9	72.6	4.6	-	0.80
Cat fish, smoked (adwena)	2	14.7	5.3	74.0	5.1	-	0.53
Salt fish, imported (bagaya)***	1-3	24.5	24.6	49.0	3.0	-	0.34
Perch, fried whole (didee)****	5-10	11.0	15.7	49.2	23.1	-	4.40
Corn meal balls (kenkey)	3-5	55.0	0.7	4.4	2.0	37.9	0.005

* Edible portions of the first three foods included small bone softened by the curing process so that they appear to be eaten.

** Includes S. cameronensis and S. aurita.

*** Total ash included salt used for curing.

***** Cichlid from the lagoons whose weights ranged from 3-7 Gm. after frying.

TABLE 3.

CALCIUM AND ASCORBIC ACID IN CERTAIN GOLD COAST FOODS

Food	Number of Samples	Ascorbic acid mg/100 Gm.	Calcium mg/100 Gm.
Cassava, sweet*	1-3		
Raw		40.0	23.9
Boiled		23.0	18.6
Boiled and pounded(fufu)		18.2	17.4
Cassava, bitter	1-3		
Raw		31.6	-
Boiled		20.1	-
Boiled and pounded		13.3	-
Plantain	1-2		
Raw		12.8	-
Boiled		9.4	-
Fried		6.5	-
Plantain and Cassava**	2		
Boiled and pounded		12.2	14.5
Coco-yam leaves*** (Kontomle)	2		
Raw		-	107.0
Boiled		-	85.6

* Also known as "manioc". The sweet and bitter varieties differ in hydrocyanic acid content.

** Samples prepared by an African woman and said to contain approximately 1/3 sweet cassava and 2/3 plantain.

*** Xanthosoma saggitifolium only.

learned that an undetermined amount of fat had been removed at the end of the cooking period). Finally, on the basis of the weight of the water used for extraction and the cooked weight of the soup as prepared in Ayeduase, a value of 10 per cent fat was considered to be representative of the product there.

After the cured fish were cooked in water as for soup, the moisture content was found to be 57 per cent (average resulting from five samples of four species). Refuse of the cured fish, including dry skin, scales, larger bone, appendages and intestines ranged from 38 to 54 per cent.

Foods Provided for the Children

The average amount of food provided per child per day in four households during the total period of study is shown in Table 4. Large quantities of roots and plantain were provided with the children in the first group receiving more of these foods than those in the other groups. Flesh foods, too, were provided more generously for this group with a total of 49 Gm. per child, while there was 11 Gm. per child per day in the fourth household. The total weight of legumes and succulent vegetables ranged from 21 to 56 Gm. As an average, the amount of peanuts used was small. The red palm oil was the result of small servings of soup, and was likewise small as an average.

As there was a wide range in the ages of the children in three of the groups, the averages do not, of course, represent the precise intake of individual children. A few individual data were obtained that suggest the

TABLE 4.

AVERAGE WEIGHT OF RAW EDIBLE FOOD PROVIDED PER CHILD PER DAY IN EACH OF FOUR HOUSEHOLDS IN AYEDUASE*

Food	Average Weight of Food Provided per Child			
	Household One (Gm./day)	Household Two (Gm./day)	Household Three (Gm./day)	Household Four (Gm./day)
Plantain	370	282	141	73
Coco-yam	232	170	370	230
Cassava	178	179	166	41
Yam	52	28	76	0
Rice, unmilled	4	6	3	0
Flour, wheat	0.5	0.5	3	0
Corn dough (moisture 45%)	0	4	0	0
Cassava flour	0	0	6	0
Lima beans	18	13	11	3
Peanuts (groundnuts)	0.5	0.5	3	2
Eggplant(garden eggs)	15	6	12	1
Red peppers	7	5	4	2
Tomatoes	2	0.5	0	0
Onions	1	0.5	0.5	0.5
Coco-yam leaf	13	23	17	13
Orange	10	4	15	0
Papaya (pawpaw)	0	10	0	0
Banana	0	0	7	0
Smoked fish (moisture 16%)	32	17	10	2
Meat, lean**	12	4	15	6
Salt fish (moisture 24%)	1	0.5	1	1
Snails	2	0.5	0	0
Crabs	0	2	0	0
Sardines	2	0	0.5	2
Pork, lean	0	0	3	0
Pigs feet	0	0	0.5	0
Red palm oil	3	3	3	1
Coconut	0	4	0	0
Sugar	3	0.5	1	0

** Includes beef, mutton and antelope.

* The age range in the first group is from 6 to 12 years, in the second and third groups from 2 to 15 years, and in the fourth [illegible] to 7 years. See discussion for examples of individual intake based upon data from a few whose food was provided individually.

extent of the variations. During a period of three days, a favored child 12 years of age in the first group received 150 Gm. of staples beyond that shown by the average there, as well as 11 Gm. more of flesh food and 25 Gm. more rice. As a result of meals that a child of 2 years of age in the second group ate alone, it is estimated that he consumed from 300 to 350 Gm. of tubers and plantain per day and from 10 to 15 Gm. of flesh foods. There was evidence that the child of 4 years of age in the second group ate similar quantities of staples and a few grams more of flesh food. The boy of 14 years of age in the third group ate alone during most of the first period as there were no other boys in the household then. During this time he received 40 Gm. of tubers and plantain beyond the average for the group, 44 Gm. more of cassava flour and 12 Gm. more flesh foods. Little individual data were obtained for the fourth group.

Nutritive Value of the Diets

The nutritive value of the average weights of raw food is given in Table 5. These values serve to place the general quality of the diets. The caloric requirements of the children were considered in terms of the mean environmental temperature (25.6° C.) as recommended by the Committee on Calorie Requirements of the Food and Agriculture Organization (17), the National Research Council's allowances being the basis for corrections (18). Even after corrections for temperature, the disparity between the caloric values and the requirements appeared to be large. Considering the first group as a whole, the average deviation in calories was 768. In the

TABLE 5.

NUTRITIVE VALUE OF THE AVERAGE WEIGHT OF RAW EDIBLE FOOD PROVIDED PER CHILD PER DAY IN FOUR HOUSEHOLDS IN AYEDUASE *

Food Component	Average per Child per Day			
	Household One	Household Two	Household Three	Household Four
Calories	1164	923	1049	423
Protein, Gm.				
Animal	26	13	11	4
Total	41	25	27	11
Fat, Gm.	8	7	9	4
Carbohydrate, Gm.	232	190	215	88
Calcium, mg.	400	260	270	124
Iron, mg.	10	7	9	4
Vitamin A, I.U.	4862	5367	4021	2592
Thiamine, mg.	0.70	0.51	0.80	0.41
Riboflavin, mg.	0.84	0.65	0.63	0.25
Niacin, mg.	8	6	8	4
Ascorbic acid, mg.	142	126	92	39

* See footnote to Table 4 or 6 for ages of the children. See text for examples of individual food intakes.

second group the deviation was 1010 calories; in the third group it was 1065, and in the fourth 890 calories.

When the average protein requirements of each group were calculated in terms of the weights of the children or their desired weights, the diets were found to deviate by 15, 26, 14 and 28 Gm. respectively. Despite the deviations, it is noteworthy that much of the protein was probably of high quality. Because of the high concentration of protein in smoked fish, from 36 to 63 per cent of the totals came from animal sources.

The average amount of calcium provided deviated from the allowances of the National Research Council by from 876 to 600 mg. In the quantities consumed, the tubers provided much of the total but coco-yam leaf made some contribution and, even in the small quantities provided, the smoked fish was an excellent source. Leverton (19) has shown that Filipino girls utilize calcium from the bones of small fish ("dilis") as well as from milk. And even though the annual mean sunshine in the forest is relatively low (4.62 hr. as an average for five years), the children are without clothing when young and are often naked to the waist as older children, so that calcium utilization is favored.

The more generous diets essentially met the allowances for iron for children of the ages of those consuming them. The vitamin A values of the diets appeared to meet the allowances though it must be emphasized that there was no reliable source of preformed vitamin A in these diets, as the values were largely derived from red palm oil and vegetables. It is evident that at least the minimal requirements for ascorbic acid were met by the diets

in the first three households even when cooking losses are considered.

When the thiamine content of the raw food is considered in terms of 0.5 mg. per 1000 calories, as suggested by the National Research Council, the content of the diets is satisfactory. In view of the probable losses occurring during cooking and in view of the probable caloric lacks, this finding loses some of its significance. In terms of riboflavin allowances, arrived at by application of the factor 0.025 to the average allowance for protein, the diets appear to have been inadequate. The niacin content of the diets likewise was low in terms of allowances for all ages. As root vegetables and plantain contributed a large part of the B-complex vitamins discussed here, there would have been losses in the water drained at the end of the cooking period in addition to losses resulting from heat.

Physical Findings*

Heights and Weights.- The heights and weights of the children, taken at the beginning of the study and after an interval of seven months, are given in Table 6. Those of ten infants of the area are given in Table 7. Since the exact ages given for more than half the group in the four households could not be verified, these data have not been expressed in terms of standards that relate to other groups. But nearly all of the children in the first three households grew during the interval. For the first three groups, the average gain in height was 3.7, 3.6 and 1.6 cm. respectively. The average

* The clinical examinations were done by the courtesy of Dr. Susan Ofori Atta, Colonial Hospital, Kumasi; laboratory examinations were by the staff of that institution.

TABLE 6.

HISTORIES AND PHYSICAL FINDINGS FOR TWENTY-THREE CHILDREN IN FOUR HOUSEHOLDS IN AYEDUASE

Household One

Child	Sex	Age (yr)	Age of First Supplement (mo)	Nature of Supplement	Condition at or near Weaning[b]		Height (cm.)		Weight (k	
					Age[a] yr.	Condition	Initial	Final	Initial	Fi
KW	m	6	-	- -	-	-	109.7	113.0	19.3	19
KA	m	7	-	-	-	-	113.0	116.9	18.4	20
KM	m	7	7	Root vegetable	1	Worms	124.5	125.7	21.4	22
AT	f	8	6	Plantain	2	-	121.9	127.0	20.9	21
KT	m	10	10	Root vegetable	2.5	-	128.3	132.1	24.5	24
KN	m	12	11	Root vegetable	8	Good	131.6	136.6	30.2	29

a Age of weaning in years.
b Refers to conditions of which the mother was aware.

