Food and Nutrition Studies Programme

Seasonality in the Coastal Lowlands of Kenya

Part 4/5: Food consumption and anthropometry

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Report No. 38/1991

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ISBN 90 70110.92.X

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Note on Authors

This study has been a genuine team effort in which several researchers participated in different phases of the research. Also, during the course of the study some of our colleagues left and were replaced by others. Since it is not possible to list all of them as authors to each report, we have chosen to list as authors the researchers who have taken a large hand in that particular report, be it in data collection, analysis, reporting or otherwise. The full team, however, has contributed to the end result and therefore needs to be mentioned. The respective names, disciplines and periods of participation in the study follow below:

Ir. Inge Brouwer	human nutrition	1989
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Drs. Rudo Niemeijer	anthropology/data management	1985-
Walter Okello BSc	economy	1985-
Drs. Willem Veerman	data management	1987

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Acknowledgements

This report is the fourth of a series on seasonality in Coast Province, the result of a joint programme by the Ministry of Planning and National Development, Nairobi and the African Studies Centre, Leiden. The study was carried out over a period of two years and a great number of people were involved. Without the assistance and support of these individuals and the institutions they represent the study could not have been realized.

We wish to mention, firstly, the extensive support of the officers of the Ministry of Planning and National Development. Mr. J.O. Otieno, Chief Planning Officer of the Sectoral Planning Department, contributed greatly to the realization of the study, as did Mr. F.Z. Omoro and Mrs. L.I. Shitakha, successive heads of the Food and Nutrition Planning Unit. In Mombasa, the Provincial Planning Officer, Mr. P.B. Mjambili, gave invaluable assistance with the local introductions and the organization of logistics. He was later replaced by Mr. J. Echessa. We are also indebted to the District Development Officers in the two districts: Dr. K. Oigara, Mr. H. Ajwang and Mr. R.W. Machina, as well as the Division Officers, Chiefs and Assistant Chiefs in the different locations.

Our colleagues of the Central Bureau of Statistics, Mr. F.M. Munene and Mr. N. Mwasigwa, District Statistical Officers, assisted us greatly with the sample selection and the recruitment of assistants. We wish to mention in particular the CBS field supervisors Mr. J. Ngolo and Mr. G. Tumbo, who played an active role throughout with the supervision of field assistants. The team benefitted greatly from their long experience.

We are particularly grateful to the members of our office and field staff. Although the group experienced the usual ups and downs, it functioned as a coherent and harmonious team. Miss P. Dzombo, Miss S. Ngala, Mrs. A. Kazungu, Mr. J.A. Odingo, Mr. B.O. Ajode, Mr. R.C. Chacha, Mr. J.K. Hamisi, Mr. M.A. Maalim, Mr. S.S. Masha, Mr. S.R. Mwaguni, Mr. I.M. Mwaropia, Mr. F.M. Nyundo, Mr. E.M. Pekeshe, Mr. L.S. Rasi, Mr. M. Salim and Mr. R.D. Washe formed a fine team and we regret that it had to be disbanded.

At various stages all our studies have benefited from the comments of members of the FNSP Steering Committee, of whom we wish to mention in particular Mr. S.

Akach, Central Bureau of Statistics, Mr. L. Wasonga, Office of the President, and Dr. G. Ruigu, Institute of Development Studies.

In June 1988, a district workshop was organized in Mombasa to present and discuss the preliminary results of several FNSP-studies with government officers from Kwale and Kilifi Districts and from the Food and Nutrition Planning Unit. We appreciate the many comments and suggestions by the participants on that occasion. In November 1990, at a workshop in Diani Beach, a preliminary version of this report was discussed by government officers from the National, Provincial, and District levels together with representatives from the counterpart institutes involved in the FNSP. The present version of the report greatly benefitted from the comments by the participants in this workshop. Finally, we thank the members of the administrative staff of the African Studies Centre for their assistance in general and for the preparation and printing of this and coming reports, in particular Mrs. R. van Hal-Klap, Mrs. M. Zwart-Brouwer and Mr. D. Stelpstra. Mrs. N. Betlehem-de Vink prepared the maps and Mrs. I. Rike edited the text.

The research was made possible by a grant of the Netherlands Ministry of Development Co-operation.

Summary

This is Part 4/5 of a series concerned with seasonality in the Coastal Lowlands of Kenya. Household surveys were carried out in six locations in Kwale and Kilifi Districts; two locations in each of the three major agro-ecological zones: CL3 (coconut-cassava), CL4 (cashewnut-cassava) and, more inland, CL5 (livestock-millet). In each location 50 households were visited five times over a period of two years, 1985-87. The data concern household and demographic characteristics, agriculture and off-farm employment, food consumption and nutritional status. Previous reports presented a description of research objectives and study design (Part 1), a review of existing literature on seasonality and the two districts (Part 2), and the socio-economic characteristics of the households in the six research areas (Part 3). The present report deals with food consumption (4) and the nutritional condition of the study population (5).

The average energy intake in the sampled households is substantially lower than the reference requirements. However, energy intake differs according to research area, income class and season. In general, the food consumption level in the Kwale areas is higher than in the Kilifi areas; a phenomenon that can be ascribed to the difference in household size between the two districts, as the average energy intake per consumer unit is lower if the household is larger. Energy intake is also higher in richer households and in those households in which farming is an important component of the household's resource base. The latter is caused by the relatively high energy intake during the period when labour requirements in agriculture are highest. This implies that the seasonality of food consumption is highest in those households where farming is important. However, this does not apply to the poorest households, i.e. with an annual income of less than KSh.1000 per consumer unit, notwithstanding the fact that the (very low average) income is mainly derived from farming. In these households, energy intake is relatively low the whole year through.

On average, only about one-third of the energy intake is covered by the households' own food production. Stocks of home-produced food fluctuate throughout the year. They are largest immediately after the harvest of the long rains and smallest shortly before the new harvest. The latter period is also the period of highest labour

requirements in agriculture. Nevertheless, the average energy intake is highest then. Apparently, many households resort to monetary means to supplement available food during that time of the year.

The bought food is not sufficient, however, to prevent a decline of the nutritional condition of the adult women during this period of peak labour, especially in those areas where the cultivation of maize is important. At the same time, the children appear to benefit from the greater quantities of food prepared and realize the highest weight growth. Height growth also shows seasonal fluctuations and is highest between December and February, i.e. during the driest period of the year.

The general seasonality pattern of height and weight growth of the children differs little between the research areas. In all areas, the peak in height growth occurs during the dry season, while in four of the six areas maximum weight growth takes place during the long rains, i.e. between March and May. However, the amplitudes of the seasonal fluctuations differ between the areas. Especially in one area - where the dependence on agriculture under difficult conditions is greatest - strong fluctuations in weight growth among the children occurred, while also the condition of the women showed large seasonality. Household income level appears to be another important variable underlying differences in the seasonality of height growth and weight growth. Children in poor households show relatively large seasonal fluctuations regarding both height growth and weight growth, while for children in the relatively rich households both seasonalities are relatively low. Thus, the latter children show a much more even growth pattern throughout the year than the poor children.

The relationship between household income level and seasonality in the mothers' weight is more complex. It is in the 'middle income' groups that maternal weight loss during the growing season is largest. Women in the poorer groups have a rather constant body weight throughout the year, albeit at a low level.

In the present study, 'seasonal stress' is assessed in terms of a deterioration of the nutritional condition of the people. To a certain extent, most households are able to prevent this type of seasonal stress by buying food, with money derived from a more or less regular type of off-farm employment and to a lesser extent also from farm sales (cash crops, livestock). The poorest households are poor because they lack a regular source of wage income. For them, the non-regular type of off-farm employment, i.e. casual labour on a neighbouring farm, plays a crucial role in solving seasonal stress: during peak labour periods, a large part of the income from this source is used to raise the level of food consumption, although this level remains relatively low.

1. Introduction

1.1. The seasonality study

Coast Province is the third area of major population concentration in Kenya, after the Central and Western regions of the country. Going inland, rainfall diminishes quickly while the potential evapo-transpiration increases. Most soils are chemically poor and the fertility of the land tends to be low (Boxem et al., 1987). The region comprises different agro-ecological zones that can alternate over relatively short distances (Jaetzold & Schmidt, 1983). The relatively humid coconut-cassava zone has a wide potential for food and cash crops, mainly depending on local variations in soil fertility. In the somewhat drier cashewnut-cassava zone, possibilities for crop production are more restricted. The livestock-millet zone and the ranching zone cover more than two-thirds of the agricultural land and offer only limited potential for rain-fed agriculture.[1] Agriculture in the first two zones is dominated by food crops and perennial cash crops, while in the third zone livestock rearing is combined with cultivation of food crops. The seasonal character and the low reliability of rainfall, however, severely restrict the scope and productivity of agricultural activities. Maize production in the region is insufficient to feed the population and substantial imports are required from elsewhere in Kenya. In most parts, the short rains are unreliable and many farmers do not plant in that season (Kliest, 1985). The population in the drier zones, in particular, have to deal with the disruptive effects of shorter and longer drought periods (MENR, 1984a; 1984b).

The present study aims to record, describe and analyse the effects of climatic seasonality on food supply and nutrition among the rural populations in the coastal

[1] Beside these five agro-ecological zones, the Lowland sugar-cane zone is found in the south-eastern corner of Kwale District. This zone covers only a small area and is mainly used for sugar-cane production.

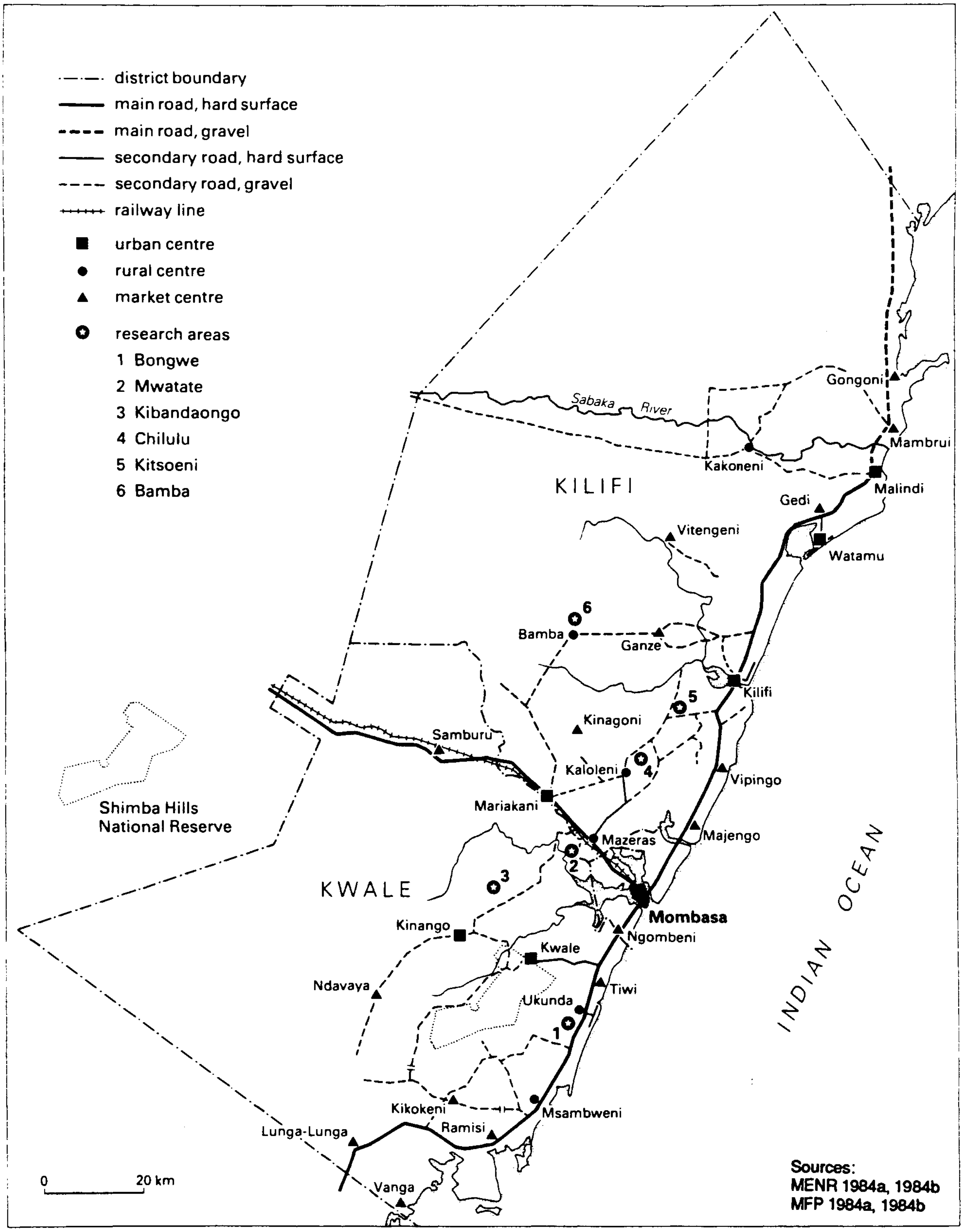
lowlands, together with the coping strategies that are utilized by different population groups in order to deal with these seasonal variations. A second objective is to collect information on food practices and nutritional conditions among the rural populations in the districts concerned.[2] The study was carried out in Kwale and Kilifi, the two districts that account for more than two-thirds of the rural population in the province.[3] Attention is further concentrated on three agro-ecological zones, namely the coconut-cassava zone (CL3), the cashewnut-cassava zone (CL4) and the livestock-millet zone (CL5). These zones cover about two-thirds of the land surface of the two districts and almost 90% of the farm families is located there (Foeken & Hoorweg, 1988: 48).

Six research locations were selected, one in each zone in each district (see Maps 1 and 2). They are, respectively, Bongwe and Chilulu in CL3, Mwatate and Kitsoeni in CL4, and Kibandaongo and Bamba in CL5. Some miscellaneous information on the research areas is listed in Table 1.1. A total of 300 households - 50 in each area - were visited five times, in such a way that two agricultural years (1985 and 1986) were covered in the questionnaires.