TABLE 6.

HISTORIES AND PHYSICAL FINDINGS FOR TWENTY-THREE CHILDREN IN FOUR HOUSEHOLDS IN AYEDUASE

Household One

Clinical Findings[a,b]	Laboratory Findings[c]	Comment
Hair and skin dry; tropical sore; 2 carious teeth; gums ulcerous; abdomen enlarged; spleen ++; liver +; development fair; moderately alert	Roundworm Hb, 8.4 Gm. per 100 ml.; RBC 2.63 million per c.mm.	Quiet child; mother absent
Hair and skin dry; tropical sore; carious tooth; abdomen enlarged; spleen +; parotids enlarged; development fair; alert	Roundworm Hb. 8.6 Gm. per 100 ml.; RBC 2.76 million per c.mm.	School; moderately active; mother absent
Hair dry; tropical sore; abdomen enlarged; neck gland enlarged; development fair; moderately alert	Roundworm Hb. 8.5 Gm. per 100 ml.; RBC 2.59 million per c.mm.	School; moderately active; mother present
Hair and skin dry; abdomen elongated; spleen ++; development fair; alert	Roundworm Hb. 8.9 Gm. per 100 ml.; RBC 2.84 million per c.mm.	School; moderately active; mother absent
Hair and skin dry; sublinguals enlarged; development fair; alert	Roundworm Hb. 9.6 Gm. per 100 ml.; RBC 3.12 million per c.mm.	School; moderately active; mother absent
No abnormality diagnosed; development good; alert	Hb. 10.4 Gm. per 100 ml.; RBC 3.59 million per c.mm.	School; moderately active; a favored child; mother present

a Examinations by the courtesy of Dr. Susan Ofori Atta

b Symbols: + and ++ refer to one or two fingerbreadths below the costal margin

c Hemoglobin determinations by a visual colorimetric procedure with the standard 14.8 Gm. per 100 ml.

TABLE 6. (cont'd)

Household Two

Child	Sex	Age (yr)	Age of First Supplement (mo.)	Nature of Supplement	Age of weaning (a) yr.	Condition at or near Weaning (b)	Height (cm.) Initial	Height (cm.) Final	Weight (kg.) Initial	Weight (kg.) Final
KP	m	0.5	5	Corn dough gruel (akasa)	-	Fever	68.6	-	7.5	7.9
KW	m	2	6	Corn dough gruel (akasa)	0.6	Anorexia; loss of weight; fretful; hair changes	78.7	83.6	8.4	11.7
KM	m	4	6	Corn dough gruel (akasa)	0.7	Nausea; bloated; rash	106.4	108.0	17.3	17.7
YP	f	5	8	Root vegetable	1.5	Good	106.7	109.2	16.6	17.1
BK	m	6	6	Corn dough gruel (akasa)	0.9	Anorexia; loss of weight; diarrhea	103.6	106.7	17.3	18.7
KDA	m	8	-	-	2	-	121.9	127.0	19.1	21.8
KA	m	12	12	Root vegetable	2	-	139.7	142.2	28.4	30.3

a Age of weaning in years.
b See page 44 or 48.

TABLE 6 (cont'd)

Household Two

Clinical Findings	Laboratory Findings	Comment
Occasional skin ulcer; spleen ++; development good	Hb. 8.1 Gm. per 100 ml.; RBC 2.75 million per c.mm.	Breast fed
Hair soft and dyspigmented at temples; rash about face; abdomen moderately enlarged; spleen ++; liver palpable; development fair; edema of face; fretful	Roundworm Hb. 9.6 Gm. per 100 ml.; RBC 3.48 million per c.mm.	Ill after mother became pregnant; improved in 7 months
Hair and skin dry; shins shiny; papillae on arms enlarged; spleen ++; parotids enlarged; carious teeth; development poor; moderately alert but apathetic at times	Malaria parasites; roundworm Hb. 9.6 Gm. per 100 ml.; RBC 3.45 million per c.mm.	Women believe he has a tumor; mother absent
Hair dry; ulcer on ear; scabies on hands; spleen +; axillaries enlarged; development fair; moderately alert	Roundworm; flagellates Hb. 8.6 Gm. per 100 ml. RBC 2.84 million per c.mm.	Moderately active; no illness reported
Hair and skin dry; lips denuded, fissure at left; abdomen enlarged; spleen +; development poor; moderately alert but apathetic at times	Roundworm Hb. 9.5 Gm. per 100 ml. RBC 3.30 million per c.mm.	None
Hair and skin dry; tropical sore; shins shiny; papillae on arms enlarged; carious tooth; abdomen moderately enlarged; development poor; alert	Roundworm Hb. 9.3 Gm. per 100 ml.; RBC 3.41 million per c.mm.	School; moderately active
Hair dry; tropical sore; shins shiny; papillae on arm enlarged; carious tooth; abdomen moderately enlarged; spleen +; development fair; alert	Roundworm Hb. 9.6 Gm. per 100 ml. RBC 3.30 million per c.mm.	School; moderately active

TABLE 6 (cont'd)

Household Two (cont'd)

Child	Sex	Age (yr)	Age of First Supplement (mo)	Nature of Supplement	Age of Weaning (yr.)[a]	Condition at or near Weaning[b]	Height (cm.)		Weight (kg.)	
							Initial	Final	Initial	Final
KT	m	13	-	-	-	-	141.0	144.2	30.9	31.4
AK	m	14	-	-	-	-	142.2	147.3	28.4	28.9
Household Three										
AKK	f	2	14	Corn dough gruel (akasa)	1.5	-	85.1	88.6	10.5	11.8
AN	f	12	12	-	2	-	127.0	129.5	25.5	27.2
KB	m	13	-	-	2	-	132.1	132.6	29.5	30.0
AK	f	15	-	Root vegetable	2.5	Weak; thin; fever	124.5	124.5	25.4	27.7

a Age of weaning in years.
b Refers to conditions of which the mother was aware.

TABLE 6 (cont'd)

Household Two (cont'd)

Clinical Findings	Laboratory Findings	Comment
Hair and skin dry; tropical sore; shins shiny; carious tooth; abdomen moderately enlarged; spleen ++; liver +; development poor; limps; alert	Roundworm Hb. 8.9 Gm. per 100 ml. RBC 2.56 million per c.mm.	School; moderately active; orphan
Hair and skin dry; tropical sore; gums hypertrophied; development fair; alert	Roundworm; flagellates Hb. 10.4 Gm. per 100 ml. RBC 3.39 million per c.mm.	School; moderately active; mother absent
Household Three		
Hair dry and scanty; tropical sore; abdomen enlarged; spleen ++; development good; alert but fretful	Malaria parasites Hb. 10.8 gm. per 100 ml. RBC 3.46 million per c.mm.	Not definite, despite parasites
Hair and skin dry; shins shiny; scabies on hands; carious tooth abdomen irregular; neck glands enlarged; development fair; alert	Roundworm; hookworm Hb. 9.5 Gm. per 100 ml. RBC 3.14 million per c.mm.	School; moderately active
Skin and hair dry; shins shiny; carious tooth; abdomen moderately enlarged; spleen ++; liver ++; development good; alert	Roundworm Hb. 9.9 Gm. per 100 ml. RBC 3.45 million per c.mm.	School; moderately active; mother absent
Hair and skin dry; generalized dyspigmentation of hair; severe scabies carious teeth; axillaries and groins grossly enlarged; spleen ++; development poor; weak	Malaria parasites; round worm; threadworm Hb. 10.8 Gm. per 100 ml. RBC 3.48 million per c.mm.	Complete diagnosis not obtained; ill through childhood

TABLE 6. (cont'd.)

Household Four

Child	Sex	Age (yr)	Age of First Supplement (mo.)	Nature of Supplement	Conditions[a] at or near Weaning		Height (cm.)		Weight (k
					yr.	Disease	Initial	Final	Initial
AB	f	2	8	Corn dough gruel (akasa)	1.3	Anorexia; fever; diarrhea; vomiting	76.2	78.7	8.0
KJ	m	3	7	Corn dough gruel (akasa)	0.9	Anorexia; fretful; loss of weight	86.4	88.9	11.8
AD	f	3	14	Root vegetable	2.8	Anorexia; fretful; hair changes	85.1	86.4	13.4
AN	f	7	12	Root vegetable	2.5	-	104.6	-	16.4

a Refers to conditions of which the mother was aware

TABLE 6. (cont'd)

Household Four

Clinical Findings	Laboratory Findings	Comment
Hair and skin dry; septic spots on face; carious tooth; gums bleeding; abdomen moderately enlarged; development fair; edema of face; fretful	Roundworm; hookworm Hb.8.22 Gm.per 100 ml.; RBC 2.49 million per c.mm.	Mother associates condition with her pregnancy
Hair and skin dry; septic spots on face; shins shiny; carious teeth; gums bleeding; abdomen moderately enlarged;spleen ++; neck and groin glands enlarged; development fair; edema of face; fretful	Roundworm Hb. 10.1 Gm.per 100 ml.; RBC 3.27 million per c.mm.	Fretful; was held much of the time
Hair dry; soft,dyspigmented at temple; septic spots on buttocks; gums bleeding; abdomen moderately enlarged; spleen ++, liver ++; edema of face; development fair; fretful	Roundworm; pus cells in urine Hb. 7.4 Gm.per 100 ml.; RBC 2.32 million per c.mm.	Obviously ill; held much of the time; improved then failed
Hair and skin dry; scalp ulcers; unidentified rash; abdomen moderately enlarged; spleen ++; liver ++; parotids enlarged; development poor; conjunctivitis; moderately alert; gums bleeding	Roundworm Hb. 8.0 Gm.per 100 ml.; RBC 3.11 million per c.mm.	School during first 3 months; death in 7th month

TABLE 7.