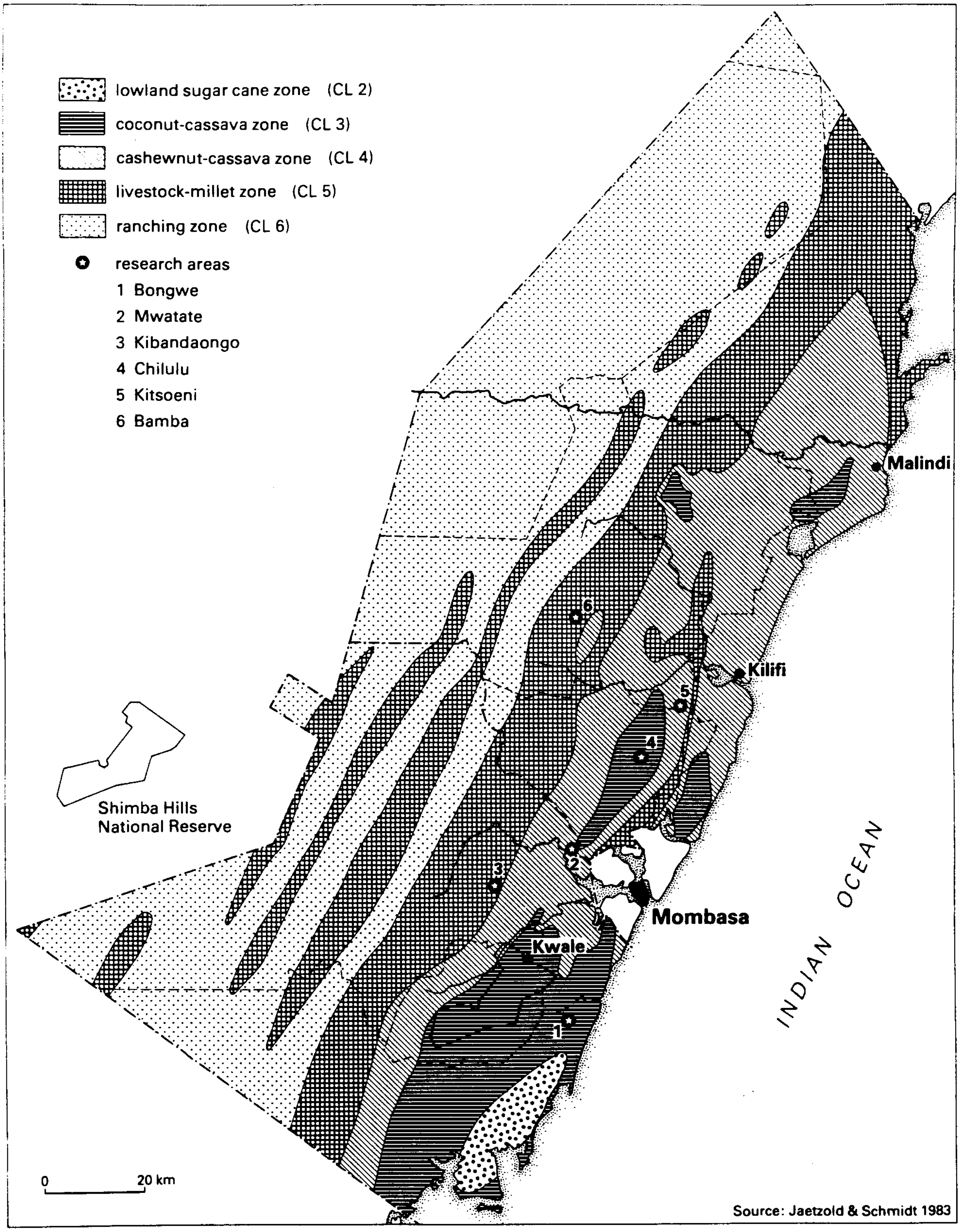
A comprehensive description of research objectives, study design and data schedules has been given in Part 1 of the series of reports (Hoorweg, Kliest & Niemeijer, 1988). The second report in the series contains a review of current knowledge on seasonality in Africa and discusses the various topics related to seasonality: climatic seasonality; its effects on the agrarian cycle, agrarian labour, food consumption, nutritional status, and health; and the ways people cope with seasonal fluctuations. The report also reviewed the existing conditions in Kwale and Kilifi Districts, together with the available information on social and economic conditions in the districts (Foeken & Hoorweg, 1988). Finally, Part 3 of the seasonality research reports was concerned with the socio-economic characteristics of the six research locations. On the one hand, a description was given of the productive organization in the respective areas by means of the presentation of the baseline socio-economic data collected for the first and second survey rounds in 1985; on the other hand, the report

[2] The study detailed here was one of several which were carried out in Coast Province at the time. Subsidiary studies to the present one are concerned with the aetiology of childhood malnutrition in the region (Peters & Niemeijer, 1987) and with the topic of farm management and ecological adaptation (Oosten, 1988). Other studies were concerned with another FNSP topic, namely nutrition in agricultural and rural development, and they concern the following: nutritional conditions at settlement schemes (Hoorweg et al., 1991) and nutrition and dairy development (Leegwater, Ngolo & Hoorweg, 1991). Finally, a study on women's social and economic projects was carried out (Maas & N van Hekken, 1991).

[3] These two districts and the sparsely populated Lamu District form the coastal region as such, with its distinctive ecological and cultural characteristics. The two other districts in Coast Province, Taita and Tana River, are mainly situated inland and have their own distinct characteristics.



Map 1
Infrastructure



Map 2
Agro-ecological zones

Table 1.1
Research areas

	Bongwe	*Chilulu*	*Mwatate*	*Kitsoeni*	*Kibandaongo*	*Bamba*
Agro-ecol. zone[1]	CL3	CL3	CL4	CL4	CL5	CL5
District	Kwale	Kilifi	Kwale	Kilifi	Kwale	Kilifi
Location	Diani	Jibana	Mwavumbo	Chonyi N.	Kinango N.	Bamba
Sub-location	Bongwe	Chilulu/Tsagwa	Mwatate	Kitsoeni	Kibandaongo	Mikamini
Ethnic group	Digo	Chonyi	Duruma	Chonyi/Kauma	Duruma	Giriama
Population density[2]	133	312	203	109	40	35
Distance Mombasa (km)	25-30	45-50	15-20	55-60	35-40	95-100

1 CL3 = coconut-cassava zone; CL4 = cashewnut-cassava zone; CL5 = livestock-millet zone (see Jaetzold & Schmidt, 1983)
2 The density figures are for 1979 and apply to the sub-locations concerned (CBS, 1981).

offered a characterization of the research areas in terms of magnitude and composition of the total resource base, as well as a characterization and differentation of individual households in socio-economic terms (Foeken et al., 1989).

The present report is the final one in the series and is concerned with the seasonal fluctuations as such. The objectives of the report are twofold. The first is to present the data concerning food consumption and nutritional conditions for all five survey rounds, in order to discern and analyse seasonal trends regarding these two characteristics. The second objective is to describe and analyse some of the coping strategies households use in order to deal with the adverse effects of climatic seasonality.

Earlier on, four factors were identified that are expected to play a prominent role in determining the degree to which seasonality is felt (Foeken & Hoorweg, 1988: 69-72). These factors, operating at different levels, are: climate, the productive organization of society, the household's income level, and age/gender characteristics. Climatic seasonality and unreliable rainfall are felt in all agro-ecological zones in the two districts. However, in drier areas, agricultural production is more risky because only a very limited range of crops can be grown there. Regarding the productive organization of the six areas under consideration, none of them can be considered as being self-sufficient, or, from the viewpoint of the farming households, as producing enough staple-food to sustain the household at subsistence level. The household's income level is an important variable as relatively rich households are considered to be potentially able to buy food during periods of stress. Finally, the impact of seasonality on individuals is age and gender specific; for instance, from the existing literature it is known that women (and especially those who are pregnant) and young children are the most vulnerable groups regarding seasonality.

The factors climate, household income level and age/gender characteristics, as well as the degree of climatic seasonality, determine the ways households are able to cope with seasonality, be it either preventive or curative.[4] In its turn, the success of coping determines the degree in which seasonal fluctuations occur regarding labour requirements, food supply and health, i.e. the three intermediate variables that are known to show seasonal fluctuations and that determine the nutritional condition of people. In the present study, these are treated as independent variables. The ultimate dependent variable concerns the nutritional condition of the children and their mothers. In Figure 1.1, this chain of relationships between independent, intermediate, and dependent variables is shown. The figure offers a general framework for the way of reasoning in the present report.

Climate determines to a high extent the agricultural possibilities, i.e. the choice between cropping and livestock rearing as well as the type of crops that can be grown. As such, climate strongly influences the amount of labour to be done in agriculture and the amount of food that can be harvested. To a certain extent, the health situation is influenced both by the factor climate and by climatic seasonality, as some diseases are related to either wet or dry seasons. The second determinant of seasonality, household income level, mainly operates through the factor food supply: potentially, more well-to-do households are always able to buy food. Income level may also influence the labour situation as richer households may spend more money on hired labour. The relationship between income level and the health situation of the members in the households is a rather complex one and has to do with the level of food consumption, education, response to emergencies, etc. In general, however, richer households tend to spend more on health services and are generally more inclined to call these services for help. Finally, age/gender works through all three variables. Because food production is mainly a task of women, this group will be most susceptible to fluctuations in labour requirements. Health is an age-related factor, as children - and especially young children - are more prone to fall sick than adults. The relationship between age/gender of individuals and food supply is less clear, although some research has shown that men tend to have a higher food consumption level (relative to their requirements) than women and children.[5] A similar finding was reported by Niemeijer et al. (1985) who

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[4] In Section 1.3, coping mechanisms will be discussed.
[5] See, for instance, Schofield, 1974; and Haaga & Mason, 1987.

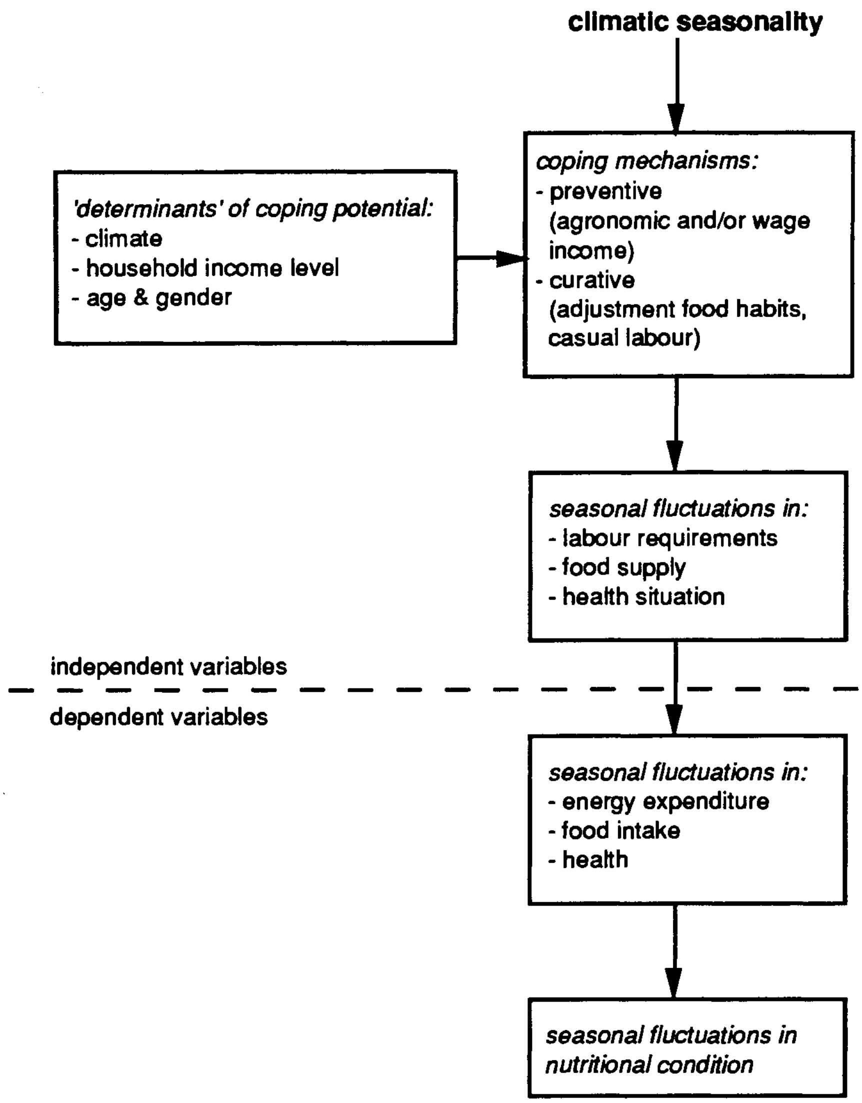

Figure 1.1
Seasonal aspects of food consumption and nutritional condition*

* It is important to note that Figure 1.1 is intended only to depict the impact of climatic seasonal variations on nutritional variables in terms of their fluctuations, and not the absolute or average levels of the outcomes. The general literature on seasonality, on which this figure is based, does not allow further specification of the effects of the three intermediate variables separately, neither of any differential effects on the components of nutritional condition (weight and height, respectively).

compared household intake data with the intakes of small children in a period of food shortage in Western Kenya.

The fluctuations of the intermediate variables are also interrelated. According to the literature on this topic, they may sometimes reinforce each other. For instance, during periods of high labour requirements, food availability tends to be limited and people are less healthy, resulting in a relatively bad nutritional condition. In areas where arable farming predominates, this occurs in the rainy season(s), in pastoralist societies in the dry season(s).

In the last instance, the three factors health, food intake, and energy expenditure again interact at the level of indivuals influencing their nutritional status through, for instance, fluctuating health or changes in the energy balance.[6]

1.2. Seasonality in Coast Province

Precipitation is the dominant factor in the ecology of Coast Province. Along the coastal strip and on the ridges bordering this strip precipitation ranges between 1100 and 1300 mm annually. This relatively humid zone has a fair agricultural potential for food and cash crops (the coconut-cassava zone). Going inland, precipitation becomes less with levels between 900 and 1100 mm, and the potential for food and cash crops diminishes (cashewnut-cassava zone). Further to the interior, annual rainfall decreases in the livestock-millet zone (700-900 mm) and the ranching zone, with rainfall below 700 mm annually. The six research areas included in the present study represent this range in precipitation levels. With about 1100-1150 mm, annual rainfall is highest in Bongwe and Chilulu. Bamba has the lowest annual precipitation: about 700 mm.

Basically, the Kenya Coast is characterized by a uni-modal distribution of rainfall, i.e. one wet and one dry season annually, but there is a tendency towards a more bi-modal (two wet and two dry seasons) distribution towards the interior. There is a marked dry period in January and February and a rainy season in April and May, the so-called long rains. More inland, a second, moderate, peak of rainfall occurs in October and November (the short rains) after a relatively dry period from July onwards. Nearer to the coast rainfall is more evenly distributed throughout the remaining part of the year.

These differences have important consequences for the type of crops cultivated, the harvests obtained, and the timing of the agricultural cycle. In Part 2 of the

[6] The energy balance is the difference between energy intake and energy expenditure.

Seasonality reports, a general overview (based on Jaetzold & Schmidt, 1983) has been given, showing the relationships between agro-ecological (sub-)zone, type of crops and yield potential. On the basis of Part 3, we are now able to illustrate this general picture with empirical evidence. In Table 1.2 (p. 11), the main characteristics of both arable farming and livestock rearing are presented for each of the six research areas. In interpreting the figures of the table, two things should be kept in mind. First, the climate factor does not fully determine the type of farming households perform. It sets limits regarding the possibilities for certain farming activities[7], which can be seen, for instance, with rice and the various cash crops. But within these limits, households will make a choice regarding the types of crops to be cultivated; a choice which can be influenced by many social, economic and cultural factors (farm size, availability of labour, taste preferences, etc.). Second, the figures in Table 1.2 do not reflect the agricultural potential, but represent the actual use of the land, and there can be important discrepancies between the two.

The degree of freedom of choice within the climatologically set limits can best be illustrated by comparing the two extremes in Table 1.2, i.e. Bongwe and Bamba. The former area is the wettest of the six and a wide range of crops can be grown. Bamba is

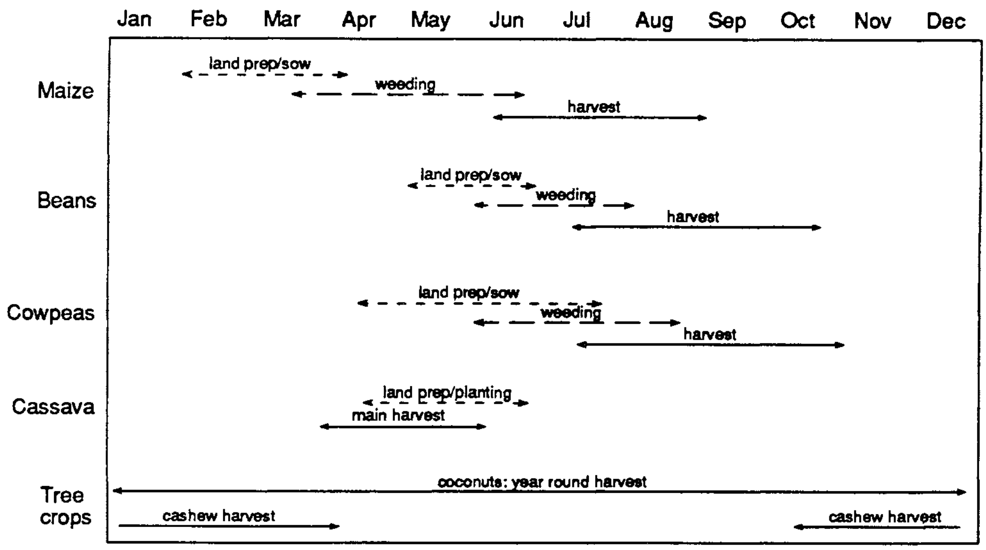

Figure 1.2
Agricultural calendar (long rains only)
Sources: Jaetzold & Schmidt, 1983; Vervoorn & Waaijenberg, 1986; Waaijenberg, 1987; Oosten, 1989.

[7] There are also other limiting factors; for instance, soil fertility (as included in the agro-ecological zoning).

the driest area and many crops - especially cash crops - do not survive there. Moreover, cassava does not thrive either because of the heavy soil. For these reasons, livestock rearing is of some importance in Bamba.

The amount of labour to be carried out in agriculture is determined primarily by the importance of annual cropping (cereals and pulses), maize in particular. Figure 1.2 gives a schematic overview of the agricultural calendar in Kwale and Kilifi Districts. Because the short rains are very unreliable and a reasonable second crop is rather exceptional, only the cropping season of the long rains is taken into consideration. In the existing literature on the Coast[8], the period between March and July-August is generally regarded as the period in which labour requirements in agriculture are high. It is the period of seeding, weeding and the beginning of harvesting of maize, land preparation for a second crop, weeding and some first harvesting of beans and cowpeas, and planting of cassava. However, the weeding of maize, a heavy task in terms of energy expenditure[9], is, according to Vervoorn & Waaijenberg (1986: 56), also in man hours, by far the most labour-consuming task. In other words, the period between, roughly, mid-April to the end of June can be considered as the annual labour peak in this part of Kenya. Taking into account the acreage used for food crops, the percentage of households cultivating maize, and the average maize production per household (Table 1.2), one may expect the highest labour peaks in Kitsoeni and in Kibandaongo, the lowest in Bongwe and in Bamba.

As stated, the second rains are generally too unreliable to permit a reasonable harvest. Nevertheless, farmers may try a second maize crop, provided there is sufficient rain. Especially in years when the harvest of the long rains' crop has been poor, many farmers will be eager to obtain an additional harvest from the short rains. The new maize is usually sown either in the fields that just have been harvested or between the cassava plants. This is done in September and it is not very labour-intensive. The amount of weeding to be done depends on the growth of weeds and on the prospects of the crop (Vervoorn & Waaijenberg, 1986: 51). In 'normal' years, then, there may be some weeding around November, but not very much. If there is any harvest, it is collected in December.

In the general literature on seasonality, the existence of a 'hunger season' is often stressed.[10] Food supply is highest immediately after the harvest and diminishes gradually until the following harvest. During the months preceding the new harvest,

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[8] Jaetzold & Schmidt, 1983; Waayenberg, 1987; Oosten, 1989; see also Foeken & Hoorweg, 1988: 55.
[9] WHO/FAO/UNU,1985.
[10] See for instance, AMREF, 1982; Chambers et al. , 1979; Foeken & Hoorweg, 1988; Longhurst, 1986; Sahn, 1989.

Table 1.2

Farming characteristics of households, by research area

Research area:	*Bongwe*	*Chilulu*	*Mwatate*	*Kitsoeni*	*Kiband'o*	*Bamba*
Agro-ecol. zone:	CL3	CL3	CL4	CL4	CL5	CL5
(N=)	(50)	(50)	(48)	(50)	(49)	(50)
FOOD CROPS						
acreage under food crops	2.4	2.0	1.4	3.8	2.9	4.4
% households cultivating						
maize	32	78	90	92	94	62
rice	38	14	-	8	-	-
cassava	92	88	85	80	73	24
pulses	42	44	38	24	27	46
bananas	70	80	69	34	59	2
*production (per consumer unit)**						
maize (kg)	3	31	62	146	111	25
rice (kg)	5	3	-	0	-	-
cassava (nr. of plants)	160	62	62	81	64	6
pulses (kg)	1	3	1	4	1	3
bananas (nr. of plants)	12	4	2	0	3	-
food self-sufficiency (%)	36	32	43	77	72	14
CASH CROPS						
% households cultivating						
coconuts	82	92	56	58	61	12
cashewnuts	82	56	73	50	49	14
citrus/impr. mango	72	62	71	26	43	4
production (nr. of trees/hhold)						
coconuts	37	84	4	39	20	10
cashewnuts	27	15	8	34	5	9
citrus/impr. mango	4	20	2	4	1	-
LIVESTOCK						
% households with						
cows	6	12	13	4	29	42
goats/sheep	20	48	35	34	49	58
number of animals per hhold						
cows	0.7	0.4	2.6	0.6	6.5	14.8
goats/sheep	1.0	2.3	1.9	2.4	4.6	5.3

Legend: - = not present, 0 = negligible (rounds to 0)
* See note on consumer units with Appendix 1
Source: Foeken et al., 1989: 93, 97, 99, 103, 105, 109.

'many households have no food stocks left and are forced to "tighten their belts". This classic picture' is based on the assumption that rural households will depend on their own food production as long as possible and will not start to buy food before their own stocks are depleted. It neglects the importance of cash income in preventing seasonal food shortages. So, one would hypothesise that seasonal fluctuations in food supply (hence: energy intake) will be less in areas with a higher degree of food self-sufficiency (like Kitsoeni and Kibandaongo in Table 1.2). However, it seems plausible to expect the intake from *home-produced* energy in these areas to show greater fluctuations than in the areas where home production (food self-sufficiency) is relatively small, as is the case in the other four areas. In these areas, food has to be bought almost throughout the year.

Regarding the health situation, there is some relationship between the alternation of the seasons on the one hand and the occurrence of certain diseases on the other.[11] Malaria is the most widespread disease in Coast Province and it is probable that it occurs somewhat more during the wet season than during the dry season. It is often stated that such symptoms as vomiting and diarrhoea are especially bound to the beginning of the wet season, partly because people are beginning to drink (dirty) surface water instead of the relatively clean water from taps or wells further away.

1.3. Coping mechanisms

People adjust to seasonal stress in many ways, showing diverse adaptations in the agronomic, nutritional, economic, demographic and social spheres. When such coping is present, the climatic seasonality of their living environment will only have a reduced effect on the nutritional variables of interest.

The following provides an overview of the main coping mechanisms[12] found in the study areas. For analytical reasons, it is important to distinguish between preventive and curative coping (cf. Figure 1.1). In the first case, we are dealing with more or less structural mechanisms, in the second case with famine-related responses. However, the

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[11] See, for instance, Bradley, 1981; Chambers et al., 1979; Rowland et al., 1981; White, 1986.

[12] The concept of 'household strategy' is often used and different authors give it different meanings. Moreover, the discussion is the more confusing as many related concepts have come into fashion: livelihood strategies, survival strategies, sustenance strategies, self-rescue strategies, etc. For a discussion of the various concepts and an attempt to place all the different terminologies in a typology, see Dietz, Druyven & Foeken, 1992. In the present study, the term 'mechanism' is preferred, denoting a structural element in society that either prevents or solves (diminishes) seasonal stress. The actual preventive or curative activities of people can be labeled as 'coping behaviour' or simply as 'coping'.

latter are often extensions of the former and it is not always easy to draw a clear line between them.

Preventive coping mechanisms

Mechanisms to prevent seasonal stress are mainly found in the agronomic and income-earning spheres. It is, in fact, the household's resource base - land, farming potential, income from off-farm employment - that determines the degree to which the household is able to avoid the adverse effects of climatic seasonality (i.e., food shortages). The following summary of preventive coping found in the study areas is therefore based on the main agricultural and income characteristics as discussed in Part 3 of the seasonality reports.

Cultivation practices can be said to be 'traditional'. Farming is very labour-intensive, capital inputs are negligible. Planting is done in an irregular manner and plant densities are low. When rain fails at the appropriate time, re-planting may be practiced, but the risk of such climatic vagaries cannot be avoided. The cultivation of different crops on the same plot and inter-planting of maize with pulses and/or cassava are common practices.

As regards the choice of crops, food crops dominate; especially maize, which is cultivated by three-quarters of the households. Bananas are grown by 54% and pulses by 37% of the households. Drought-resistant cereals like sorghum and millet are hardly grown; only five out of the fifty households in the driest research area (Bamba) cultivate millet. Cassava is a well-known crop in times of cereal shortages, as it can remain in the ground for a relatively long period. It is not only a 'famine crop', however. In Bongwe, for instance, it is known to be a fairly common staple food crop, beside maize.

Drought-resistant cash crops - i.e. tree crops - may be of some value during times of food shortages. In the past, the coconut palm has been a well-known cash crop used for bridging hunger periods.[13] The nuts can be harvested the whole year through, although the tapping and selling of palm wine, presently no longer permitted, was reported to be the major strategy to solve seasonal stress. Sixty per cent of the households own an average of 55 palms. These ways of coping, however, are very much bound to suitable areas, i.e. in areas with sufficient average rainfall. For instance, the large majority of the households in Bongwe and Chilulu (CL3) own coconut palms, against only 12% in Bamba (CL5) (Table 1.2). Nor do other tree crops thrive in the latter area.

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[13] See Herlehy, 1983. Coconut palms can 'survive' a dry year without a loss of productivity.

Mixed farming - i.e., the combination of crop cultivation and livestock keeping - is also viewed as a preventive mechanism in the agronomic sphere. During periods of food shortage livestock can be slaughtered for consumption or sold in order to buy food. First, goats or sheep will be sold. Not all households in the survey are able to do so, as six out of every ten households do not have these animals. If the situation grows worse, surplus cattle may be sold. However, for only 18% of the households this is a real option because the remaining 82% do not own any cattle. In general, livestock keeping is to a certain extent dependent on agro-ecological zone. Although in all research areas both cattle and goats/sheep can be found, substantial differences regarding the frequency and numbers exist between the areas in the different zones. For instance, in the two CL3 areas 8% of the households own cattle and 34% goats/sheep. The corresponding figures for the two CL5 areas are 36% and 54%, respectively (Table 1.2). The same applies to the number of animals: 0.8 livestock equivalents per household in the CL3 areas and 11.4 livestock equivalents in the CL5 areas.[14] In conclusion, for the households in the CL3 zone, cash crop production is expected to be a main coping mechanism; for the households in the CL5 zone this rather applies to livestock rearing.

Outside agriculture it is predominantly off-farm employment[15] which offers the most secure way to prevent seasonal stress. Because agriculture is a rather risky business in areas where rainfall is very unpredictable, people will, wherever possible, try to seize off-farm opportunities in order to secure a more or less stable income. Over 40% of the adult men in the six research areas is engaged in off-farm employment. Half of them managed to find a regular job, the other half is self-employed or temporarily employed. In all, 60% of all the households has an income from off-farm employment, and Table 1.3 shows that, on average, 62% of the total household income is derived from this source.

The table shows two other things which are important for the present discussion: total household incomes differ and the composition of the household incomes differ. The general notion that household income level is perhaps the most relevant determinant of the degree in which seasonality is felt may be true, but the composition of the household income is also of importance: in view of the risks involved in

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[14] One livestock equivalent equals one head of cattle or 7 goats/sheep. The figures include the households without cattle or goats/sheep. It should be mentioned that cattle trade in Bamba was very much restricted during the whole survey, because of foot-and-mouth disease.

[15] Off-farm employment refers to income-generating activities other than agricultural activities on one's own farm and may be regular wage labour, temporary wage labour or self-employment. Only casual labour on a daily basis on neighbouring farms is not included, because it can be regarded as curative coping, while total household income can be regarded as a preventive mechanism. See Foeken et al., 1989: 62, 145-146.

agriculture, a more than moderate income from off-farm employment is potentially a more secure preventive mechanism than an equal (potential) income from farm

Table 1.3
Household income, by research area
(shilling per consumer unit per year*)

	Total N=(297)	*Bongwe* L3 (50)	*Chilulu* L3 (50)	*Mwatate* L4 (48)	*Kitsoeni* L4 (50)	*Kib'o*** L5 (49)	*Bamba* L5 (50)
- farm income	730	643	561	569	983	1139	488
- wage income	1180	1911	791	1553	642	641	1544
Total household income	1910	2554	1352	2123	1626	1780	2032

* See note on consumer units with Appendix 1 ** Kibandaongo
Source: Foeken et al., 1989: 52

activities. Table 1.4 shows the relationship between income level and income composition.[16]

At an income level of KSh.2000/- per consumer unit and higher, wage income forms about 70% of the total household income. For these households, food production - which is the most unreliable household resource - is a relatively unimportant activity in monetary terms. The households with an income of less than KSh.1000/- per consumer unit, however, rely heavily on their own food production; the income from wage labour comprises only one-fifth of the total household income. Finally, the households with an income between KSh.1000/- and KSh.2000/- per consumer unit rely more or less equally on farming and on off-farm employment to make a living.

Table 1.4
Household income composition, by income class

income class (KSh/cu)	*-999*		*1000-1999*		*2000-2999*		*3000-3999*		*4000+*	
(N)	(123)		(63)		(48)		(30)		(33)	
	abs	%	abs	%	abs	%	abs	%	abs	%
income composition										
- food production	320	66	582	41	409	16	679	20	853	14
- cash crops + livestock	62	13	204	14	336	13	256	7	859	15
- farm income (subtotal)	382	78	786	56	746	30	935	27	1712	29
- wage income	106	22	625	44	1761	70	2523	73	4176	71
- household income (total)	488	100	1412	100	2507	100	3458	100	5888	100

Source: Foeken et al., 1989:127

[16] In *Seasonality in the Coastal Lowlands of Kenya, Part 3: Socio-economic profile*, an income classification consisting of nine categories was used (see Foeken et al., 1989: 55-57). For the present report, these are regrouped into five categories.

Table 1.5 presents the percentages of households in the five income classes, both for the total population and for the six research areas. Over 40% of the households had - at least in 1985 - an income of less than KSh.1000 per consumer unit. The latter income level was tentatively defined as the 'food poverty line', i.e. an income level below which households do not have sufficient income to assure the very minimal aggregate energy requirements of the household members.[17] This group of households depend for their income mainly on their own food production. Another 20% of the households has an income between KSh.1000 and KSh.2000 per consumer unit. On average, these households depend almost equally on farming and on wage labour for their income (Table 1.4). The remaining 37% of the households had an income of KSh.2000/cu or more. These households resemble each other in the sense that, on average, the household income is for about 70% derived from wage income.

Table 1.5
Household income distribution, by research area (%)

	Total N=(297)	*Bongwe* L3 (50)	*Chilulu* L3 (50)	*Mwatate* L4 (48)	*Kitsoeni* L4 (50)	*Kib'o** L5 (49)	*Bamba* L5 (50)
income class (per c.u.)							
KSh.0-999	41	24	58	40	44	47	36
KSh.1000-1999	21	16	22	17	34	22	16
KSh.2000-2999	16	28	8	19	8	10	24
KSh.3000-3999	10	20	6	6	8	10	10
KSh.4000+	11	12	6	19	6	10	14
	100	100	100	100	100	100	100

Source: Appendix 1 * Kibandaongo

Table 1.5 also shows that the six research areas differ substantially regarding the distribution of the households over the income classes. In Chilulu, almost 60% of the households fall within the lowest income category. Also in Kitsoeni and Kibandaongo, the percentages of households with an income of less than KSh.1000 per consumer unit is relatively high. If KSh.2000/cu is taken as a division line, it appears that in both Chilulu and Kitsoeni, about 80% of the households have an income below that level. Bongwe is the most prosperous area, followed by Mwatate and Bamba. From these findings one can also conclude that average household income is not consistently related with agro-ecological zone.