THE AGE, HEIGHT AND WEIGHT OF TEN BABIES IN OR NEAR AYEDUASE

Age		Height (cm.)	Weight (kg.)
Days	Weeks		
4		53.3	3.2
5		50.8	3.4
7*		47.0	2.4
7*		46.7	2.4
13		50.8	3.6
16		54.6	3.0
18		54.6	3.5
	8	55.4	4.8
	9	55.8	4.8
	35	63.5	6.1

*These babies are twins. Five months later they weighed 4.8 and 4.5 kg.

gain in weight for these groups was 0.8, 1.3 and 1.5 kg. One child in the first group lost 0.7 kg. Three children in the fourth group gained in height but lost an average of 1.2 kg., with one child losing 3.5 kg. The death of the oldest child of this group occurred before the final measurements were taken.

The measurements of the infants resemble those of children in the United States of similar ages. According to Goodman (20), babies born in Accra, in the coastal zone, are small by standards for English and American children at birth but these newborn put on weight more rapidly. They were said to double their birth weight between the 13th and 20th week of life. The twins of the Ayeduase group weighed 2.4 kg. when seven days old, and 4.5 and 4.8 kg. at the end of five months. The weight of KP in the second household was comparable with that of any well nourished baby of five and one-half months, though he failed to gain significantly during the interval.

Clinical Findings.- As shown in Table 6, these children were afflicted with various abnormalities of the hair and skin. Despite the popular opinion that the teeth of Affican children are sound, carious teeth were common. Abdomens, spleens and livers were enlarged for many of the group.

Laboratory Findings.-Thick blood films were examined for parasites. Despite the number of enlarged spleen, the parasites were identified for three only. This finding was not evidence, however, that parasites were absent as they may have been present in exo-erythrocytic form. Roundworm was the most common intestinal parasite, though hookworm and threadworm ova were identified. All were anemic in terms of usual standards. Mean hemoglobin

was 9.1, 9.3, 10.2 and 8.4 Gm/100 ml. for each group respectively, while the red blood cells were 2.92, 3.15, 3.58 and 2.79 million per c.mm. for each.

Correlation Between the Nutritive Value of the Diets and the Physical Findings

Complete interpretation of the findings is a medical problem having sociologic aspects. The following discussion is limited to relatively obvious and general interrelations.

The gain in weight made by some of the children appears anomalous. Still, even though activity studies were not conducted, it was apparent that these children were less active than those for whom the "Calorie Requirements" were designed. The Committee of the Food and Agriculture Organization (17) describe the reference children as "very active". During study, young boys in the second group were observed at moderately active play only once. With the exception of the 5-year old girl, the other children near this age seemed content to sit quietly and watch the activities of the court-yard.

True growth, of course, implies a laying down of protein as muscle, organ, nerve and bone tissue. It may be that the amount of protein in the diets did not provide adequately for the construction of these tissues. Still Bray (21) has shown recently that underdeveloped children in the Gambia, whose diets were somewhat similar to those of these children, retained considerably more nitrogen than well nourished American children. The author suggested that African children may be conditioned to planes of

nitrogen metabolism lower than that of American children. Possibly the children studied in Ayeduase are also conditioned to a somewhat lower plane of nitrogen metabolism.

The physical environment may have been involved to an extent in the dryness of skin and hair. Examinations were made during the period when the air is dry, windy and dust laden (the harmattan season). Some use was made of crude home-made soap. However, the fact that the fat content of the diets was extremely low cannot be overlooked, nor can the lack of preformed vitamin A be overlooked in the etiology of these conditions. The enlarged papillae of the arms described for three may be further indication that a lack of vitamin A was involved.

The one case of cheilosis occurred where the average diet provided 0.63 mg. of riboflavin. The three cases of rash were not identified by the physician in terms of specific dietary lacks, but as they occurred in the fourth group where the diet was scant, and in the second group where the child so afflicted had only recently commenced to accept food after a period of anorexia following weaning, it is likely that dietary deficiencies were involved.

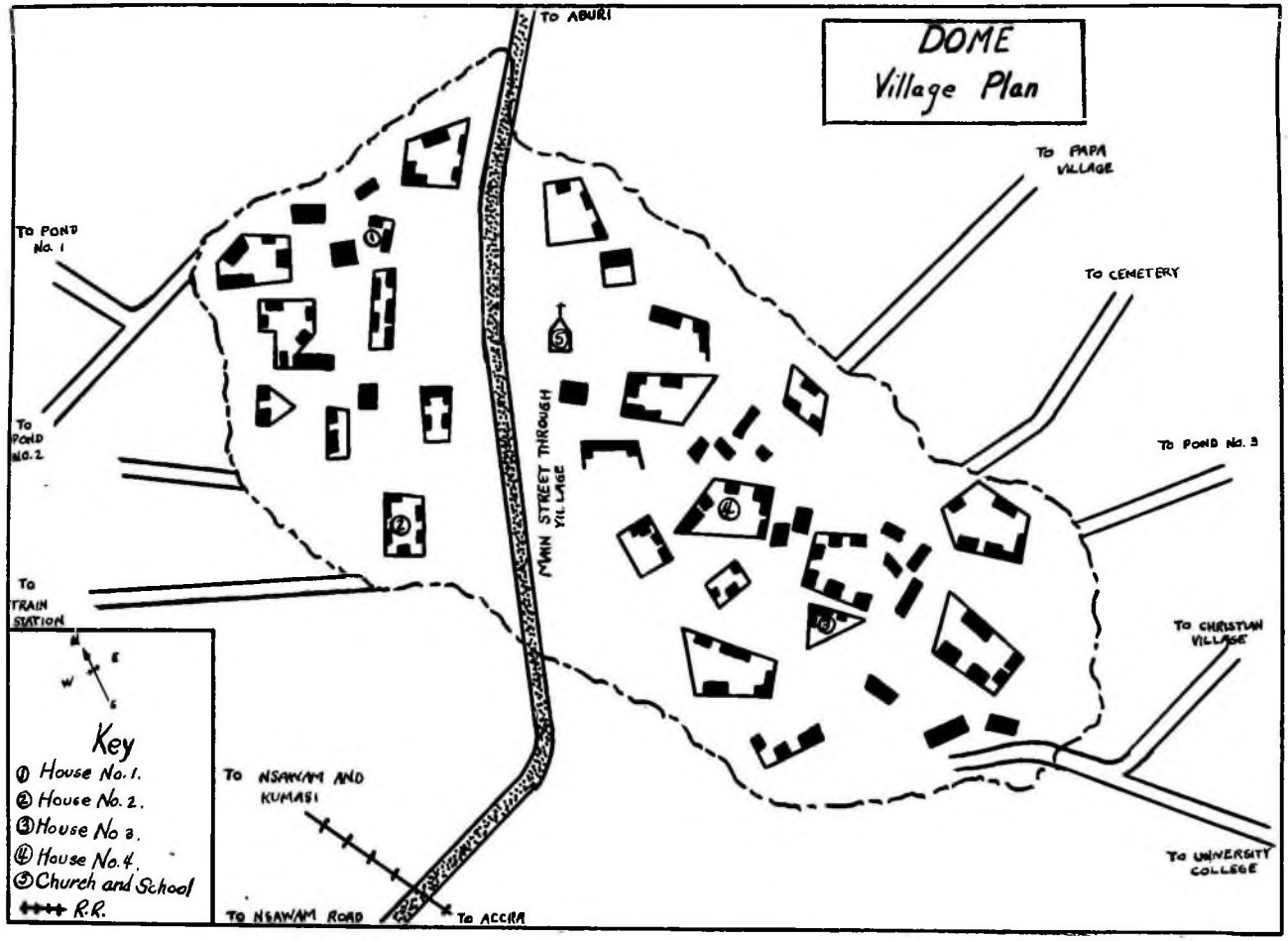
The dyspigmentation and soft texture of the hair of two young children seemed similar to that described by Brock and Autrey (1) for children with kwashiorkor. Still with the parasitic infestation and low calorie level of the diets, the condition evidently was not uncomplicated kwashiorkor.

Enlarged abdomens are a common finding in children of the area. This is said to be related to two factors(22), namely, the high carbohydrate content

of the diet which favors fermentation and flatulence, and the enlargement of the spleens and livers. The enlarged spleens, also prevalent, are related to the presence of malarial parasites or to past attacks of malaria. The enlarged livers are said to result often from the same cause.

There were probably three factors involved in the production of the anemia: the occurrence of malaria at some period, the intestinal parasites, and the quality of the diet. Williams (4) has pointed out that roundworm can cause anemia as severe as that caused by hookworm. Wilson(22) has found that, regardless of the parasites, the anemias common to these children respond to dietary treatment and iron salts.

The final cause of death in the child in the fourth group was not determined. It has been found that undernourished children succumb quickly to respiratory infections or to acute malaria. The season favored both of the conditions. Other children of the group were practically moribund at the end of the study.


DOME
Village Plan
TO ABURI
TO FAFA VILLAGE
TO CEMETERY
TO POND No. 3
TO CHRISTIAN VILLAGE
TO UNIVERSITY COLLEGE
TO POND No. 1
TO POND No. 2
TO TRAIN STATION
MAIN STREET THROUGH YIL LAGE
TO NSAWAM AND KUMASI
TO NSAWAM ROAD
TO ACCRA
N
E
W
S
Key
① House No. 1.
② House No. 2.
③ House No 3.
④ House No. 4.
⑤ Church and School
R.R.

CHAPTER III.

GROUPS IN AND NEAR THE COASTAL ZONE

The Groups and the Extent of Study in Each

As Dome is a heterogenous village of laborers, no particular cultural pattern was apparent from casual visits into the homes. Three groups were represented in the four households studied, including the Ewe of the southeastern part of the country, and the Gurunsi and the Dagmoba of the northern savannah land. There was an average of 9 persons per household studied, which included an average of 4 children in each. One group consisted of two brothers and their wives and children. Two groups consisted of man and wife, their children and an elderly father or uncle. A fourth group consisted of an elderly woman and her married son and family with whom she shared her home.