[17] See Foeken et al., 1989: 146.

Curative coping mechanisms

Despite all the measures taken in the preventive sphere, seasonal stress may be felt, i.e. a food shortage may occur. Many ways are open to the household to cope with such a situation. There is some consensus in the literature about the existence of a hierarchy of curative coping mechanisms, in the sense that as the stress becomes worse, more far-reaching measures will be necessary (Hartog & Brouwer, 1990: 82). The simplest way to cope with food shortages is thought to be by adjusting food habits: consume 'reserve crops' (like cassava), consume 'wild foods', reduce the number of meals per day, reduce portions, add extra water, etc. At the same time, money can be obtained in order to buy food by selling cash crops (like coconuts or palm wine) or surplus livestock. Casual labour on a nearby farm is another way of earning a cash income. For instance, Duruma farmers living in the livestock-millet zone (CL5) are known to go looking for work in Digo households in the coconut-cassava zone (CL3) in periods of food shortage (Oosten, 1989). Conceivably, the number of mouths to be fed can also be reduced, for instance by sending one or more children to stay with relatives elsewhere.

If the situation grows worse, a household may be forced to sell properties like jewelry, the cattle herd or even land. People may be compelled to borrow food or wander around in search for food in other areas or temporarily settle down elsewhere. These are types of coping, however, which go beyond the 'normal' seasonal stress circumstances and did not occur at any appreciable scale during the survey period. In this study, adjustment of food habits, as outlined above, and casual labour on neigbouring farms are regarded as the strategies used by households in situations of normal seasonality.

In Seasonality Report 3, casual labour on nearby farms was mentioned as being an important addition to the income of poorer households. Table 1.6 shows the average income from rural casual labour for the five income classes as recorded during the first survey round.

Table 1.6
Income from casual labour, by income class

income class (KSh/cu) (N)	*0-999* (123)	*1000-1999* (63)	*2000-2999* (48)	*3000-3999* (30)	*4000+* (33)
- income from rural casual labour (KSh/cu)	111	99	37	16	61
- as percentage of total household income*	23	7	1	1	1

* Excluding income from rural casual labour

Again, a dividing line can be drawn at an income level of KSh.2000 per consumer unit. Below that level, the average income from local casual labour is about 2.5 times higher than above that level. Moreover, for the poorest group of households, this seasonal income source increases the annual income by almost one-quarter. This indicates that for this group of households, casual labour on neighbouring farms forms an indispensable way to obtain money in order to maintain a minimally desired level of living.

Types of coping addressed by the present study

This study does not address the curative coping that goes beyond the 'normal' seasonal stress situations (see above). However, the study is designed in such a way as to address the main types of preventive and curative coping that one can expect in Coast Province under the conditions prevailing during the time of the survey.

The six study areas represent six agro-economic 'conditions', being from three different agro-ecological zones and with different access to employment opportunities. This provides different 'mixes' of preventive and curative coping (Chapter 6). A breakdown of the households by type of resource base provides another important contrast for comparison (Chapter 5). Using both comparative perspectives, an analysis is made of the effects of climatic seasonality on food and nutrition outcomes.

At household level, the independent variables of household income, household food supply and age/gender have been measured quantitatively, as well as the dependent variables of household food intake (Chapter 3) and the nutritional status of children and women (Chapter 4). The intermediate variables of household labour requirements and prevailing health conditions, and the dependent variable of energy expenditure (Figure 1.1) have not been measured directly, but have been inferred from the interplay of the other variables in the analysis.

1.4. Outline of the report

The outline of the present report is as follows. After a brief discussion of some methodological issues (Chapter 2), first the main findings are presented for the total study population, i.e. the populations of the six research areas grouped together. This general analysis is sub-divided into two main parts: food consumption (Chapter 3) and anthropometry (Chapter 4). The following two chapters contain an analysis on lower levels of aggregation. In Chapter 5, food consumption and anthropometrical data are presented for categories of households, grouped according to income levels. Chapter 6 contains an analysis based on the six research areas. At the end of each chapter, the main conclusions are summarized.

The last chapter of the report (Chapter 7) contains general conclusions about the effects of climatic seasonality on food supply and nutrition among the rural populations in the coastal lowlands and about the coping strategies used in order to deal with these seasonal fluctuations. Policy recommendations are not included in the report, but can be found in a separate report with the proceedings of a dissemination seminar, based on all the studies that were carried out in Kwale and Kilifi Districts in 1985-1987.[18]

As regards the presentation of the data, all basic figures are included in a series of appendices at the end of the report. These appendices are included to allow for comparison with data from the companion studies, and to enable the readers of this report to analyze the data along different lines than have been presented in this report.[19] In the text, only the main results and findings will be discussed. The study population of the present report consists of households and individuals. Data on food consumption are presented as household findings (even though they are mainly expressed per consumer unit), while the anthropometric figures refer to individuals. More details concerning methodology and the study populations are presented in the next chapter.

[18] See Foeken & Hoorweg, 1992

[19] It should however be pointed out, that the detail with which the data are presented in the appendices also has its drawbacks. Some of the sub-groups have only very small numbers due to the sample size employed in the study. It is upon the user of the data to ensure that alternative interpretations of the data are based on sufficiently large numbers.

2. Methodology[20]

For the present survey, five survey rounds were conducted in the period between June 1985 and October 1986 (see Table 2.1).[21] Thus, in each of the six research areas, the 50 selected households were visited five times, at intervals of about three to four months. Two agricultural years were covered in the questionnaires, i.e. the harvests of the short rains of 1984, the long and the short rains of 1985, and the long rains of 1986.

Basically, the sample was longitudinal, as the *same* households were visited each time. Nevertheless, the several study populations (households, women, children) were not exactly the same during each survey round. Sometimes one or two households appeared to have left or the composition of the household was different from that during a previous round. Moreover, children grew older during the survey, so some of

Table 2.1
Survey rounds

survey round	*period of data collection*	*agricultural season covered (retrospectively)*	*season during survey round*
1	1985, July-August	short rains 1984	before long rains harvest
2	1985, November-December	long rains 1985	short rains land preparation
3	1986, February-March	short rains 1985	end of dry season
4	1986, May-June	long rains 1986*	long rains labour peak
5	1986, September-October	long rains 1986	long rains harvest completed

* Pre-harvest

20 More detailed information on research objectives, sampling procedures, data schedules and survey procedures can be found in Hoorweg, Kliest & Niemeijer, 1988.
21 A sixth round was carried out in June/July 1987, but only in the three Kilifi areas. These data were collected for the survey on Nutrition and Dairy Development in Kilifi District (see Leegwater, Ngolo & Hoorweg, 1991) and are not used in the present report.

them shifted to a higher age category while the survey was going on. Children were enrolled as soon as they were at least six months old and children were no longer followed up beyond their tenth birthday. Strictly speaking, the anthropometrical component of the study followed a "mixed longitudinal design".

The food consumption data were obtained by a 24 hours recall method, i.e. a recall was made of all food prepared in the compound during the day prior to the interview. In households with more than one kitchen, food preparation data were collected for each kitchen. The women concerned[22] were questioned about all the foods and drinks they had prepared or served in the course of the previous day. Starting with the first dish of the day, all subsequent dishes (including drinks and snacks) were covered. The women were further asked to demonstrate the cooking procedures and to indicate the quantities of the different ingredients used. In case of leftovers from meals, the proportion of the food that had not been eaten was estimated and subtracted. For each ingredient it was further noted whether it was home-produced or from an other source.[23]

At the start of the survey, that is during the first survey round, the 300 households had 2650 members, of which 2314 were full-time residents. Anthropometric observations were obtained for all full-time resident children between 6 months and 10 years of age. During each round the inventory of all children resident in the household was remade and measures were taken of all eligible children. Table 2.2 presents the children participating in the survey during the five rounds, classified according to three age

Table 2.2
Study population: children and mothers (N)

	Jul/Aug '85	*Nov/Dec '85*	*Feb/Mar '86*	*May/Jun '86*	*Sep/Oct '86*
children					
6-23 months	140	139	141	154	122
24-59 months	271	310	322	313	273
60-119 months	437	431	437	444	445
total	848	880	900	911	886
mothers	346	349	325	324	315

Source: Appendix 2

[22] In very few households men prepared the food.

[23] It was recorded that in some households visitors consumed part of the food prepared, and in other households some members had a meal elsewhere, while visiting a friend or relative. A check revealed no systematic bias from this source: both visitors and outside meals cancel each other out statistically.

groups.[24] The age distribution in the first survey round shows an apparent over-representation of children of 2 and 5-6 years old and an under-representation of children of 4 and 9 years of age (see Appendix 2). This suggests a tendency to estimate age in certain comfortably rounded numbers (2, 5-6, and 10 years - children of the latter age were excluded from the study). In later rounds the effects of this tendency of course shift slowly to older age groups.

Anthropometric measures included in the study were height, weight, mid-upper arm circumference and age. Height was taken in supine position for children up to 24 months. Older children were measured standing against a portable measuring pole specially developed for the survey. Weights were obtained with electronic weighing equipment with a precision of 0.1 kg. Reinforced household measuring tapes were used to measure mid-upper arm circumference. The anthropometric data were checked by members of the research team during frequent field visits on a more or less random basis. When data collected in the field were inconsistent (after comparison of weight, height, mid-upper arm circumference and age) or when data collected in consecutive rounds were suspect, further field checks were made. Because a low incidence of birth registration was observed, most age estimates were checked by members of the research team during the second round.

If the mother of children included in the survey also was a full-time resident, anthropometry was collected for her as well. The number of women for whom observations are available is also shown in Table 2.2. Although this selection procedure allows correlation of the findings for the children with the condition of their mothers, it should be noted that the data on adult women exclude women without children, or whose children are outside the age group of 6 months to 10 years of age. As a result, the mothers' population consists mainly of women between 20 and 40 years old. The same equipment that was used for the anthropometry of the children was used for the adult women.

To standardize the anthropometric data obtained for the children, the usual indicators such as weight-for-age, height-for-age, and weight-for-height were calculated using the NCHS tables (WHO, 1983). No standardization was attempted for mid-upper arm circumference. Growth figures were obtained by taking the difference of observed values at consecutive visits to the household and dividing the result by the number of months of the interval. Sometimes a child was absent during a particular round. In such cases it was not judged necessary to remove the data of such children completely from the growth analysis: children are included for each pair of consecutive cycles for which

[24] The distribution of the children according to one-year age groups is included in Appendix 2.

data are available; the age reported is the age at the beginning of the interval. Nevertheless, an effort has been made to keep the number of missing data as small as possible. As long as a child remained resident in the household and was not absent for several weeks, return visits were made to obtain the lacking data.

The anthropometric data for the adult women were standardized using a table for weight-for-height published by Jelliffe (1966). It is not usual to standardize height measures in the case of adult women. Pregnancy, although recorded during the survey, was not taken into account in the calculations. This means that the estimated weight-for-height is slightly biased and represents an over-estimate. This over-estimation concerns each survey round, however, so it is likely that the bias does not influence the differences between the rounds. Because residence is far less stable for the adult women than for the children, it was decided to estimate changes in weight-for-height by cross-sectional comparisons only; otherwise the number of observations, already small for seasonal comparisons, would have been reduced further.

The health situation of both mothers and children was assessed by the average number of days the respondent(s) had been ill during the two weeks prior to the interview. There is a tendency among the respondents (the mothers) to answer in whole weeks, so that the frequencies of 0, 7 and 14 days are over-represented. This tendency hardly influences the reported averages, however. Data obtained by this type of method cannot be treated as objective estimates of the health situation: they indicate levels of perceived health, only. In fact, mothers from richer socio-economic groups tend to report a higher prevalence of illness, and it was found that reported illness also became lower while the survey progressed. Although the data collected are reported fully in the appendices of this report, it should be pointed out that comparison of illness rates between children of different backgrounds or between different seasons cannot be based on the present data, without proper correction for these two factors.

In the presentation of the data, the children are divided into three age categories, i.e. 6-23, 24-59 and 60-119 months. The separate treatment of the 6-23 months age category is based on two considerations. First, these children are still being breastfed, so it is expected that there is a direct negative link between labour duties and/or poor nutritional condition of the mothers on the one hand and the growth performance of these children on the other. And second, it is known that children in an early stage of life are more prone to diseases than older children.[25]

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[25] See e.g. Niemeijer et al., 1985: 105.

3. Food consumption

3.1. Food habits

In most households, three meals are prepared daily. The first meal, breakfast, is prepared early in the morning, before the children leave for school. The second meal, lunch, is prepared between twelve and two o'clock, while the third meal, dinner, is taken in the evening, usually at about seven o'clock. While some households may skip either lunch or breakfast - or sometimes even both when no food is available - dinner is taken almost always and constitutes the most important meal of the day. It is also the meal in which all resident household members partake. Some members may leave early in the morning for work, before breakfast, often skipping lunch as well. Others may only skip lunch. Most of those who, for various reasons, were absent during the day usually returned before dinner.

Breakfast in many households consists of some leftovers from the previous evening. These leftovers, heated up or consumed cold, are usually accompanied by some tea with sugar (and/or milk). Other households may prepare special foods for breakfast, such as *chapatis* (unleavened bread), a loaf of bread or *uji* (thin maize porridge). Lunch and dinner generally consist either of *ugali* (stiff maize porridge) taken with a relish, or of a dish prepared with boiled roots, mostly cassava. This latter type of dish is more commonly taken at lunch time when the cassava is carried home from the field for that purpose. Side dishes are mainly different types of cooked green vegetables, but other kinds are prepared from legumes, unripe mangoes, fish, meat, or chicken, or simply consist of sour milk. If nothing else is available, some households may take *ugali* with just a little salted water. The *ugali* is eaten from a big plate or bowl, shared by a number of people who break off lumps of porridge and dip them in the relish to increase its palatability.

This general pattern, which nowadays is common in many parts of Kenya, does not do justice to the great variety in the coastal food culture. In the narrow coastal strip, dishes generally contain more ingredients - like fish (fresh, dried, or fried) and coconut - than in the hinterland, which is due to the influence of the Swahili tradition on the local kitchen. This is particularly true for the Digo of Kwale District. Compared with the other coastal communities, the former use more spices, and consume, beside the basic dishes mentioned above, a larger variety of snacks, such as *chapatis* and various types of fritters, and special dishes, such as *pilau* (spiced rice) and sweetened vermicelli. Furthermore in Bongwe, the only Digo research area, a lot of food-peddling takes place, which is rather uncommon in the other five research areas. Especially during the month of Ramadan[26], when people fast during day-time hours and eat during the evening and night, food is often bought from peddlers and stalls, to be carried home for consumption as the first meal of the day. Food-peddling is, however, present throughout the year and contributes to the variety of the kitchen along the Coast, in particular in Kwale District.

Food preparation is a duty shared among the married women of the household. These in turn may leave the actual task of preparation to some of the younger unmarried women, who carry out their duty under their mothers' supervision. If no women are present, cooking will be done by one of the boys. All married women take part (in person or as supervisor) in food preparation, but often do so in turns, enabling them a greater freedom of movement on days that the other women are preparing the meals.

When the food is prepared it is shared out between the household members. The men usually eat together, the women may take their meal together in some households, but they often eat on their own with their children. This latter case then implies that the women prepare their food separately, i.e. each woman cooks daily without an arrangement of cooking in turn, and each woman will send some of her food to the men, who will thus sample from all food prepared in the household.