Differences in the earnings of the men were not great. The combined earnings of each set of parents ranged from £7 ($19.60) to £11 ($30.80) per month. The women contributed by selling firewood and herbs. While the amount of flesh food provided in the families with the lowest incomes was somewhat less, the general nature of the diet was similar in each group, and the ages of the children were also comparable so that the four groups have been considered together.

Sixteen children were studied in the four households, including three children between the ages of 1 1/2 and 2 years who were not yet weaned. The older children ranged in age from 3 1/2 to 13 years. In order to

supplement the data, the noon meal of 36 elementary school children in the village was weighed. Further information concerning the diet of the school children was obtained by interviews with the mothers of ten of these children. Medical examinations were obtained for the 59 children enrolled in the school, including eleven of the sixteen children in the four households. Quantitative dietary data were obtained during three days in each of the households. General study of the village was carried out intermittently during five consecutive months.

The people in Mampong are largely Akwapim, a group related to the Ashanti in Ayeduase. There was an average of 11.7 persons in each of the four families studied, which included 7.3 children and adolescents. However, as the purpose of study in this village was to obtain information concerning the diets of the younger age groups found to be the most frequent patients in the clinic there, only twelve children were studied in the three households. The incomes in these households were not learned. One woman who headed a group owned a small cocoa farm from which she obtained an annual income. In addition she obtained staples and palm nuts from her farm. A daughter added to the income by sale of fried cakes at a roadside stand. The male head of another group was a driver for a well-to-do African and probably earned about £7 ($19.60) monthly. The woman who headed a third group was a food farmer who received some financial assistance from her sister, a nurse.

Three days of quantitative dietary data were collected in these groups. Medical examinations were obtained from the clinic there for three of the group who were patients.

Twenty-five mothers were interviewed at the clinic in Mampong. Case histories were obtained for sixteen children there with their mothers as patients, and laboratory data were obtained for seven of these. Further study was not carried out in this village.

A moderately well-to-do group studied in Accra consisted of four adults and ten children and adolescents. Six of the latter were children of relatives. Nine of the children and adolescents were studied, with quantitative dietary data obtained during four days with general information resulting from various visits. Because of the position of the family in the community, it was neither desirable nor necessary to learn the specific incomes earned by the adults of the group. They lived comfortably but not lavishly. The amount of money provided per month for food seemed adequate for the area.

Thirty Fanti women were interviewed in the village of Mpamfukrom near the coast. The village was of special interest as its site in the inaccessible bush of the zone had just been moved to a roadside where many improvements were under way. Villagers and a Mass Education team had cooperated in this project. A class in child care, where the interviews took place, represented one phase of the project.

Practices and Attitudes of the Women

As in Ayeduase, all of the children in the households studied in Dome and Mampong had been delivered by traditional midwives. But each of the mothers had had some experience with clinics in the area, and one or more of the children of each had been taken for some ailment. However, the

women in Dome had not been regular in their attendance, and even where yaws was concerned, they had not returned regularly after some initial improvement. Of ten other women interviewed in Dome and twenty-two in Mampong, approximately one-half had utilized the services of medically trained midwives. According to the head of the clinic at Mampong, the women waited until illness was far advanced before seeking aid from qualified centers. Many of the children bore scars resulting from the application of aboriginal medications. Others wore charms as cures or preventives against disease. Some of the women appeared to lack the initiative to seek medical care for their children from the nearby clinic. Several infections needing immediate attention were encountered which had gone untreated until the children were taken to the clinic for examinations included as part of this study.

It was learned that none of the total groups interviewed in Dome and Mampong observed food taboos during pregnancy. More than half ate more food than usual during pregnancy. Three-fourths of them reported the use of oranges during pregnancy. This was said not to be the result of clinic influence in Dome but was the result of this influence in Mampong. In contrast with Ayeduase, none fasted if relatives died.

Information concerning the feeding practices of 43 women with infants and older babies is summarized in Table 8. The ages when the first supplements were given are similar to those in Ayeduase. Corn dough gruel (akasa) was the most common food and, in contrast with the latter village, evaporated milk was said to be used with the gruel by sixteen of the women. This was

TABLE 8.

INFORMATION OBTAINED FROM FORTY-THREE WOMEN IN DOME AND MAMPONG CONCERNING FEEDING PRACTICES WITH BABIES*

Category of Information	Number in each
Age of first supplement:	
6 to 8 months	8
8 to 10 months	16
10 to 12 months	12
12 to 14 months	5
No supplement	2
Nature of the supplement:	
Corn dough gruel (akasa) with sugar	20
Corn dough gruel with sugar and milk**	16
Corn dough gruel with sugar and tea	2
Oatmeal porridge	1
Oranges	2
Age of weaning:	
Young mothers with no statements	9
12 to 16 months	5
16 to 24 months	26
24 to 36 months	3

* Included the women in seven households in these villages, as well as those interviewed at the clinic.

** The quantity of milk is described as "small".

definitely the result of the greater contact with Europeans or with the clinics. However, the use of milk with gruel was not observed and, according to reports from the medical centers, in their eagerness to win approval, the women indicate that milk is used though the amount may be insignificant or its use infrequent. Even so, the women have evidently learned that milk is desirable. In the entire village of Ayeduase there appeared to have been only two women who had used evaporated milk for babies. The age of weaning was somewhat later with these women than that reported by many in Ayeduase. However, pregnancy was also a frequent reason for weaning at the given age.

The Fanti women at Mpamfukrom gave gruel and sugar between the ages of three and five months. Following this, cassava was given and by the end of the first year, fish, meat and soup. Before taking the class in child care they had believed that oranges should not be given until after weaning, but this belief had been changed, as they now gave or would give this food at the age of three months. If oranges were not available, they would use tomato juice (the preparation of which was demonstrated during the class). Formerly this group had considered palm nut soup and oil unfit for pregnant women, but this too had changed. Where they used oranges, it was learned that many women of this area associated the fruit with deeply colored urine and, as those who displayed this condition were ill, they concluded that oranges were an unsuitable food. It is probable that these women erroneously attributed the symptoms of blackwater fever (a bilious fever associated

with a severe form of a malarial disease) with the use of the fruit.

As in Ayeduase, the women in these communities were aware that children frequently sicken at or near the time of weaning. Of approximately seventy women, only Ga women in Dome associated the term "kwashiorkor" with the condition that often develops at this time. Fanti women on the coast referred to the condition as "asun". The use of the term by the Ga women of the coast does not conflict with the recent discussion of Williams (4) concerning its origin.

The explanations given by these women for the condition were similar to those given in Ayeduase. They believed that children are so afflicted because the mothers become pregnant while the current babies are being nursed and are in close contact with their bodies. Some thought there was something injurious in the milk after conception, while others thought that the babies were injured by some emanation from the mother's body. Finally, after discussion, the women at Mpamfukrom concluded that certain women must carry the sickness in their wombs and transmit it in some way, since the children of some women develop it while those of others do not.

Food in the Communities: Its Preparation and Service

The general nature of diet in the areas discussed here is the same as in Ayeduase. There are certain differences in the staples. The main staples of the coastal zone are fresh cassava, cassava flour("kokonte")and meal ("gari"), and corn meal products largely fermented. Some plantain is used,

though not as extensively in the communities studied as in Ayeduase. Cocoyam and yam are not used in the coastal communities, as conditions are not suitable for their cultivation. These tubers are used in Mampong, however. Garden eggs, peppers, tomatoes and onions are used as in the heart of the forest, and okra, not seen in Ayeduase, is used by coastal groups. Palm nuts appear to be used in larger amounts in these communities than in the heart of the forest. Supply is a factor, as palm trees grow prolifically in the Mampong area and are common in the coastal zone. Some use is made of fresh fish by the people of the coastal zone, and the small fish (didee), eaten whole, is in common use after frying, or salting and toasting.

Preparation of the soups and stews follows a pattern similar to that described, with the vegetables parboiled and pounded to a paste before addition to the stock. Where fresh fish is used in the soup, it is fried first.

Fresh cassava is prepared by boiling and pounding to "fufu". Cassava flour is made into a porridge by cooking a given weight of flour with about three times the weight in water. The flour is prepared by pounding or grating cassava that has been previously dried over a low fire and subsequently in the sun. Cassava meal is prepared for eating by mixing approximately equal weights of meal and warm or cool water. Cooking is not necessary, as the product is precooked. In the initial preparation of the meal, the tubers are peeled and grated, then the mass is packed in burlap bags and pressed between boards for two days. Following this, the product is emptied into shallow pans and dried over a low flame with frequent stirring. The dry and partially cooked product is packed in bags again and stored or sold. The

composition of the meal has not been studied, but it is apparent that the treatment of pressing and drying must result in significant losses of soluble salts and of vitamins as well. However, as some fermentation takes place during the period before drying, some synthesis of vitamins is possible.

The preparation of the fermented corn dough is noteworthy. Preparation of the dishes made from the dough may start with the dry grain. In the Dome area, grain is soaked for at least 24 hours, after which it is taken to the mill for grinding. The mill is a simple affair driven by one motor and the meal is not bolted, though in some communities the hull is removed after the preliminary soaking. After grinding, the meal is mixed with enough water to make a firm dough, covered and allowed to ferment for from two to three days, the time depending upon the preference. After a period of fermentation lasting three days, the moisture content is approximately 45 per cent. This dough is the starting material for many dishes, including the popular boiled dough balls (kenkey), the bread in the coastal zone, the unstrained porridge ("poponsu") and the strained gruel (akasa). Many housewives purchase the dough and proceed from that point; others purchase the final products ready to eat. When the dough balls are prepared, one-half of a given weight of dough is mixed with about twice the weight in water and then cooked until very thick. The cooked portion is then combined with the raw portion and shaped into balls weighing between 1/2 and 1 pound. The balls are wrapped securely in several thicknesses of corn husks and placed on shredded husks in the bottom of a large pot. A small amount of water is added; the pot is covered and placed over a low fire for about two hours.

The method must retain all of the water soluble nutrients. In addition, it results in a product so carefully wrapped that it will keep for as long as three days without refrigeration. As with the meal,,determinations of the B-complex vitamins have not been carried out for the different stages, but it is probable that a significant amount of synthesis takes place during fermentation.

Cooking utensils in Dome were much the same as in Ayeduase, as all groups used pots of local clay (swish) and iron, with a few owning aluminum pots also. In addition, there was some use of empty kerosene tins for boiling cassava.

In Dome and Mampong, children shared food from a common vessel, though in Dome where there was a wide range in ages, a few children ate alone. In the home in Accra, the three youngest children and the oldest boy were served alone, while two or more of the older girls shared food from common vessels.

Total Food Consumption of Women

As in Ayeduase, a record of total food consumption of the families was not obtained, as the families were often dispersed during the day. The following represents the average diet of two Ewe women in Dome during three days (in raw edible weights):

Fresh cassava - 1200 Gm.
Corn dough - 150 Gm.
Cassava meal - 75 Gm.
Succulent vegetables - 75 Gm.
Dry, cured fish - 20 Gm.
Red palm oil - 40 Gm.
Coconut oil - 5 Gm.
Sugar - 5 Gm.

This diet would provide approximately 2600 calories and 31 Gm. of protein (13 Gm. from the fish). This was a more restricted diet than that estimated for some of the adults in Ayeduase.

The diet of two women in Mampong was similar to that of some of the adults in Ayeduase. The following raw edible portions were ingested during study in one household:

Cassava - 750 Gm.
Wheat flour - 65 Gm.
Coco-yam - 18 Gm.
Succulent vegetables - 50 Gm.
Cured fish - 34 Gm.
Red palm oil - 52 Gm.
Sugar - 18 Gm.

The caloric value of this food is 1700 and the protein content 38 Gm. This diet illustrates the greater use of palm oil (nearly four times the estimate for Ayeduase) and the greater use of sugar and flour. The last items are probably the result of the longer contact of the people in Mampong with Europeans.

Foods Provided for the Children

Despite the similarity of the foods provided for the groups in Dome and Mampong, the records have been considered separately, as the group in Mampong did not include children over eight years of age.

Dome.- In connection with the average amount of food shown in Table 9 for the children in Dome, it was useful to find that the food provided for a 3 1/2-year old girl was served in a separate bowl. This food differed somewhat from the average. During the days of study, she received 150 Gm. cassava and 150 Gm. corn dough as staples. The balance of the food consisted

TABLE 9.

AVERAGE WEIGHT OF RAW EDIBLE FOOD PROVIDED PER CHILD PER DAY IN EACH OF FOUR GROUPS IN OR NEAR THE COASTAL ZONE

Food	Average Weight (Gm./day) of Food Provided per Child in Households in			
	Dome	Mampong	Accra	Nursing Children
Cassava	220	178	189	10
Plantain	37	23	95	6
Coco-yam[a]	0	160	0	10
Corn dough[a]	140	31	499	31
Cassava flour and meal	127	0	33	11
Rice, milled and unmilled	0	0	34	0
Flour, unenriched	0.5	10	7	0
Lima beans	0	0	17	0
Peanuts (groundnuts)	0	0	8	0
Tomatoes	8	20	6	0.5
Okra	9	0	0	0
Eggplant (garden eggs)	5	2	0	0
Onion	4	5	2	1.5
Peppers[b]	3	3	1	1
Orange	0	0	4	0
Papaya (pawpaw)	0	0	0.5	0
Mango	0	0	5	0
Banana	0	0	12	0
Fish, fresh	12	0	36	0
Fish, fresh water "perch"[c]	7	0	4	0
Fish, smoked	5	12	6	2
Fish, salt	4	0.5	2	0
Crabs	0	0	2	0
Prawns	0	0	4	0
Snails	2	0.5	0	0
Meat, lean[d]	4	3	4	0
Cow hide	0	0	11	0
Pigs feet	0	0	6	0
Red palm oil	10	13	21	1
Coconut oil	3	0	0	1
Lamb fat	0	1	0	0
Avocado pear	0	0	5	0
Butter	0	0	0.5	0
Milk, evaporated	0	10	3	0
Sugar	5	8	15	4

a Calculated to a moisture content of 45 per cent.
b In Dome, two-thirds of the peppers were green; all others were red.
c Refers to a small fish sold after frying (didee); cooked weights.
d Included beef and mutton.

of 15 Gm. cured fish, 11 Gm. vegetables, 4 Gm. oil and 3 Gm. sugar. The diets in the families from the northern savannah zone contained more meat and oil than that of the coastal family studied in Dome. It is not known whether this was related to differences in income or to traditional patterns of eating.

Mampong.-In this village the children received larger amounts of fresh tubers and plantain and less corn dough than those in Dome. The average amount of flesh food was less. However, the average age was younger. Nearly all of the 16 Gm. of flesh food was provided from cured fish with low moisture content. Milk was provided for one child as a result of suggestions from the clinic there. Three 2-year old children received only 155 Gm. of fresh tubers and plantain, 15 Gm. corn dough and 8 Gm. flour. The amount of flesh food was essentially the same as the average, and oil and vegetables were likewise similar.

Accra.-The diet provided in the moderately well-to-do home in Accra differed from that in the villages in quantities of food provided, greater variety of flesh food, and the use of fruits, including avocado pear. The three youngest children received most of the fruit and milk.

Nursing Children.-The supplementary food shown in Table 9 for the children not yet weaned was given at one or two feedings. Onechild (K in Dome) received a larger amount of corn dough porridge and less other foods as he was particularly fretful during the period and his mother thought porridge more suitable.

Diet Throughout the Year.- There was no evidence that the diet would vary significantly in Dome. Fruit was not plentiful during the month of the quantitative study in the homes. However, visits were made later when fruits were plentiful and the children were not observed eating fruit. The school children were not provided with fruit during the day of dietary survey. Further, the diet of these children appeared to agree both in quality and quantity with that in the four homes. In Accra, the food budget did not vary from month to month and, according to the women, the diet was much the same throughout the year. During later visits in this home, the food provided for the children appeared essentially the same. According to the women in Mampong, the quantity of food provided for the children was much the same at all times. But they reported the use of legumes at least once each week in soup and the frequent use of coco-yam leaves, items not recorded during the study. As methods of preparation, these were much the same as in Ayeduase. The quantities of these foods prepared would doubtless be much the same also.

Cost or Value of the Diets.-Prices of all food stuffs vary greatly. Sales are made by the piece or the cigarette tin. In Dome during March and April, ten purchases of three different kinds of smoked fish varied in price from 2s.9d. to 4s.5d. per lb. In Accra during the same period, the average price of these fish was approximately 5d. cheaper. Based on the small purchases made by the women in Dome and the value of the staples raised, the value of the diet shown for the group there was nearly 8d.(about 9 cents) per child per day. The actual cost per child per day of the Accra

group was 1s.5d.(nearly 20 cents). Costs were not obtained in Mampong. From the prices of fish and staples in this village, it is probable that the average amount of food shown in Table 9 had a value of about 5d. (almost 6 cents).

The Nutritive Value of the Diets (Table 10)

As with the other diets, it is considered that formal comparisons of the nutrients with allowances or requirements established for other groups of children are not completely suitable when so little is known concerning the effects on requirements of the endemic parasitic diseases. The considerations in terms of the National Research Council's allowances (18)that are to follow are made with the limitations of the present knowledge in mind.

Dome. As a result of following the suggestions of the Food and Agriculture Organization(17) for correction of the calorie requirements for reference children living in a mean environmental temperature of the area (about 27°C.), the average requirement of the group in Dome was found to be 1968. The value of the average diet deviated by 704 calories. Based upon the average weight or desired weights, the average allowance of the group for protein was 49 Gm., so that the average deviation was 26 Gm. There were large deviations where calcium and the B-complex vitamins are concerned also. With only 0.48 mg. of riboflavin provided by the diet, there was a deviation from the average allowance of 0.72 mg. The iron, vitamin A as carotene, and ascorbic acid of the diet werere latively generous.

TABLE 10.

NUTRITIVE VALUE OF THE AVERAGE RAW EDIBLE FOOD PROVIDED PER CHILD PER DAY IN FOUR GROUPS IN OR NEAR THE COASTAL ZONE

Food Component	Average per child per day			
	In Households in			In Nursing
	Dome	Mampong	Accra	Children
Calories	1264	761	2154	175
Protein:				
Animal, Gm.	11	9	17	1.5
Total, Gm.	23	18	52	4
Fat, Gm.	20	17	48	3
Carbohydrate	248	134	379	33
Calcium, mg.	481	181	336	24
Iron, mg.	10	5	13	1
Vitamin A, I.U.	5305	7122	11512	583
Thiamine, mg.	0.42	0.37	1.48	0.09
Riboflavin, mg.	0.48	0.41	0.77	0.05
Niacin, mg.	5	4	12	0.5
Ascorbic acid, mg.	83	76	87	6

Mampong.- The nutritive value of the average diet in Mampong showed weaknesses and lacks similar to those discussed for Dome. With only 181 Gm. of calcium calculated for the raw food, the diet failed to provide the amount considered desirable to an even greater extent than that in Dome.

Accra. With the caloric value of the average diet of the Accra group 2154, the average requirement of the group was met. Distribution of the food was such that the individual energy needs were met with the exception of that of the oldest boy (BT). The most apparent weaknesses of the diet as a whole were in the amounts of calcium and riboflavin, as there were only 336 mg. and 0.77 mg. of these nutrients respectively.

Nursing Children.-The caloric value of the average amount of supplementary food provided for four children from 9 to 24 months of age was 175. The caloric requirement of three of the children who were 1 1/2 to 2 years of age would have been about 1100. The milk production of the mothers is not known. According to Brock and Autrey(1), Platt found the milk production of mothers in the Gambia to be about one pint per 24 hours when babies were from 12 to 18 months of age. Assuming a similar production by these mothers, the children may have lacked approximately 500 calories. It is probable that these children were also poorly supplied with the essential nutrients.