In households with young children, some special weaning foods may be prepared in addition to the main household dishes. Sometimes this is just a portion of *ugali* which is diluted with a little milk or reconstituted milk powder. *Uji*, however, is the most important weaning food. The mother usually hand-feeds the very small child, at a later age the child will drink from a cup. If *uji* is prepared in the household, also the older children and adults present may receive a share. There is no clear distinction

[26] In 1986, Ramadan was from May 10 until June 9, i.e. during the fourth survey round. Conceivably, this could have affected the results for Bongwe, as there are many muslims in that area. However, the energy intake from home-produced food (in particular cassava) was rather high during that round, which suggests that the Ramadan tradition did not influence actual behaviour that much. There was no evidence of a higher consumption of food bought from peddlers.

between weaning food and adult food in this respect. At the end of the weaning period, that is from about two years onwards, the young child often eats with the father, who is served first from the prepared food. The father will feed the child small morsels of food while taking his own meal. When the father is not available, another adult or one of the older children may be given this responsibility. Afterwards, the child may still join the other children who are fed in a group, sharing a dish together. When the next child comes of age, however, the special position with the father has to be relinquished and the child is left to its own in procuring its share from the common dish in competition with the other children.

3.2. Energy and protein intake

Appendices 9-11 and Tables 3.1-3.8 offer information regarding the intake of energy and proteins: the average intake per consumer unit per day, the distribution of the households at different levels of intake, the composition of the intake according to food groups and macro-nutrients, the percentage of the intake of energy and proteins which is derived from home-produced food, and, finally, the percentages of the energy intake from the various food groups that are home-produced.

Intake levels and composition

The average energy intake - measured in kilocalories per consumer unit per day - is shown in Table 3.1. Departing from an energy requirement of 2960 kcal/day per consumer unit[27], the table shows that in each of the five survey rounds the energy intake was, on average, substantially (6-17%) below that reference value. During the five survey rounds, in only about one-third of the households the average one-day energy intake per consumer unit was equal to or above the reference value, while in no less than one-quarter of the households the average energy intake appeared to be less than 60% of the requirements, i.e. less than 1776 kcal.[28]

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[27] See WHO/FAO/UNU, 1985: 133; also Foeken et al., 1989: 144. For lack of quantitative data on physical activity patterns, the same average value is used throughout the year. A requirement of 2960 kcal per consumer unit corresponds with less than 2000 kcal per capita.

[28] The figures in Tables 3.1 and 3.4 do not reflect the percentage of households with a *continuously* low energy respectively protein intake, as the data are based on a one-day 'snapshot' per household in each season. The prevalence of households with a more or less continuously low energy intake is bound to be somewhat less, depending on the extent of day-to-day variation in intake (which has not been measured in this study, as it would have required a different study design).
In *Seasonality in the Coastal Lowlands, Part 3: Socio-economic profile*, an energy intake of 2115 kcal was considered the minimum nutritional needs. Based on this intake, the so-called food poverty line, i.e. the annual household income needed to obtain the amount of calories to meet this minimum level, was

Table 3.1
Energy intake, by survey round

(N=)	*Jul/Aug'85* (283)	*Nov/Dec'85* (278)	*Feb/Mar'86* (272)	*May/Jun'86* (269)	*Sep/Oct'86* (266)
- average (kcal/day/cons.unit)	2511	2632	2507	2780	2458
- % households with energy intake					
- 100+% of requirements*	29	32	29	37	28
- <60% of requirements*	25	27	29	23	28

* Energy requirements are put at 2960 kcal/day per consumer unit (see Foeken et al., 1989: 144)
Source: Appendix 9

The highest level of energy intake was found in May-June. Because the energy intake from cereals is fairly constant in the five survey rounds, this peak can to a large extent be explained by an increased intake of roots, tubers and starchy staples (Table 3.2), i.e. of cassava, as we have seen before. Fruits (especially mangoes), legumes, and oil seeds and nuts (coconuts) also contribute to the higher intake. The lowest level of energy intake was reached a few months after this peak, namely in September-October. Again,

Table 3.2
Energy intake, by food group and survey round
(kcal/day/consumer unit)

(N=)	*Jul/Aug'85* (283)	*Nov/Dec'85* (278)	*Feb/Mar'86* (272)	*May/Jun'86* (269)	*Sep/Oct'86* (266)
- cereals	1948	1940	1956	1872	1836
- legumes	52	97	74	180	155
- roots, tubers & starchy staples	113	125	138	257	89
- vegetables	52	41	13	43	22
- fruits	2	22	10	34	13
- animal products	111	159	154	132	132
- fats	49	68	17	40	21
- oil seeds & nuts	75	67	65	112	86
- miscellaneous	108	113	81	110	103
Total	2511	2632	2507	2780	2458

Source: Appendix 10

calculated at Sh.1000/cu. It appeared that 41% of the households in survey round 1 had an income below the food poverty line. Now, we are able to calculate the percentage of households with an average energy intake below 2115 kcal per consumer unit. For the first survey round, this appears to be 39%. See Foeken et al., 1989: 54, 146.

the lower consumption of cassava plays a central role.

On a yearly basis, the following fluctuations regarding energy intake are visible:

- a low intake in February-March; a period during which vegetables and legumes are relatively scarce;
- a high intake in May-June; mainly due to a high consumption of cassava, cowpeas, coconuts and mangoes;
- a low intake from July to October; although the harvest takes place in this period and stocks are plentiful, there is no increase in energy intake; and
- an intermediate intake in November-December; the small increase of energy intake from the foregoing period does not reflect an increased intake of cereals, but a higher consumption of most other foods.

In the general literature on seasonality, a close correlation is mentioned between rainfall, food consumption and labour, implying that the fluctuations of food consumption and labour reinforce each other: during the rainy season, food consumption is relatively low (because stored food from last year's harvest is finished), but at the same time there is a labour peak (land preparation, sowing, planting, and weeding; harvesting usually takes place at the onset of the subsequent dry season)[29].

In the coastal areas of Kenya, this relationship appears to be much more complex. The long rainy season roughly starts in March and ends in June, but April and May are the months with the real rainfall peak. Food intake is indeed relatively low at the beginning of the long rains (March), when land preparation and seeding of maize are being done (see Figure 1.2, p. 9). The peak of the rainy season (April-May) coincides with the peak in labour requirements, as weeding is the most intensive (both in hours and in effort) type of labour to be fulfilled. It appears, however, that energy intake is highest during this period. In the following two months energy intake is relatively low again. This is the period when maize and beans are harvested. Finally, the period from September to January is, in terms of agricultural labour, a relatively lean period, except for those farmers who try to realize a second harvest. This latter group experiences a second peak of agricultural labour during the short rains (November-December), which is reflected in a concurrent minor peak of energy intake.

There may be a good reason for this 'deviating' pattern. The 'classical pattern' of seasonal fluctuations as described in many studies often concerns only farmers at subsistence level, i.e. farmers who do not have enough money to buy the food that is needed when own stocks are depleted. Under such circumstances it is rational for farmers to increase food consumption in the immediate post-harvest period so as to

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29 See Ferro-Luzzi, Pastore & Sette, 1987.

quickly fill their body's energy reserves that were depleted by the combination of low food intake and high physical activity in the previous growing season. The food thus consumed is then safe from food storage losses as occur in the granary. In so doing they also make sure that their body weight is maximal at the start of the next growing season (Payne, 1989). Incidentally, this strategy involves a strong seasonal fluctuation of body weight.

Recent evidence has shown that this 'classical pattern' is not universal in rural areas of developing countries. In some areas, physical activity may be rather evenly spread throughout the year, thus attenuating the effects of a seasonally low food availability (Ferro-Luzzi, 1990). There are also situations where food intake does not follow the seasonal fluctuation of food availability, but rather goes hand in hand with variations in energy expenditure (Payne, 1989). The latter case is thought to occur in a situation where there exist increased opportunities for filling the gaps of the household farm production calendar, either with extended varieties of food or cash crops or with off-farm employment.[30] So it is to be expected that this effect is even stronger when a large proportion of the food is actually bought. Regarding the present study, this would certainly explain that in May-June, when stocks are low and labour needs are high, energy intakes are high as well, while in July-October, when stocks are high, energy intakes are low. It would also fit with the small increase in consumption during the short rains in November, when energy requirements again rise for some farmers.

The contribution of carbohydrates, fats and proteins to the total energy intake is presented in Table 3.3. It is clear that, although the absolute levels per macro-nutrient show some fluctuations, the contributions in terms of percentages are very constant throughout the year, especially for protein and carbohydrates. Fats contribute about 12%, which, although within the 5-35% range that is considered to be not incompatible with health, is a fairly low percentage[31], resulting in a low energy density of the food.

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30 Payne (1989) presents evidence to this effect from case material concerning farmers in Myanmar (Birma), demonstrating that they tend to follow a 'strategy' of trying to maintain approximate energy balance throughout the year and of not losing body weight below a supposedly critical lower limit. There is no evidence of 'post-harvest feasting', such as in the classical study of farmers in The Gambia and on which much of the prevailing seasonality 'scenario' is based.

31 The contribution of macro-nutrients to total energy intake will not be presented in the sections regarding areas and regarding household income level. Five of the six areas fit very well in the general pattern as shown in Table 3.3. Only Bamba has a deviating pattern, in the sense that the contribution of fats is even lower there: 7 to 8 per cent. This means that for growing children, the diet in Bamba is worse than in the other five areas (see Appendices 19-24), as young children will find it hard to obtain a sufficiently high energy intake with this low-fat diet. In richer households, the energy from fats is higher than in poorer households. For instance, the average energy intake from fats in the highest income class is about 125 kcal/cu higher than in the lowest income class (see Appendices 13-17).

Table 3.3
Contribution of macro-nutrients to energy intake, by survey round
(kcal/day/consumer unit)

	Jul/Aug'85		*Nov/Dec'85*		*Feb/Mar'86*		*May/Jun'86*		*Sep/Oct'86*	
(N=)	(283)		(278)		(272)		(269)		(266)	
	mean	%	mean	%	mean	%	mean	%	mean	%
Carbohydrates	1918	77	1983	76	1948	78	2163	78	1859	76
Fats	318	12	357	13	274	11	318	11	312	13
Proteins	275	11	292	11	285	11	299	11	287	12
Total	2511	100	2632	100	2507	100	2780	100	2458	100

The average intake of proteins is presented in Table 3.4. It ranges from a minimum level of 69 grams/day per consumer unit in July-August to 75 grams/day in May-June. Thus, protein intake shows no substantial fluctuations, which is to a large extent due to the fact that the intake of the main sources of proteins - cereals and animal products - is quite stable throughout the year (Appendix 11).

The 'peak' during May-June coincides with the highest energy intake. In fact, when one expresses the energy derived from protein as a percentage of total energy, it varies only minimally (10.8-11.7%; see Table 3.4). Following the methodology of WHO/FAO/UNU (1985), a "safe level of protein intake" was estimated to be 50 grams/day per consumer unit.[32] Table 3.4 shows that in each survey round about one-

Table 3.4
Protein intake, by survey round

	Jul/Aug'85	*Nov/Dec'85*	*Feb/Mar'86*	*May/Jun'86*	*Sep/Oct'86*
(N=)	(283)	(278)	(272)	(269)	(266)
- average (grams/day/cons.unit)	69	73	71	75	72
- % households with protein intake					
- 100+% of recommendations*	69	67	68	70	65
- <60% of recommendations*	10	12	11	12	9
- protein intake as percentage of energy intake**	11.0	11.1	11.3	10.8	11.7

* A safe level of protein intake was estimated at 50 grams/day per consumer unit (see Appendix 9).
** Protein intake multiplied by four kcal/g and divided by total energy intake, times 100%.
Source: Appendix 9

32 See Appendix 9 for the calculation of this level of protein intake.

third of the households have an average protein intake below the recommended level, while in one-tenth of the households average protein intake is even less than 60% of that level.[33] Although the results for protein intake are much more favourable than the results for energy intake, it has to be realized that if energy is lacking in the diet, proteins will be more readily used for energy purposes than for the body building purposes to which the requirements refer.

Origin of energy and protein intake

Table 3.5 shows which part of the energy and protein intake is derived from home-produced food.[34] A clear seasonal pattern is visible. It is highest (almost 45%) in September-October, a period shortly after the harvest of the long rains, so cereals and many vegetables, legumes and fruits are available. After that, the contribution of home-produced food falls steadily to a minimum of 20-25% in May-June. This is also the period with the highest energy and protein intakes, however, which means that most food is bought then.

The importance of home production for the consumption of food differs according to the various food groups. In Figure 3.1, for each food group the overall average energy intake is compared with the overall average home-produced energy. As regards cereals, the figure makes not only very clear that this food group is by far the

Table 3.5
Origin of energy and proteins, by survey round

(N=)	*Jul/Aug'85* (283)	*Nov/Dec'85* (278)	*Feb/Mar'86* (272)	*May/Jun'86* (269)	*Sep/Oct'86* (266)
% home-produced:					
- energy	41	36	28	22	44
- proteins	43	38	28	25	43

Source: Appendix 10, 11.

[33] As before, it should be noted that this table does not reflect the percentage households with a *continuously* low protein intake (see Note 28).
[34] In Seasonality-Report Part 3, the degree of food self-sufficiency was estimated to be 45%. The figures in Table 3.5 show that this rather low figure appears to be even too high, as the average energy intake from home production is about 35% of the total energy intake. The difference is due to two factors. First, the figure in Part 3 was calculated from the total production of staple foods (cereals, cassava, beans and bananas) in 1985 and based on data collected in the second and third survey rounds (November-December 1985 and February-March 1986). Second, it was based on the assumption that 75% of the energy requirements were provided by the four staple foods (see Foeken et al., 1989: 34, 144). However, from the food consumption data it appears that this assumption was too low: 85% of the energy intake is provided by staple foods (see Table 3.2).

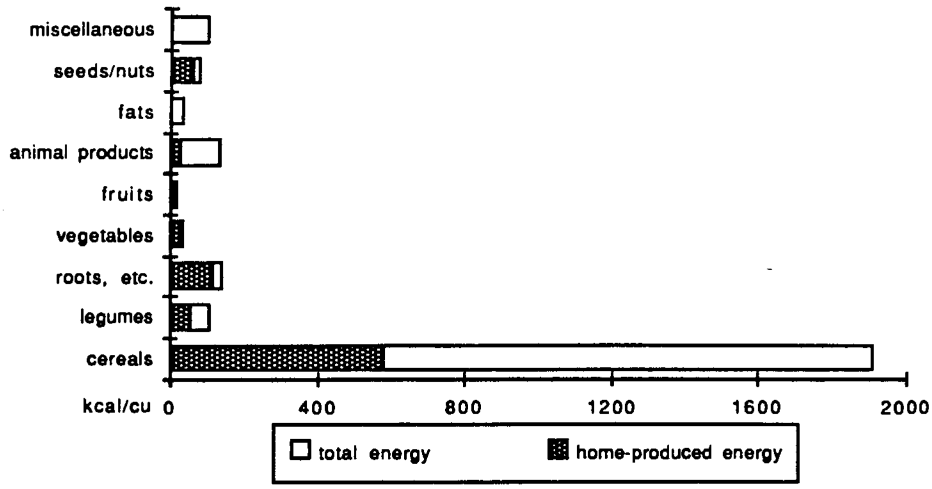

Figure 3.1
Energy intake, by food group
(Source: Appendix 10)

most important source of energy, but also that most of it (70%) is purchased, confirming that this is a food-deficit region. The intake from roots, tubers and starchy staples (mainly cassava), vegetables (mainly green leaves), fruits (mainly mangoes), and oil seeds and nuts (coconuts) is largely derived from home production. Legumes and animal products are to a large extent bought. Finally, fats and the various items under the category miscellaneous are almost exclusively purchased.

Table 3.6 (next page) shows the seasonal fluctuations of the four main sources of home-produced energy. Home-produced intake from cereals has a strong unimodal pattern of fluctuation: it is highest during and immediately after the long rains harvest (July-December: 650 - 800 kcal/cu) and lowest during the period preceding the harvest (May-June: about 160 kcal/cu). The second largest food group as a source of home-produced energy - roots, tubers and starchy fruits - has a uni-modal pattern as well. It shows a maximum during the long rains (May-June: 190 kcal/cu), the period in which most of last years' cassava is harvested and the new crop is planted. Legumes, third in importance, show a less clear pattern. Part of the legumes are harvested fresh during the long rains (May-June) and the short rains (November-December), but only the long rains of 1986 produced a sizeable harvest. Oil seeds and nuts provide a small but stable source of home-produced energy, with little seasonal fluctuation.

Table 3.6
Home-produced energy of selected food groups, by survey round
(kcal/day/consumer unit)

(N=)	*Jul/Aug'85* (283)	*Nov/Dec'85* (278)	*Feb/Mar'86* (272)	*May/Jun'86* (269)	*Sep/Oct'86* (266)
- all food groups	1030	953	710	616	1087
- cereals	811	659	469	162	790
- legumes	19	55	19	86	96
- roots, tubers & starchy staples	82	108	114	190	85
- oil seeds & nuts	49	51	51	71	72

Source: Appendix 10

The seasonal fluctuations regarding home-produced energy are graphically presented in Figure 3.2 (next page). Total home-produced energy (the black columns) shows considerable fluctuation. It follows a unimodal pattern, reflecting the situation for maize, the dominant cereal (the light-grey columns). If the people in the research areas were to subsist on home-produced maize only, they would experience a serious shortage at the height of the long rains when consumption from this source is about 640 kcal/cu lower than that of the post-harvest season. The cultivation of cassava, as the second major supplier of energy from home production, evidently plays a role as a preventive coping mechanism in those areas that allow its cultivation. The energy intake from home-produced roots, tubers, and starchy fruits (the dark-grey columns in Figure 3.2) increases when energy from home-produced cereals diminishes, although not enough to fill the gap. At its peak, this source of home-produced energy accounts for almost 200 kcal/cu. Figure 3.2 demonstrates how these two sources of energy have different, compensatory seasonal patterns. As a result, the unimodal seasonality of total home-produced energy is less pronounced than that of home-produced cereals alone. Comparing the situation in May-June with that of the post-harvest period, the difference lies in the region of 430 kcal/cu.

Food purchases are another mechanism reducing the effects of the unimodal cycle of cereal production. The white columns in Figure 3.2 represent the total energy intake, so the differences between the white columns and the black columns indicate the food purchases. As noted earlier in this section, total energy intake is at its maximum in May-June, i.e. during the long rains. During that period energy requirements are higher and consumption rises by about 300 kcal/cu. This would suggest that, as a coping mechanism, food purchases are responsible for an increase of energy intakes by

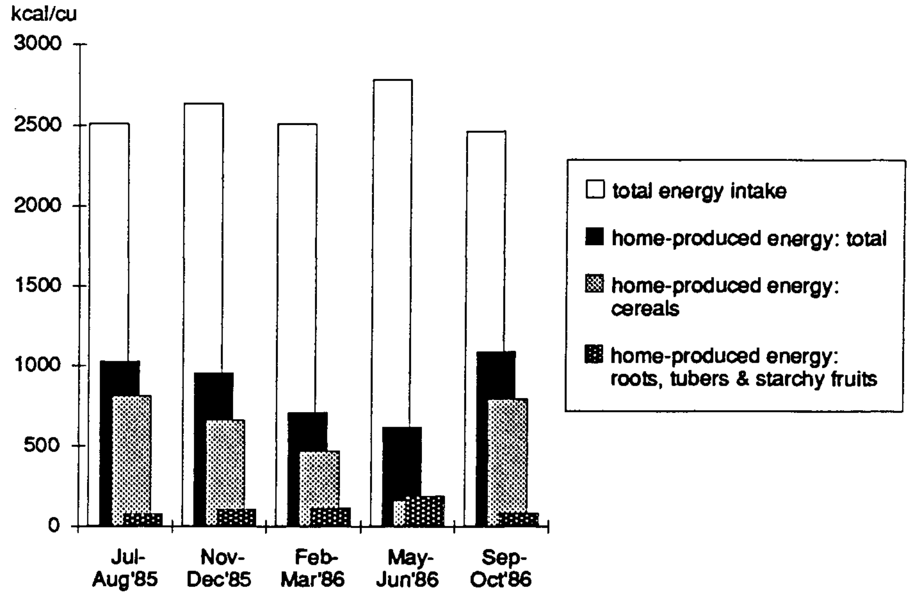

Figure 3.2
Energy intake and home-produced energy, by survey round
(Source: Appendix 10)

approximately 730 kcal/cu (the 430 kcal/cu gap left by home-produced energy plus the 300 kcal/cu increased intake during the peak season).

Agro-ecological zones and districts

Table 3.7 shows the average energy intake and its seasonal fluctuations for the three agro-ecological zones. The average intake does not show important differences. In all

Table 3.7
Energy intake, by agro-ecological zone and survey round
(kcal/day/consumer unit)

	average	*Jul/Aug'85*	*Nov/Dec'85*	*Feb/Mar'86*	*May/Jun'86*	*Sep/Oct'86*
- CL3*	2499	2455	2577	2408	2675	2378
- CL4*	2584	2489	2757	2386	2877	2413
- CL5*	2654	2587	2569	2745	2793	2595

* CL3=coconut-cassava zone, CL4=cashewnut-cassava zone, CL5=livestock-millet zone.

zones, energy intake is highest in May-June, but in the cashewnut-cassava zone (CL4) the peak is clearly higher than in the other two zones. Maize production in this zone is relatively important, so most likely the figure reflects high energy needs due to high labour requirements.

The differences in average energy intake per district (Table 3.8) are much more important than those regarding agro-ecological zones, the average energy intake in Kwale being about 250 kcal higher than in Kilifi. During the 'peak' in May-June, the difference even comes up to over 400 kcal per consumer unit. These differences can be related to an important finding, i.e. a negative relationship between household size on the one hand and energy intake per consumer unit on the other: in larger households the average food intake is lower than in smaller households (Figure 3.3). In the present survey, one consumer unit more means 73 kcal lower energy intake per consumer unit. In Kwale, the average household counts 4.6 consumer units (6.7 members), against

Table 3.8
Energy intake, by district and survey round
(kcal/day/consumer unit)

	average	*Jul/Aug'85*	*Nov/Dec'85*	*Feb/Mar'86*	*May/Jun'86*	*Sep/Oct'86*
- Kwale	2709	2542	2787	2530	3003	2688
- Kilifi	2454	2482	2481	2485	2570	2249

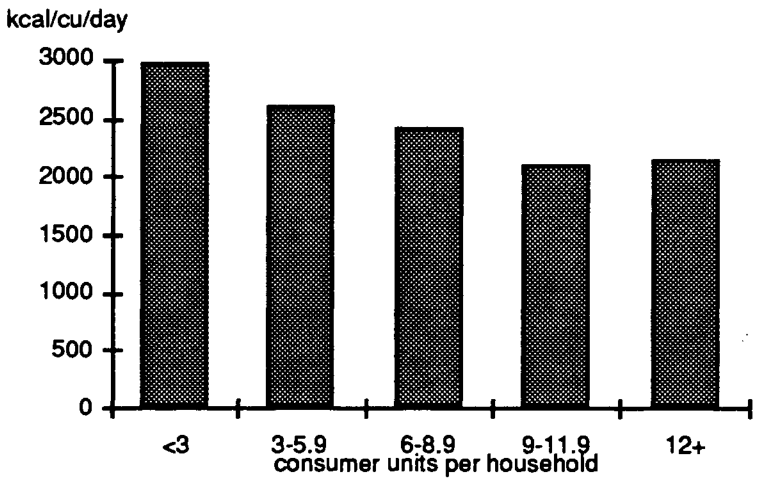

Figure 3.3
Average energy intake, by household size
(Source: Appendix 12)

7.0 consumer units (11.1 members) in Kilifi.[35] Thus, the difference in average energy intake between the two districts (250 kcal) can to a large extent be explained by the difference in average household size.

3.3. Conclusions

The diet of the Coastal population is rather one-sided. In general, the meals consist predominantly of cereals. As a result, 77% of the energy is derived from carbohydrates, only 12% from fats and 11% from proteins. This composition is very constant throughout the year. The average energy intake is considerably lower than the estimated requirements of 2960 kcal/cu. About one-quarter of the households had an average energy intake that is lower than 60% of the requirements. In general, the people in Kilifi have an energy intake that is considerably lower (250 kcal/cu) than the people in Kwale. This district difference can be explained by a difference in household size: the larger the household, the lower the average energy intake per consumer unit.[36]

The seasonal fluctuations regarding energy intake run parallel with the agricultural calendar. This is related to labour requirements and can best be seen in May-June: it is the period of the highest labour requirements in agriculture and also of the highest energy intake. The lower peak in November-December (mainly attributable to Kwale) is considered to be due to the fact that despite the unreliable character of the short rains, several households try a second crop. Thus, although rainfall - and as a result also the agricultural harvest - is unimodal (or at best weakly bimodal), energy intake has a bimodal character.

On average, only about one-third of the energy intake is covered by the households' own food production. In general, the energy derived from home production is lowest in the period that labour requirements in agriculture are highest: May-June. At the same time, this is the period of highest energy intake. In other words, people are able to buy food when they most need it. It is not sufficient, however. Even at this time, when the energy requirements rise above the average reference requirements of 2960 kcal per consumer unit due to the higher energy expenditure in agriculture, the average intake over the five rounds stays well below this figure.

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[35] See Foeken et al., 1989: 18.

[36] In section 5.1 the effects of income level are discussed. The effects appear to be of the same magnitude as the effects discussed here. Above an annual income level of KSh.2000/cu, the average energy intake is about 250-300 kcal/cu higher than in households below that level.

4. Anthropometry

This chapter presents the main anthropometrical findings regarding the total study population, i.e. the children between six months and ten years of age as well as their mothers. For the children, not only the basic anthropometrical measures (weight-for-height, height-for-age and weight-for-age) will be presented, but also the growth rates regarding weight and height. First, however, a few words will be devoted to the condition of the mothers. The basic data can be found in Appendices 26 (mothers) and 30-37 (children). The tables in the text contain the main results.

4.1. Adult women: the mothers

Table 4.1 presents some basic data regarding nutritional status and health for all mothers. It is clear that the nutritional situation of the adult women in the survey population is not good. Average weight-for-height ranged between 92% and 88% during the five survey rounds, while the percentage of women with a weight-for-height below 80% of the reference lies between 13% and 23%. The lowest average weight-for-

Table 4.1
Mothers: anthropometry, by survey round

	Jul/Aug'85	*Nov/Dec'85*	*Feb/Mar'86*	*May/Jun'86*	*Sep/Oct'86*
- average weight (in kg)	48.6	47.9	48.1	47.1	48.2
- average height (in cm)	153.2	153.3	153.7	153.8	154.2
- average weight-for-height	92.1	90.6	90.5	88.4	90.2
- % of women with wh<80%	13.1	17.0	15.1	23.2	15.6

Source: Appendix 26

height and the highest percentage women with a weight-for-height below 80% of the reference are found in May-June 1986. This is the period of planting and weeding during the long rainy season, i.e. the period of highest labour requirements.[37] However, also during the other periods of the year weight-for-height averages are rather low, which indicates the risk of a public health problem.

4.2. The children

Introduction

The nutritional condition of the children is primarily related to the quantity and quality of the food consumed and to the children's health situation. Indirectly, the condition of the mothers may also have effect on their nutritional status. One effect might be that the labour requirements of the agricultural cycle during peak periods compete with child care. This would affect the younger children more, as these require the attention of their mothers most. Another effect might result from the poor nutritional conditions of the mothers themselves, which is passed on to their children through low birth weights and/or a high number of prematures, or through inadequate breast-feeding and child care.

The survey did not include data on pregnancy outcome and lactation performance but data from other sources for Kwale and Kilifi Districts as a whole confirm small seasonal effects on child birth. Birth weights in May-July are reported to be slightly lower than those in the remainder of the year, while the number of births is particularly high in that same period. The number of stillbirths shows a much weaker seasonality (Boerma, 1989).

General nutritional condition

Table 4.2 presents a general overview of the nutritional condition of the survey population between six months and ten years old, compared with results from CBS-surveys which were held previously. The averages of all the usual anthropometric measures are shown as well as their critical values.

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[37] Weight losses may result from three different sources that may upset the energy balance: lower energy intake, higher energy expenditures, or poor health (which is to a large extent not a truly independent factor in as far as it may either be caused by under-nutrition or be a cause of lower food intake due to lack of appetite). From the previous section we know that energy intakes are higher in May-June 1986. This would also seem to indicate, that, although health conditions are often slightly worse during the rains, there is no evidence of a concurrent lack of appetite. The logical conclusion then is to look for changes in energy expenditure that may explain the weight loss.

Table 4.2
Summary of anthropometry from various sources

area	year of survey	reference	age group (months)	nr. of children	average H-A	%children <90% of ref.H-A	average W-H	%children <80% of ref.W-H	average W-A	%children <80% of ref.W-A	%children <60% of ref.W-A
Kwale/Kilifi: farmers*	1985/6**	this survey	6-23	127	91.6	34.4	92.5	9.0	77.8	59.2	5.9
Kwale/Kilifi: farmers*	1985/6**	this survey	24-59	263	91.8	36.6	93.5	5.4	80.9	48.1	3.4
Kwale/Kilifi: farmers*	1985/6**	this survey	6-59	390	91.7	35.9	93.2	6.6	79.9	51.7	4.2
Kwale/Kilifi: farmers*	1985/6**	this survey	60-119	386	91.9	35.5	92.4	3.2	77.6	60.7	5.1
Kwale: farmers*	1985/6**	this survey	6-59	145	92.4	30.7	94.3	5.9	82.0	43.4	3.9
Kilifi: farmers*	1985/6**	this survey	6-59	245	91.3	39.0	92.5	6.9	78.6	56.6	4.4
Kwale: rural	1982	CBS 1983	3-59	138	92.1	38.5	101.8	4.9			
Kilifi: rural***	1982	CBS 1983	3-59	210	91.6	42.1	99.7	5.1			
Coastal Zones	1977	CBS 1977	12-47	81	95.3		95.2	9.0	88.7		
Kenya	1982	CBS 1983	3-59	5323	94.2	24.0	100.7	3.0		23.0	0.7
Kenya: rural	1977	CBS 1977	12-47	1383	93.0		96.0	9.0	86.0	33.0	

* CL3, CL4, and CL5 zones
** Average of 5 survey rounds
*** Including Tana River and Lamu Districts

In general, the earlier CBS findings are confirmed by the figures in Table 4.2: in comparison with Coast Province and Kenya as a whole, the nutritional condition of the children in the rural parts of Kwale and Kilifi Districts is rather poor. Confining ourselves to the 6-59 months age category, the children in the two districts score lower on all anthropometric measures. Compared with Kenya as a whole, the percentage of stunted children (height-for-age index below 90% of the reference) and wasted children (weight-for-height index below 80% of the reference) is very high.

Compared with previous findings for Kwale and Kilifi Districts in 1982, the percentage of stunted children is lower, especially in Kwale. On the other hand, wasted children were more numerous in 1985/86 than in 1982. Finally, the table offers a first impression of the deviating pattern of the youngest children (6-23 months), in the sense that their nutritional condition is worse than that of the children between two and ten years old.

Figure 4.1 (next page) presents graphically the anthropometric indices of the children during the study period. One must be careful with the interpretation of the figure, however. Comparisons between survey rounds can at best be indicative. Part of the children moved from one age category to another during the course of the survey, especially the youngest ones. This means that from round to round the groups only partly overlap. Another problem concerns the missing values: children in the first round may be missing in the second.[38] This implies that the age composition of the three groups changes slightly from round to round, which in turn may explain some of the differences of the anthropometric indicators from round to round (see Appendix 2). Nevertheless, the figure offers a first impression of the seasonal fluctuations regarding attained height and weight.