Physical Findings

The heights and weights of the members of the groups in Dome and Accra are given in Table 11; those of the school children in Dome in Table 12. Having obtained the birth dates of the children in Dome from the school master there, it was possible to make comparisons with the averages for

TABLE 11.

HISTORIES AND PHYSICAL FINDINGS FOR TWENTY-FIVE CHILDREN IN THE COASTAL ZONE

Four Households In Dome

Child	Sex	Age (yr.)	Age of First Supplement (mo.)	Age of Weaning (yr.)	Condition at or near Weaning	Height (cm.)	Weight (kg.)	Laboratory Findings
KAT	m	1.5	8	-	Fretful;sickly at 1 year; fever	71	11.8	Malaria parasites; Hb.7.5 Gm.per 100 ml.;RBC 2.15 million per c.mm.
K	m	2	7	-	Very fretful; well until 6 mo. of age; after this fever	73.7	10.0	Malaria parasites; Hb.12.3 Gm.per 100 ml.; RBC 3.25 million c.mm.
MR	f	1.5	10	-	Good	70.4	10.5	No data obtained
MM	f	3.5	8	1.5	Anorexia	79	12.4	No data obtained
MA	m	5	-	2	Anorexia; diarrhea; fever	86.4	10.9	Malaria parasites; Hb.8.4 Gm.per 100 ml.;RBC 2.10 million per c.mm.
KT	m	5	6	3	-	105.4	15.7	Malaria parasites; Hb.10.3 Gm.per 100 ml.; RBC 2.02 million per c.mm.
AT	m	6	-	-	-	96.5	12.7	Malaria parasites; roundworm. Hb. 11.1 Gm.per 100 ml.; ?RBC 3.03 million per c.mm
DD	f	6	-	2.5	Anorexia;fretful;improved after starting school	99.1	13.6	Hb.9.5 Gm. per 100 ml. RBC 3.03 million per c.mm.
AM	m	7	8	2	-	116.8	20.2	Malaria parasites; Hb.10.9 Gm.per 100

TABLE 11.

HISTORIES AND PHYSICAL FINDINGS FOR TWENTY-FIVE CHILDREN IN THE COASTAL ZONE
Four Households in Dome

Clinical Findings	Comment
Hair dry; sores on back and ear; inflammation of middle ear; tonsilitis; abdomen moderately enlarged; spleen ++[a] liver +; liver smooth; development fair; moderately alert	Not weaned
Hair soft and dyspigmented at temples; sores on back, wrists and scalp; front teeth decayed to stumps; eyes dull; abdomen enlarged; development poor; edema of the face; somewhat apathetic	Not weaned; very weak
No data obtained	
No data obtained	
Hair dry, sandy in color; tropical sores on legs; scars from native medication; fissuring of right angle of mouth; abdomen enlarged; pubic region strangely developed, set apart; spleen +; liver +; mucous membranes pale; apathetic	Anorexia during the study; hair color "probably not abnormal" as mother's is similar
Hair dry, patchy, dyspigmented at temples; knees scaly with very deep pigment; yaws; abdomen moderately large; spleen and liver just palpable; mucous membranes pale; development fair; moderately alert	Attends school
Hair dry, dyspigmented at the temples; teeth malerupted; gingivitis; yaws; abdomen enlarged; spleen+++, liver ++; development fair to poor; slight edema of face; apathetic	Attends school; has just joined father; mother in another village
Hair soft, dyspigmented at temples and crown; tropical sore; shins shiny and etched; severe gingivitis; severe conjunctivitis; eye whites muddy; abdomen enlarged; spleen palpable; left lobe of liver very large; fatty; development fair; slight edema of face; moderately alert	Attends school
Hair soft, dyspigmented at temples and crown; skin on knees thickened, flaky; mild lip fissure at left; 3 carious teeth; gingivitis; conjunctivitis; systolic murmur; abdomen enlarged; spleen +; parotid glands enlarged; development fair; moderately alert	Attends school; very quiet child

[a] ... indicates no information; +, ++ or +++ refers to fingerbreadths below the costal margin

TABLE 11 (cont'd)

Four Households in Dome (cont'd)

Child	Sex	Age (yr)	Age of First Supplement (mo.)	Age of Weaning (yr.)	Condition at or near Weaning	Height (cm.)	Weight (kg.)	Laboratory Findings
FM	m	7	8	2	-	118.1	17.5	Roundworm;intestinal flagellate; Hb. 10.9 Gm.per 100 ml.;RBC 3.36 millionper c.mm.
KA	m	7	12	1.5	-	113.0	20.9	Malaria parasites Hb. 6.2 Gm. per 100 ml.; RBC 2 million per c.mm.
OK	m	8	8	1	Anorexia; vomiting; diarrhea	128.3	25.5	Hb.15.1 Gm.per 100 ml.;RBC 4.25 million per c.mm.
KV	m	9	12	2	-	114.3	21.7	Hb.12.9 Gm. per 100 ml.; RBC 3 million per c.mm.
AB	m	9	-	-	-	127.0	24.5	Hb. 10.6 Gm. per 100 ml.; RBC 3.24 million per c.mm.
KK	m	10	12	2	Worms	129.5	28.8	Malaria parasites Hb. 12.9 Gm. per 100 ml.; RBC 3.10 million per c.mm.
SK	f	13	8	1	Fretful; fontanels failed to close	147.3	36.1	Hb. 12.9 Gm.per 100 ml.; RBC 4.05 million per c.mm.

TABLE 11 (cont'd)

Four Households in Dome (cont'd)

Clinical Findings	Comment
Hair patchy, somewhat soft and dyspigmented at temples; tropical sores; knees and elbows scaly with deep pigment; 2 carious teeth; mild gingivitis; corneal ulcers; corneal edema; abdomen enlarged; liver ++; apathetic	Attends school part of the time
Hair dry and sandy in color; lips denuded, mild fissure at right; teeth worn down; abdomen moderately enlarged; liver +; parotid glands enlarged; development fair; moderately alert	Attends school; does not appear to be ill
Hair patchy and thin; papillae of upper arms enlarged; mild fissuring of lip at right; yaws; granular conjunctivitis; abdomen enlarged; axillary and groin glands enlarged; development fair	Attends school;has received treatment for yaws; discontinued trips to clinic with improvement
Hair dry; shins shiny and etched; mild follicular keratosis; dyspigmented areas on buttocks and neck; low grade conjunctivitis; abdomen enlarged; development fair; alert	Attends school; dyspigmented areas said to follow rash or scabies
Hair dry; teeth malerupted; 1 carious tooth; conjunctivitis; abdomen moderately enlarged; liver +; development fair; moderately alert	Attends school; mother absent
Mild respiratory infection; liver +; development fair; alert	Attends school
Fungus infection; granular conjunctivitis; spleen ++; parotid glands enlarged; development fair; slightly knock kneed	Attends school; appears well

TABLE 11. (cont'd)

Moderately Well-to-do Home in Accra

Child	Sex	Age (yr)	Age of First Supplement (mo.)	Age of Weaning (yr.)	Condition at or near Weaning	Height (cm.)	Weight (kg.)	Laboratory Findings
AE	m	6	9	1.5	Well	112.0	19.0	Hb.12.7 Gm.per 100 ml.;RBC 5.16 million per c.mm.
KE	f	8	8	1	Well	124.0	24.0	Hb.13.0 gm. per 100 ml.; RBC 4.88 million per c.mm.
ME	f	10	7	1	Well	132.0	28.6	Hb. 14.9 Gm. per 100 ml. ; RBC 5.13 million per c.mm.
QE	f	12	-	-	-	142.0	31.0	Roundworm, scanty Hb.14.4 Gm.per 100 ml.;RBC 4.50 million per c.mm.
DC	f	12	-	-	-	140.0	28.0	Hb.13.8 Gm.per 100 ml.; RBC 4.83 million per c.mm.
EO	f	14	-	-	-	151.5	39.7	No data obtained
CD	f	14	-	-	-	150.0	40.0	Hb.14.6 Gm.per 100 ml.; RBC 4.74 million per c.mm.
BT	m	14	-	-	-	147.0	35.9	Hb.16.9 Gm.per 100 ml.; RBC 5 million per c.mm.
AH	f	16	-	-	-	160.0	44.0	Roundworm; Hb. 14 Gm.per 100 ml.; RBC 4.80 million per c.mm.

TABLE 11. (Cont'd.)

Moderately Well-to-do Home in Accra

Clinical Findings	Comment
No abnormalities diagnosed; skeletal development fair; slightly knock kneed; alert	Attends school; receives malaria prophylactic
No abnormalities diagnosed; development good; alert	Attends school; receives malaria prophylactic
No abnormalities diagnosed; development good; alert	Attends school; receives malaria prophylactic
No abnormalities diagnosed; development good; alert	Attends school; mother absent
Clinical data not obtained; development good; alert	Attends school; acute malaria later; mother absent
No data obtained	Attends school; acute malaria after study
No abnormalities diagnosed; development good; alert	Attends school; plays games at school; mother absent
Considered thin : development fair; alert	Attends school; plays games at school; mother absent
No abnormalities diagnosed; development good; alert	Attends school; mother absent

TABLE 12.

PHYSICAL FINDINGS FOR FIFTY-NINE SCHOOL CHILDREN IN DOME[a]

Age (yr.)	Number of Children	Average Height (cm.)	Average Weight (kg.)	Number with the Condition[b]							
				Hair dys-pigmented	Hair soft textured	Follicular keratosis	Pre-mosaic skin	Mosaic skin	Conjuncti-vitis	Cheilosis	Angular stomatitis
6	14	108.7	17.0	5	2	1	5	7	4	1	6
7	6	114.0	18.6	2	2	2	2	2	3	1	0
8	10	117.8	20.6	3	0	2	4	2	5	2	3
9	4	121.4	22.0	1	0	1	3	1	4	0	1
10	4	123.4	24.2	0	0	2	1	0	0	2	0
11	3	134.4	27.4	0	0	1	1	1	0	1	0
12	3	136.1	30.2	0	0	0	1	2	1	1	0
13 (boys)	2	137.2	31.4	1	0	1	1	0	1	1	0
13 (girls)	2	140.7	33.2	0	0	2	0	1	2	0	0
14 (boys)	6	137.9	36.1	0	0	0	2	0	2	1	1
16 (boys)	5	138.7	37.5	0	0	0	3	0	0	0	0
TOTAL	59			10	4	12	23	16	22	10	11

a Includes 11 of the children from the four homes as they were enrolled in school.

b There were various abnormalities, such as yaws, impetigo and pigmented conjunctivae, that have not been included in this table.