The weight-for-age curves give a general longitudinal impression of the children's nutritional condition specified by age group. No clear seasonal fluctuations can be discerned. The children of 24 months and older show a rather stable nutritional condition throughout the year. The youngest children, however, show a continuously deteriorating nutrional condition. A look at the two other figures - height-for-age and weight-for-height, i.e. the two components of the weight-for-age curves - reveals that this deviating pattern of the youngest children is solely attributable to their height-for-age development. Height-for-age of the children in the two other age groups is comparatively constant. Finally, the weight-for-height development is more or less the

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[38] The numbers of children included in each survey round are presented in Appendix 2.

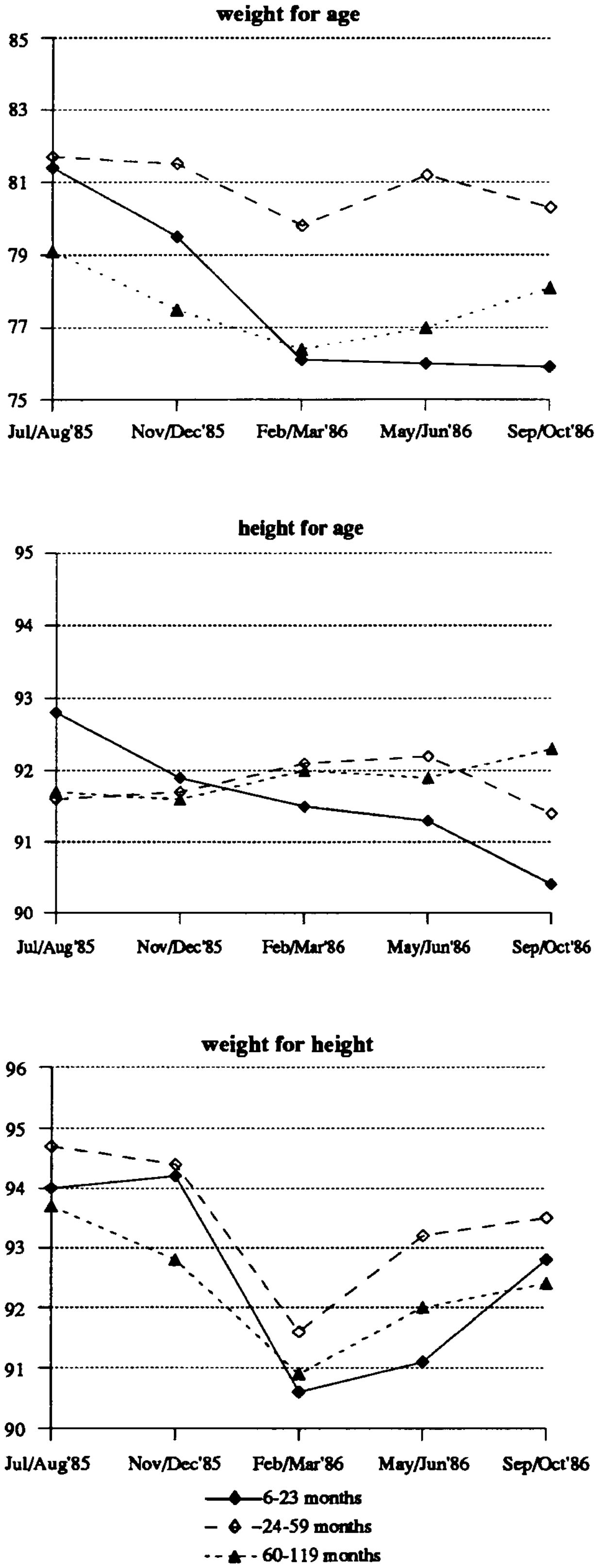

Figure 4.1:

Children: anthropometry, by age class and survey round

(Source: Appendix 32, 33, 34)

same for the three age groups, showing a clear dip in February-March. This dip occurs earlier than among the mothers, indicating that the children's drop in weight-for-height is apparently not labour-related as with their mothers. During the long rains, the children's weight-for-height recovers. However, the youngest children recover more slowly, and it is conceivable that here the high labour requirements of their mothers during this time of the year play a role.

The strong drop in weight growth between November/December and February/March goes together with a slight height-for-age improvement, at least as regards the children of two years and older. In other words, height growth during this period (dry season) takes place with lagging weight growth. This not only explains the strong weight-for-height decline, but it also indicates a relative food shortage: energy intakes seem not at par with the increased needs of the children during this growth spurt. At the same time, it suggests that height growth is primarily health-related: during the dry season the health situation of the children is generally better than during the wet season, so that the retarded height growth during the six months preceding the dry season can be made up[39].

From the foregoing, one may expect that the number of malnourished children will also show fluctuations throughout the year. Table 4.3 shows the percentage of children being wasted and being stunted, respectively. Again, the deviating picture regarding the youngest children is visible: the percentage of wasted children in this age category is continuously high (20-25%), and the percentage of stunted children shows

Table 4.3
Percentage wasted and stunted children, by age class and survey round

	Jul/Aug'85	*Nov/Dec'85*	*Feb/Mar'86*	*May/Jun'86*	*Sep/Oct'86*
% wasted (WH<85%)					
- 6-23 months	16.8	18.3	18.5	19.6	18.5
- 24-59 months	13.5	11.4	19.2	14.0	14.7
- 60-119 months	11.5	13.6	20.0	14.4	12.9
% stunted (HA<90%)					
- 6-23 months	25.4	31.5	30.9	39.2	45.2
- 24-59 months	39.3	37.2	34.2	31.8	40.9
- 60-119 months	40.5	37.7	33.8	34.1	31.4

Source: Appendix 33, 34.

[39] In the general literature on seasonality the better health conditions (less malaria, less upper respiratory tract infections, and less diarrhoea) during the dry season compared to the wet season have been often demonstrated. For Kwale there is some confirmation of this phenomenon in Boerma (1989), who documents a small increase of malaria during the rains.

Table 4.4
Percentage malnourished* children, by age class and survey round

	Jul/Aug'85	*Nov/Dec'85*	*Feb/Mar'86*	*May/Jun'86*	*Sep/Oct'86*
- 6-23 months	3.2	4.8	5.0	8.1	9.6
- 24-59 months	6.1	6.7	8.2	7.4	9.5
- 60-119 months	4.5	5.4	5.3	5.4	3.4

* Height-for-age <90% and weight-for-height <85% of reference.
Source: Appendix 35

an upward trend (which is in line with the height-for-age curve in Figure 4.1).

One way of assessing the number of malnourished children is by cross-tabulating the critical values of both height-for-age and weight-for-height (the so-called Waterlow classification; see Appendix 35). Children with a height-for-age below 90% and a weight-for-height below 85% are considered to be 'malnourished' both acutely and chronically. Thus defined, Table 4.4 presents the percentages of malnourished children. Regarding the age groups between two and ten years old, the number of malnourished children is fairly stable, despite the distinct weight-for-height fluctuations as shown in Figure 4.1. Apparently, the weight-for-height loss is somewhat compensated by a height-for-age gain. The before-mentioned deteriorating nutritional situation of the youngest children is reflected in a continuously rising percentage of malnourished children between July 1985 and June 1986. The peak in the latter month is noteworthy, as it coincides with the relatively bad nutritional condition of the mothers. Moreover, as mentioned before, weanlings are known to be more susceptible to diseases than older children and these diseases are more prevalent during the wet season. Especially diarrhoea is a very common disease among the youngest children.

Figure 4.2 (next page) shows the average number of days the children had been ill during the two weeks prior to the interview (as perceived by their mothers). The figure clearly shows that younger children are less healthy than older children. Thus, it is likely that the high percentages wasted children in the youngest age category (Table 4.3) can at least partially be explained by the factor health.

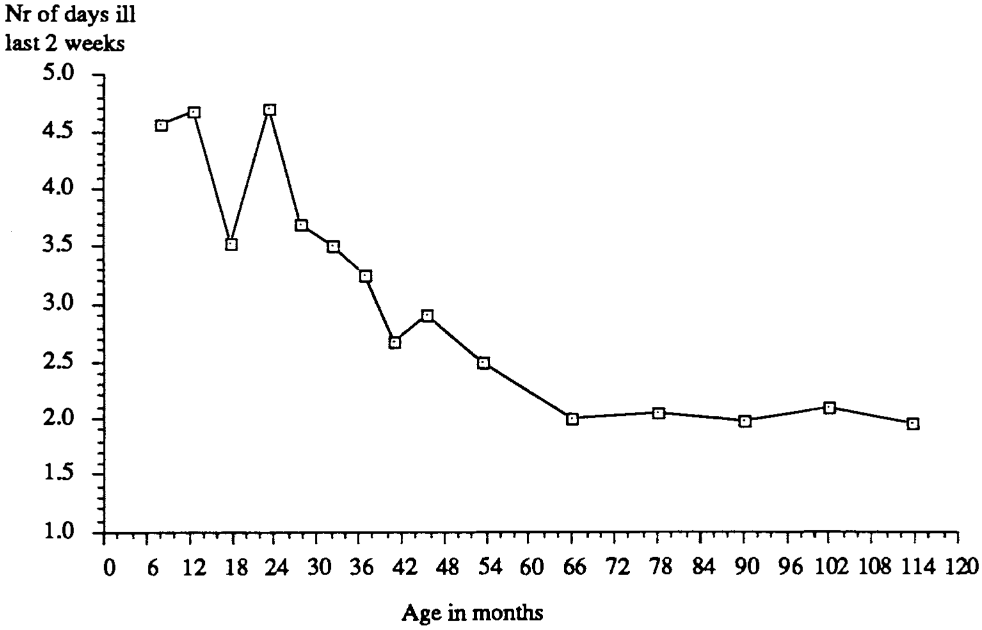

Figure 4.2
Reported health of the children
(cross-sectional data, all visits pooled).

Growth rates

By comparing the anthropometric measurements taken of the same children during different visits, it is possible to calculate gross growth rates.[40] Thus, for each child growth between two survey rounds can be expressed as the average number of centimetres per month (height growth) and the average number of grams per month (weight growth). This is a more accurate way of determining seasonal fluctuations in growth because each difference between two survey rounds concerns the same child.

Figure 4.3 presents the average growth rates in height and in weight (one point in the figure regards a period between two survey rounds!). Height growth is at its maximum during the dry season, i.e. between December and February. During this period, the average growth rate for the children between six months and two years reaches a peak of .78 cm per month, the children between two and five years old grow

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[40] Usually, difference scores have a lower reliability than the original scores, but in this case these rates have the advantage that they depend less on the estimated age of the children - one of the weaker components in the available data - because the exact length of the interval is known. Most of the data concerning growth rates are presented by age class. For this purpose, the age at the start of the interval concerned was used.

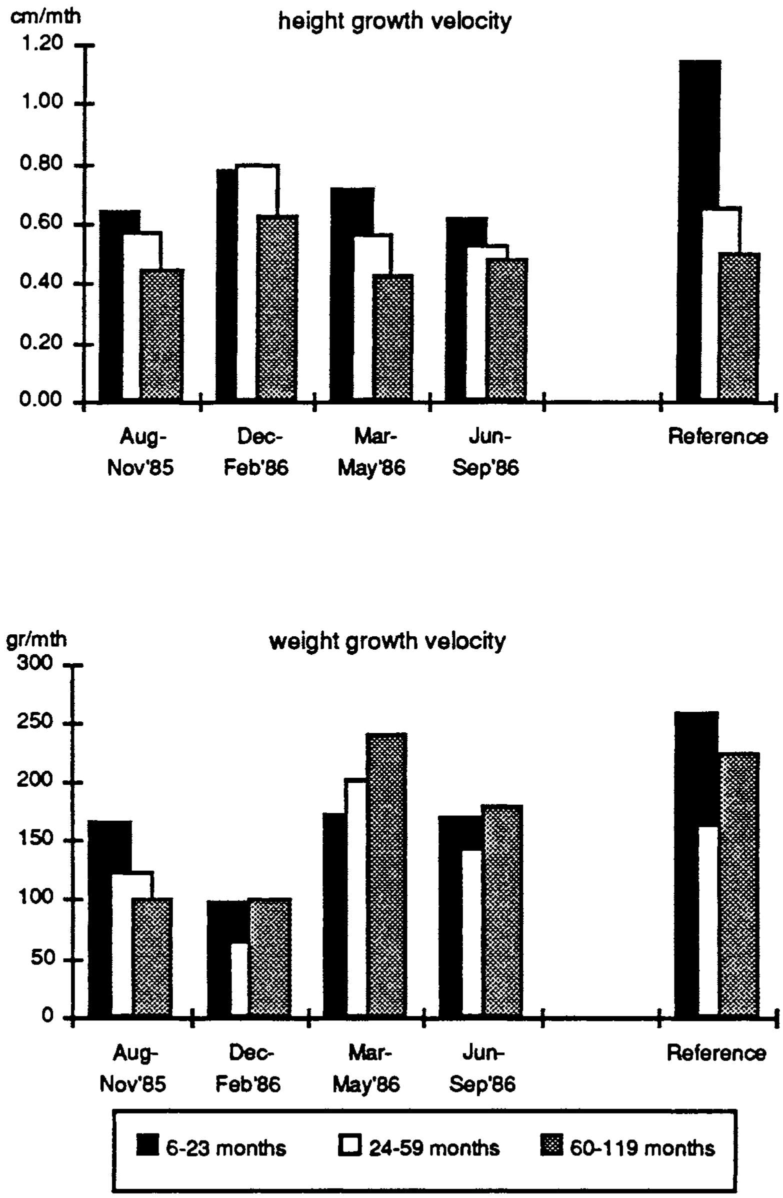

Figure 4.3
Children: height growth and weight growth velocities, by age class and season*
(Source: Appendix 36, 37)

* The references are based on incremental growth tables for international use, published by Baumgartner et al. (1986). In Niemeijer & Klaver (1990), the growth rate velocities are expressed in terms of standard deviation scores, which incorporate the growth reference values. In Figure 4.3 the presentation is in terms of centimeters and grams per month, respectively. To allow comparison with growth that can be 'expected' for each age group, average reference growth is presented in the right part of the figure.

at a rate of .80 cm per month, and the children between five and 10 years old at a rate of .63 cm per month. For the youngest children this seasonal peak in length growth is still well below normal growth for their age; for the children above 24 months it represents real 'catch-up' growth (i.e., a rate above the internationally accepted reference; see Figure 4.3).

At the same time that height growth is at its maximum, weight growth is at its minimum. Maximum weight growth takes place between March and May, i.e. during the long rains, with growth rates of 173 grams per month for the age group of 6-23 months, 200 grams per month for the children between two and five years old, and 240 grams per month for the oldest children. Here again, there is only 'catch-up' growth in weight for children from two years onwards. Apparently, the children above two years profit from the high level of household energy intake in that time of the year[41], while they show no labour effect (like their mothers) on their nutritional condition.

This period of high weight growth is followed by a continuously decreasing growth rate, leading to a minimum of 98, 64 and 101 grams per month respectively, during the dry period prior to the long rains. It means that weight growth is already decelerating immediately after the maize harvest, which is in line with the fallback in household energy intake. This pattern can most clearly be seen for the 24-59 months age group and to a lesser extent also for the 60-119 months age group. The weight growth of the youngest children is more stable. They have minimum weight growth in the same period as the older children (December-February), but they do not fully follow the others' peak weight growth in the ensuing interval (March-May); this may have to do with the heavy workload of their mothers which particularly affects the youngest children.

In sum, the seasonal pattern of the children's weight growth neatly follows the seasonality of household energy intake (as presented in Table 3.1). The pattern of height growth is the opposite of the pattern of weight growth and energy intake.