TABLE 12 (cont'd.)

Number with the Condition										Hemoglobin[c]		Red Blood Cells	
			Enlargement							Gm.per 100 ml.		million per c.mm.	
Carious teeth	Lumbar lordosis	Knock knees	Parotids	Spleen	Liver	Malarial parasites	Intestinal parasites	Tropical sores	Gingivitis	Mean	Range	Mean	Range
4	3	0	2	9	9	12	5	10	2	12.2	10.0-15.4	2.95	2.11-3.97
1	0	2	3	5	5	5	2	4	2	11.3	6.2-13.7	2.85	2.00-3.65
2	3	1	1	10	6	8	2	2	0	12.1	10.9-15.4	3.17	2.57-4.05
3	1	0	1	4	3	3	2	1	0	13.1	10.2-14.8	3.49	2.90-4.25
0	1	0	0	1	2	2	2	1	0	10.9	9.1-12.9	2.81	2.45-3.10
0	1	0	2	1	1	2	0	1	0	12.8	12.3-13.1	3.15	2.49-3.68
0	2	0	0	3	2	1	1	2	0	13.3	12.6-15.4	3.00	2.34-3.78
0	0	0	0	1	0	2	0	1	0	13.4	13.9-13.2	3.14	3.11-3.18
1	0	0	0	1	0	0	0	1	0	10.4	10.4-10.5	3.33	2.86-3.81
0	0	1	2	1	2	4	2	1	0	11.5	10.0-15.2	3.57	2.80-4.50
0	0	0	0	4	2	2	0	2	1	13.6	11.7-15.1	3.01	2.97-3.52
11	11	4	11	40	32	41	16	26	5				

c This group of hemoglobin determinations was carried out by means of visual colorimetry with the standard of 15.4 Gm.per 100 ml. for children under 13 years of age, and 14.0 and 15.4 Gm. respectively for girls and boys over 13.

boys and girls as given by Nicholls (13). The heights of seven of the children in the four homes in Dome were in fair agreement or were the same as the standards, while those of nine deviated by from 5 to 16 per cent. The weights of four of the children were essentially the same as the standards; those of two of them were 7 and 15 per cent above the standards, while the weights of ten were from 5 to 33 per cent below the standards.

The average heights of the school children in the 6, 7 and 11-year groups were reasonably close to the standards, as the deviations did not exceed 2 per cent. In the other age groups the negative deviation ranged from 3 to 12 per cent. The average weights of these groups deviated negatively by from 5 to 20 per cent. Differences in weight would have been slightly less if indoor clothing had been worn when the weights were taken.

The heights of the Accra group agreed with the standards, but the weights of two of the oldest members were 20 and 17 per cent less.

Clinical Findings*

Dome.- Abnormalities identified for the children in the homes in Dome are given in Table 11; most of those identified for the school children are given in Table 12. There were various abnormalities of the skin and hair, including pre-mosaic skin, mild follicular keratosis, cheilosis, angular stomatitis and tropical sores. A degree of dyspigmentation of the hair and texture change was described for 12, with those from the school survey

* Medical examinations of the children in Dome and Accra were done through the courtesy of Dr. Michael Wilson and Dr. Mark Edington; in Mampong, through the courtesy of Dr. Oku Ampofu.

included. The spleens of 42 were enlarged and the livers of 34. There was also gingivitis, conjunctivitis and fungus infections. Seven had yaws. Despite these findings, most of the children were alert or moderately so. The behavior of four children in the homes alternated between apathy and fretfulness.

Mampong.-Although not shown in Table 12, various abnormalities were described for the children seen at the clinic at Mampong. Of the 16 children from one to three years of age the following number of conditions were recorded:

Hair dyspigmented - 8
Hair altered in texture - 1
Pre-mosaic skin - 4
Diarrhea - 10
Fever - 8
Apathy - 4
Enlarged livers - 2

Malaria was practically eliminated as a factor for seven of the number by the absence of enlarged spleens, no history of fever and negative blood films. Five of the latter group had dyspigmented hair, 4 had pre-mosaic skin, 7 had diarrhea, 5 had anorexia and the liver of one was enlarged.

Laboratory Findings

Dome.- Parasites of malaria were found in 8 of the 14 children in the homes and in 41 of all school children. Intestinal infestation was much less common than in Ayeduase; only 2 of the 14 in the homes were so infested, and 16 of the 59 school children, many of whom came from other villages. The mean hemoglobin for three children in the homes who were under six years of age was 9.4 Gm. per 100 ml., with red blood cells 3.4 million per c.mm.

The mean hemoglobin for 59 school children ranged from 10.4 to 13.6 Gm. per 100 ml. for the different age groups. The mean red blood cells for these groups ranged from 2.85 to 3.57 million per c.mm.

Mampong.-Laboratory facilities were not available in Mampong, but hemoglobin determinations in Accra on children under three years of age resulted in a mean of 9.1 Gm. per 100 ml.

Accra.-All blood films were negative for malaria. Roundworm ova were found in two of the girls who had only recently joined this family group. Hemoglobin and red blood cells were normal or above.

Correlation Between the Nutritive Value of the Diets and the Physical Findings

Activity studies were not carried out in any area. Still it is almost certain, as it was in Ayeduase, that the children under twelve years of age, and possibly even older, were somewhat less active than those for whom the caloric allowances were intended. Even so, the requirements of the children in Dome could scarcely have differed from the calculated requirements by 700 calories, the deviation of the average diet there. It appears that the small size of many of the children may have been related to the low caloric level of the diet and perhaps to the small amount of protein and other dietary factors. As discussed previously, tropical sores are in part related to the quality of the diet. Some of the skin conditions described for the children in Dome and Mampong may have been related to a failure to utilize carotene as vitamin A. Other conditions of the skin may have been the result of lack of riboflavin or other vitamins of the B-complex. The alter-

ation in texture and pigment of the hair suggests malignant malnutrition or kwashiorkor, though none of the children so afflicted was moribund. Even so, they were obviously ill. Those in Dome with the condition were held most of the time or carried on the backs of their mothers, and apparently did not walk unless aided.

Enlarged livers may, of course, be the result of inadequate protein. But since malaria may also be a factor, a lack of protein cannot be assumed on the presence of the condition alone. Of the 34 cases identified in the children in Dome, malaria could be eliminated in four only. A lack of protein was probably the cause of the condition in Mampong where there was no evidence of malaria.

As in Ayeduase, the anemias of many of the village groups may have been associated with the poor quality of the diet and the parasitic conditions. Intestinal parasites were less of a problem in Dome because many of the people obtained water from the railroad engines stopping in the station there, but this source of pure water is rare for most villagers.

There was little or no evidence of dietary inadequacies in the Accra group. The caloric intake of two of the group may have been insufficient, but the quality of the diet was evidently high enough to prevent other symptoms, even anemia, for the two with roundworm.

Discussion

As a result of the foods available in Ayeduase, it was concluded that a diet of at least fair adequacy was possible, provided that legumes and vegetables were used in the traditional dishes in larger quantities. It was suggested that fruits and eggs would improve the diet further. In Accra, where local foods were used in traditional cookery entirely, the diet was shown to be of fair adequacy. With greater use of legumes, particularly peanuts, and the addition of green leaves, it would seem that the main weaknesses of this diet (calcium and riboflavin) could be overcome. As educated people, there is no contraindication against the use of eggs. Failure to use this food was related to habit and taste only so that the use of this food offers further possibility for improvement for such groups.

The problem of a more adequate diet in Dome may be somewhat more difficult to solve. The people probably spend all they can afford for food. It may be that the women would contribute more to the welfare of the families by more extensive farming of the land surrounding the village than they do by the peddling of firewood and the like. As in Ayeduase, part of the difficulty may result from expecting the young children to satisfy nutritive needs from a diet so bulky in nature. Apparently adults can do this and older children too, to an extent, but the younger children observed did not appear to want large quantities of bulky food. Use of fruit might stimulate the appetites. Succulent vegetables mightalso serve this purpose. But again it would seem to be largely a problem of substituting a more con-

centrated food for the large amounts of cassava tuber and flour or meal. Peanuts, being considerably cheaper than meat, would be useful for this purpose. Du Sautoy (23) has recently prepared a booklet for the Gold Coast which contains helpful suggestions for the use peanuts.

In Mampong, as in Ayeduase, the problem with many of the young children is probably not an economic one. Many of the people have land and a source of cash income as well. It would seem to lie almost entirely in the offering of suitable food now available or to be had for a small outlay or from planting more legumes. According to information from the clinic, the women of the area plant less legumes now than formerly, preferring to plant cassava because it grows prolifically and with little cultivation.

The women attending the class in child care at Mpamfukrom seemed to be on the way to overcoming the problem of an inadequate diet for younger children. The use of eggs in cereal dishes was emphasized, and of soups containing greater amounts of legumes and vegetables as well as the use of juices and fruits. It was apparent that the women had caught on from their discussion of the lessons. Not only this, but it was evident that they actually were commencing to make use of these foods. For some reason the women in Dome appeared to be less forward looking than the above group and than the younger women in Ayeduase. It may be that as migrants from their own areas, they have encountered more change than they could successfully integrate. Perhaps such groups are a special problem.

As in Ayeduase, much information concerning the composition of local food is lacking. The vitamin content of the corn dough products and the dried cassava products is of great interest, as is that of the cured fish. Little or no work seems to have been done on the composition of the species of coco-yam used most commonly in the forest zone. Moreover, the utilization of the foods by the children is not known.

SUMMARY AND CONCLUSIONS

A dietary and health study carried out for groups of children living in the Gold Coast, West Africa, has been reported. In a traditional village in the heart of the forest, dietary records were obtained during an average of ten days with each group. Study in this period was divided into three periods. Similar study was made during one period of children living in a small village near the coast. Supplementary study was carried out for young patients attending a clinic in a village on the edge of the forest country and of other children in homes of this village. To provide contrast for the traditional environment, a group living in a moderately well-to-do home in a large city was studied. In all, quantitative dietary data were obtained for fifty-nine children during periods ranging from three to twelve days. The dietary data obtained in the small village near the coast was supplemented by a survey of the diet of thirty-six school children in the village.

In order to obtain further information on matters pertaining to the welfare of the children, women in each household were questioned. Sixty-eight other women were questioned individually concerning similar matters and approximately thirty women were questioned as a group.

Medical examinations were obtained for nearly all of the children for whom dietary data were obtained. As support for the medical findings for the children in four households in the village near the coast, the results of a medical survey carried out for children enrolled in the village school have been reported.

Where information concerning the composition of some of the more important foods was necessary for calculation of the nutritive value of the diets, certain laboratory determinations were carried out.

Useful preparation for the investigation included study of the culture, political organization and economic structure of the country. Also helpful, although not necessary for the present study, were the few words of the language of the forest people which were learned before meeting the people. This made it possible to greet the people, to thank them, and to ask names of items encountered. Even this meager use of the language seemed to hasten the friendships made with these people and, thus, their cooperation.

The diets were poor in relation to commonly accepted standards of adequacy with the exception of that in the moderately well-to-do home. In this group all nutrients were supplied relatively generously except calcium and ascorbic acid, even though the general nature of the diet was the same as that in the homes in the villages.

Supplementary food was found to be given to infants from the age of five months to one year or slightly over, but from the weighed portions provided for four children, it would seem that the nutritive contributions of the supplements are not great. As a rule, the babies were weaned from one to two years of age, after which they receive small servings of the regular diet. The food provided did not seem to be sufficient to meet the estimated caloric requirements of these children, nor to meet the National Research Council's allowances for nutrients, except in the case of vitamin A

and ascorbic acid. However, approximately all vitamin A of the diets was derived from carotene.

Clinical examinations revealed some evidence of protein undernutrition, such as lack of good muscular development, generally small stature, abnormalities of the hair, tropical sores and anemia. General dryness of the skin and hair was common. Symptoms of a lack of vitamins of the B-complex group were in evidence.

Anemia was a marked and common finding in the children in the villages. In addition to the probable deficiencies of blood building factors, parasites of the intestine and blood were surely involved in the etiology of the condition.

During the study, the death of a child living in a home in a forest village occurred. While the child evidently suffered from parasitic diseases, there was no evidence that these were more severe than those of other children in this village. The terminal cause of death was not learned, but from the quality of the diet of this group, total inanition is believed to have been involved. Other children in this household were practically moribund.

Useful and interesting findings resulted from the laboratory determinations. The ascorbic acid content of the two staples, plantain and cassava, was found to be relatively high, even after cooking and further preparation such as pounding. Thus, despite the failure to use citrus fruits regularly, a source of this nutrient is included in many of the diets.

Determinations carried out on the maize products suggest that the grain is of average protein and fat content but of relatively high ash content.

The samples of smoked fish investigated suggest that the average moisture content is very low. Protein, thus, was found to be high so that this food provides about three and one-half times the amount of this nutrient for a given weight as does fresh fish. Due perhaps to the species and to the tropical habitat, the oil content of the fish was found to be low. However, maturity of the fish studied may also have been involved. The fat lost by removal of the skin was also a factor. Calcium content of the edible portions of the fish was found to be high, as small bones commonly consumed were included for determination.

Although the problem of these children is complex and the period of quantitive study short, certain inferences seem valid. These are as follows:

1. In the villages, the pattern of the diet differs little with income, as in the more well-to-do home there were no luxury items.

2. In the heart of the forest where incomes varied, the amount of flesh foods seems also to vary.

3. All younger children in the villages suffer from some degree of undernutrition; some of them are malnourished while others suffer from inanition.

4. The diet of children in the village in the coastal zone appeared to provide less protection against skin abnormalities than that in the heart of the forest.

5. Ingestion of large amounts of coco-yam and plantain, as in the forest, provides better protection against skin abnormalities than the

ingestion of large amounts of dried cassava products, and possibly better protection than the ingestion of large quantities of corn products.

6. Food resources offer the possibility of a diet of reasonable adequacy for older children with but little change in the traditional meal pattern. Larger amounts of legumes in the soups and stews, and a greater use of the succulent vegetables and fruits would affect this. The regular use of eggs would provide further improvement.

7. The traditional pattern may need further modification for children before and after weaning. Given the bulky nature of the diet and the small inclination of young children to continue to eat after hunger has been slightly allayed, a diet adequate in calories or nutrients cannot be expected otherwise.

8. The introduction of relatively concentrated soups and stews, cereal grains, with or without eggs, and of fresh fruits before the period of weaning would not only supplement the diet where it is weak but would acquaint the child with foods so that rejection of food at the time of weaning would be less likely.

9. Even though some of the village women are interested in modern concepts of nutrition and child care, few understand how to follow general directions concerning the application of these concepts.

10. Programs of direction and self-help, such as those planned by the Department of Social Welfare and Community Development (Mass Education) are required. Evidence was obtained that the women accept these programs eagerly and learn readily.

11. While the effects of the social organization on behavior were not a major area of concern, it seemed that the organization of the households is conducive to good behavior and good adjustment between the children.

12. Further study of the composition of local foods is desirable, as is study of the utilization of the foods by children of various ages.

A P P E N D I X

Figure 3.
Young Patients at Clinic at Mampong

Figure 4.
A Road Leading from Ayeduase

Figure 5.
Ayeduase

Figure 6.
Coco-Yam Plants

Figure 7.
Cassava Tubers

Figure 8.
Water Yam

Figure 9.
Yam

Figure 10
Fufu Prepared from Cassava

Figure 11.
Grating Cassava for Gari

Figure 12.
Area Where Food is Prepared

Figure 13.
Children in the Second Household in
Ayeduase Lunching from a Common Bowl

Fig. 14
Children Lunching from Boiled Coco-yam

Figure 15.
Baby Receiving Corn Dough Gruel
(Akasa)

Figure 16.
Baby 6 Months of Age in Ayeduase

Figure 17.
Eldest Daughter in the Fourth Household in Ayeduase with Infant

Figure 18.
Girl in the First Household in Ayeduase

Figure 19.
Patient at the Clinic at Mampong

Figure 20.
Women Attending a Class in Child Care at Mpamfukrom

Figure 21.
Children in a Moderately Well-to-do Household in Accra Lunching from Palm Nut Soup, Rice and Mangoes

LIST OF REFERENCES

1. Brock, J. F., and Autrey, M.: Kwashiorkor in Africa. FAO Nutritional Study No. 8, 1952.
2. Williams, C. D.: Nutritional disease of childhood associated with a maize diet, Arch. Dis. Child. 8:423, 1933.
3. _____: Nutritional disease associated with a maize diet, Lancet 2:1151, 1935.
4. _____: Kwashiorkor, J.A.M.A. 153:1280, 1953.
5. Russell, B.A.S.: Malnutrition in children under five years of age in Ashanti, Arch. Dis. Child.210:110, 1946.
6. Coulbourne, M. J., Edington, G. M., and Hughes, M. H.: A medical survey in the Gold Coast, Trans. Roy. Soc. Trop. Med. Hyg. 44:271, 1950.
7. Report on the Department of Animal Health for the year 1950-1951. Government Printing Department, Accra, Gold Cost, 1952.
8. Jackson, Rowena: A personal communication. See Report of the Annual Conference of Social and Economic Research, University of Ibadan, Nigeria, 1953, or unpublished thesis at University of Birmingham.
9. Norris, Thelma: Dietary Surveys, FAO Nutritional Study, No. 4, 1949.
10. Association of Official Agricultural Chemists: Official Methods of Analysis, Washington, 1950.
11. Cole, J. R., and Parks, C. R.: Semi-micro Kjehdahl. Anal. Chem. 18:61, 1946.
12. Platt, B. S.: Tables of representative values of foods commonly used in tropical countries. Medical Research Council Special Report Series No. 23. His Majesty's Stationery Office, 1945.

13. Nicholls, Lucius: Tropical Nutrition. London, Balliere, Tindall & Cox, 1951.

14. Wu Leung, Pecot, R. R., and Watt, B. K.: Composition of foods used in Far Eastern Countries. U. S. Department of Agriculture Handbook No.34, Government Printing Office, 1952.

15. Watt, B. K., and Merrill, A. L.: Composition of foods - raw, processed and prepared. U.S. Department of Agriculture Handbook No.8. Government Printing Office, 1950.

16. Food and Agriculture Organization of the United Nations: Energy Yielding Components of Food and Computation of Caloric Values. Washington, May 1947.

17. Committee on Calorie Requirements: Calorie Requirements. FAO Nutritional Studies No. 5, 1950.

18. Food and Nutrition Board; Recommended Dietary Allowances, Revised. National Research Council publication 302, 1953.

19. Leverton, Ruth M.: The physiological availability of calcium phosphorus and nitrogen from the bones and flesh of dilis, a small fish used in the Filipino diet, Philippine J. Science 80:23, 1951 (No.1).

20. Goodman, Leonard: Obstetrics in a primitive African community. A. J. Pub. Health 41: 56, part 2, 1951.

21. Bray, Barbara: Nitrogen balance in West African children, Brit. J. Nut. 7:3, 1953.

22. Wilson, Michael, Director of Clinic at Achimota School, Gold Coast. Personal communication.

23. DuSautoy, Marjorie: Some Gold Coast foods. Accra: Government Printing Department, 1953.