4.3. Conclusions

In general, the nutritional condition of the children in Kwale and Kilifi Districts is poor. Compared with Kenya as a whole, the percentage of stunted children under five is

[41] With a single spot observation of energy intake, it is, of course, impossible to infer when intakes started to rise from the previously low intake of February-March 1986. The minor peak in household energy intakes for November-December 1985 is not reflected in the growth rates. This peak in fact is much smaller than that of the long rains (130 kcal/cu versus 280 kcal/cu), and, possibly, also of a shorter duration.

almost twice as high. Like elsewhere, the stunting process is most active in the youngest age group, but in the case of Kwale and Kilifi Districts this problem appears to be particularly serious. Wasted children are about three to four times as frequent. These percentages are not constant throughout the year and differ according to age group. In February-March, the percentage of wasted children between two and ten years old is highest. The average household energy intake is also relatively low then. The percentage of wasted children between six months and two years is high throughout the year.

Weight-for-height and height-for-age figures are 'snapshots' of the nutritional condition at a certain moment. The average growth rates (weight growth and height growth, measured in gr/month and cm/month, respectively) reflect the nutritional situation during the period of about three months between two respective survey rounds. It appears, then, that the seasonal fluctuation in weight growth of the children is related to household energy intake. It was - unlike what could be expected from the general seasonality literature - highest between the third and the fourth survey round, i.e. between February-March 1986 and May-June 1986. Although food stores are minimal at that time, this was also the period that the average energy intake showed the strongest increase, thanks to an increase in food purchases (see Chapter 3). Apparently, the children benefited from the high household energy intakes due to the high energy requirements of adults. Thus, weight growth is primarily related to food intake. The strongest height growth took place between the second and the third survey round, i.e. between November-December 1985 and February-March 1986. This is the driest period of the year, suggesting that height growth is primarily health-related. Overall, height growth is particularly compromised among the vulnerable youngest age group.

5. Socio-economic differentation

In the general literature regarding seasonality, household income level is recognized as one of the determinants of the degree to which seasonal fluctuations are felt. Poorer households must to a relatively large degree rely on their own food production in order to avoid or to meet seasonal stress (food shortages).[42] Richer households are to a larger extent able to generate a monetary income throughout the year. The data presented in Table 1.4 (page 15) suggest that this is valid for the present study as well: the very poor households rely for their income mainly on their own food production, while the more prosperous households derive their income primarily from wage labour. Regarding the 'middle incomes', it is of importance how the income is generated, i.e. either mainly from farming or mainly from wage labour or a mixture of both. Thus, beside a pure income classification, a so-called 'household economy' classification was constructed.[43]

The present chapter contains the main findings regarding food consumption and anthropometry for households in different income categories and, where appropriate, with different economies. These findings are based on the data in Appendix 13-18 (food consumption), 27-28 (anthropometry mothers), and 38-41 (anthropometry children).

5.1. Food consumption

From the foregoing, one may expect that the average level of food consumption in the lowest income category is lower than in the higher income categories. This is confirmed by the figures regarding total energy intake in Table 5.1 and, correspondingly, total

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[42] Please note that even so their *absolute* amount of food production is lower than that of the richer households.
[43] See Foeken et al., 1989: 57-62.

Table 5.1
Total energy intake, by income class*

income class (KSh/cu): (average number of households)	*0-999* (115)	*1000-1999* (57)	*2000-2999* (45)	*3000+* (55)
- average all rounds (kcal/cu/day)	2431	2556	2755	2759
- seasonality index**	.03	.10	.06	.03

* Because of the small sample sizes, the two highest income classes have been combined. The separate figure can be calculated from the Appendices 13-17.
** For method of calculation, see box below.

Table 5.2
Protein intake, by income class*

income class (KSh/cu): (average number of households)	*0-999* (115)	*1000-1999* (57)	*2000-2999* (45)	*3000+* (55)
- average all rounds (gr/cu/day)	67	69	77	80
- seasonality index**	.03	.09	.06	.04

* Because of the small sample sizes, the two highest income classes have been combined.
** For method of calculation, see box below.
Source: Appendix 13-17.

Seasonality index

The formula of the seasonality index (si) as used in this section is derived from the seasonality index concerning annual rainfall (see Walsh, 1981: 13) and takes into account the deviation of the value of each survey round from the overall average. For all purposes, this index constitutes a robust measure of variance. The formula reads as follows:

$$s.i. = \frac{\sum_{r=1}^{r=5} | e_r - e_a |}{e_t}$$

in which: r = survey round
e_a = the overall average energy intake,
e_r = the average energy intake in round r, and
e_t = the sum of the energy intake of the five rounds.

The minimum value of each seasonality index is zero, i.e. in case each round has the same value (e_a=e_r). The maximum value for five rounds is 1.6, i.e. when four of the five rounds have a zero-score. This is a theoretical maximum: an index of about 0.8 to 1.0 indicates a very high degree of seasonality. Regarding total energy intake, however, a complication occurs because the average energy intake in a specific round can in practice never be zero and cannot be higher than a certain maximum. Thus, the theoretical maximum of the seasonality index of total energy intake depends on the chosen minimum and maximum levels of energy intake. For instance, if energy intake is 1500 kcal in three rounds and 3000 kcal in the two other rounds, si=0.34. It follows that regarding total energy intake, a seasonality index of 0.3 to 0.4 can be considered as very high.

protein intake in Table 5.2. The average energy intake per consumer unit per day in the KSh.0-999 category is about 300 kcal lower than in the categories above KSh.2000. Regarding protein intake, the same pattern can be discerned, with a difference of around 10 grams.[44]

The degree to which energy intake and protein intake fluctuate can be expressed in one figure: the seasonality index.[45] The method of calculation as well as the ways of interpretation are presented in the box on page 49. The indices in Tables 5.1 and 5.2 show that the poorest households do *not* experience the largest seasonal fluctuations. Compared with the other income categories, energy intake in the poorest households is rather stable throughout the year, be it on a low level (see Appendix 13). The energy intake peak in May-June is very modest. If, as was concluded earlier on, energy intakes reflect energy expenditures, this would indicate that also the latter vary less in poor households. The low level of energy intakes further suggests that for these women in poor households "food poverty" may constrain work output.[46]

Fluctuations are highest in the KSh.1000-1999 category. Beside the poorest households, this is the group for whom farming contributes considerably to the household's income (see Table 1.4, page 15) and which may explain the relatively high energy intake peaks in November-December and May-June (see Appendix 14). This can also be illustrated by introducing the variable household economy, which is a combination of income level and income composition. [47]

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[44] One must be careful with these figures. The differences between the income categories do not purely reflect income differences. Other variables influence the outcomes. One intervening variable, for instance, concerns household size. As mentioned at the end of Section 3.2, energy intake per consumer unit is lower as households are larger. It is also known that relatively rich households are smaller than poorer households. On average, the households with an income of KSh.2000/cu and more are 0.8 consumer units smaller than the households with an income below that level. Thus, the lower energy intake in the latter group can partly be attributed to this effect of household size. Another important intervening variable concerns research area. In the following chapter we will see that considerable differences between the areas concerning energy intake exist. Moreover, the five income classes are very unevenly distributed in the six areas (see Table 1.5, page 16). However, also after correcting the figures of Table 5.1 for 'area', the difference of about 300 kcal between the two income levels remains. In other words, one may safely conclude that energy intake in poor households is lower than in richer households.
[45] Other measures could be the largest difference between survey rounds, the standard deviation, the variance or the coefficient of variation.
[46] This may easily lead to relatively low returns per acre, which was indeed found to be the case. Compared with the 'farmers' (see Appendix 18), returns per acre were about half of that of the latter group. See Foeken et al., 1989: 60.
[47] Above and below a certain income level, the composition is not very important. Households below an income level of KSh.1000 per consumer unit were considered to be unable to meet the basic food energy requirements and were qualified as 'poor'. Households with an average income above KSh.4000/cu were supposed to dispose of sufficient resources to meet unforeseen circumstances and were qualified as 'rich'. For the group of households with an income level between these two cut-off levels, however, it is important how the income is realized. Households with an income of more than KSh.500/cu from farming but less than KSh.500/cu from wage labour were termed 'farmers'. Households with an income above KSh.500/cu from wage labour and less than that from farming were labelled 'wage earners'. And households with an income of more than KSh.500/cu from both farming and wage labour were

Table 5.3 shows the average total energy intake per survey round for two types of households "farming important" and "farming less important". It is interesting to note from Table 5.3, that the households with an economy in which farming plays an important role experience relatively high seasonality (a seasonality index of 0.09 compared to a seasonality index of 0.02 for households in which farming is less important). This is due to the very high intakes during the short and the long rains, i.e. November-December and May-June. During those survey rounds, the average energy intake of the 'farmers' and the 'mixed economies', the two household types in which farming is important both as income source and labour effort, was about 3000 kcal, against an average of about 2550 kcal for the (combined) other three types of household economy. This again indicates that labour requirements in agriculture form an important cause of the seasonal fluctuations regarding energy intake.

Table 5.3
Energy intake, by importance of farming* and survey round

		Jul/Aug'85	*Nov/Dec'85*	*Feb/Mar'86*	*May/Jun'86*	*Sep/Oct'86*
A) *farming less important*	(N=)	(203)	(199)	(196)	(193)	(193)
average (kcal/cu/day).		2445	2499	2504	2627	2440
B) *farming important*	(N=)	(80)	(79)	(76)	(76)	(73)
average (kcal/cu/day).		2680	2966	2515	3167	2507

* The category "farming important is a combination of "farmers" and "mixed economies", the category "farming less important" combines "poor", "wage earners", and "rich".
Source: Appendix 18

So far, one income component has been left out of consideration, namely rural casual labour. As mentioned before (page 14, footnote 15), this type of income was not included in the general household income, partly because rural casual labour - in contrast with the other types of income generation - is considered as a curative coping mechanism. Table 5.4 gives some insight into the relationships between energy intake and local casual labour.

considered as 'mixed economies'. See Foeken et al., 1989: 57-59. For our purpose here, the numbers of households in each category is rather small. But concentrating on the aspect of farming, it is possible to combine the households in which farming plays an important role ('farmers' and 'mixed economy') and households in which farming plays a far less important role ('poor', 'wage earners', and 'rich'). Of course, farming is important for households from the 'poor' category, as well. But, as was pointed out on page 17, these households derive nearly a quarter of their livelihood from casual labour.

If all households of the sample are considered, a (statistically significant) positive correlation between income from rural casual labour in the month preceding the survey round on the one hand and energy intake on the other hand occurs in the first and in the last survey round. However, the relationships are not strong. The bottom part of Table 5.4, therefore, shows the correlation coefficients for only those households with an income from rural casual labour in a specific survey round. It is clear that the correlations are much higher then: each KSh.100/cu earned through rural casual labour by members of the household, corresponds with an increase in average energy intake in the household of about 170 kcal/cu during the first and the last round.

Table 5.4
Correlation between rural casual labour and energy intake, by survey round

	Jul/Aug'85	*Nov/Dec'85*	*Feb/Mar'86*	*May/Jun'86*	*Sep/Oct'86*
A) *all households* (N=)	(283)	(278)	(272)	(269)	(266)
- Pearson correlation coeff.	0.18***	0.13**	-0.04	0.10*	0.24***
B) *only households with rural casual labour* (N=)	(55)	(55)	(64)	(68)	(54)
- Pearson correlation coeff.	0.55***	0.24*	0.05	0.25**	0.48***
- size of effect****	167	83	-	73	170

* p<0.10
** p<0.05
*** p<0.01
**** kcal/cu per KSh.100 income from rural casual labour

Although rural casual labour as such does not show a clear seasonality (at least not in terms of the number of households engaged in this type of work), the effect of casual labour on the energy intake does so to a high degree: for the households where casual labour is a source of income, it is of special importance in the period from July to October. In July, August and September, a lot of harvesting takes place and casual labourers are often paid in kind and require more food energy to work.

From Section 1.3 (Table 1.6, page 17) we know that rural casual labour is an important source of (additional) income for the households in the two lowest income categories. The energy intake in the first and the last survey rounds was relatively low[48], but without the additional income from casual labour on neighbouring farms the average energy intake would have been even 150-200 kcal/cu lower.

[48] See Appendices 13 and 14.

5.2. Anthropometry

The mothers

Figure 5.1 shows the weight-for-height fluctuations in relation with household income level. The overall picture that one gets from the figure is statistically significant, i.e. women in lower-income households have a lower weight-for-height than women in higher-income households. The women in the lowest income category show the smallest seasonal fluctuations, which is in line with the small seasonality regarding energy intake. Moreover, the absence of a clear weight-for-height dip in May-June in this category again indicates the relative absence of a seasonal labour peak (resulting in the above-mentioned low productivity). This seasonal dip is clearly found with the women in the two 'middle-income' groups. Many of these households depend to an important extent on farming for their income (the 'farmers' and the 'mixed economies';

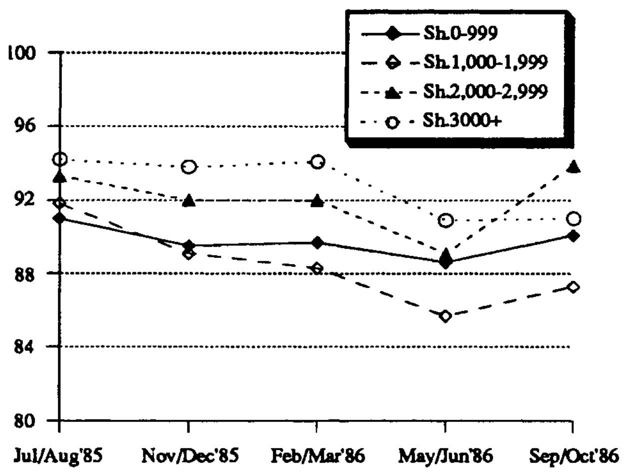

Figure 5.1:
Mothers: weight-for-height,
by income class and survey round
(Source: Appendix 27)

see Appendix 28).[49] So, this is a further indication for the validity of the hypothesis regarding the relationship between food consumption and nutritional condition of the women on the one hand and labour requirements in agriculture on the other.

The children[50]

An overall indication regarding the relationship between household income level and the overall children's nutritional condition can be obtained from the figures in Table 5.5. Contrary to expectations, it appears that such a relationship does not exist. That means that the general nutritional condition of the children in the poorest households is not appreciably worse than that of the children in the higher-income households.[51]

Table 5.5
Children 24-119 months: main anthropomentric measures, by income class*
(averages of all survey rounds)

Income class (KSh/cu)	*weight-for-age*	*height-for-age*	*weight-for-height*
0-999	78.9	91.5	93.2
1000-1999	79.7	92.3	92.9
2000-2999	77.3	91.8	91.4
3000+	80.0	92.5	93.1

* Because of the small sample sizes, the two highest income classes have been combined.
Source: Appendix 38

49 Rather surprisingly, the women in the households labelled 'wage earners' show an equally strong weight-for-height dip in May-June, indicating that although farming contributes relatively little to the household's income, the women work as hard on their plots as in the other economies. Regarding the strong dip in weight-for-height of the women in the income category between KSh.1000 and KSh.2000 during May-June, it should be pointed out that this is mainly caused by the strong seasonal fluctuation in Kibandaongo (see next chapter). These are rather poor - though not the poorest - households, relying for about 40% of their income on their own food production (Table 1.4).
50 For several reasons, the youngest children - i.e. the 6-23 months age group - are excluded from this part of the analysis as well as from the area analysis. First, per survey round this age category partly consists of different (new) children. This makes comparisons between survey rounds rather hazardous, the more so as season of birth (cohort) influences the development of the nutritional condition during the first period of life. Secondly, their nutritional status is also (directly) influenced by the care and the nutritional condition of their mothers, which 'disturbs' comparisons between areas and household income categories. And thirdly, because they show a different seasonal pattern in comparison with the other two age groups, they cannot be grouped together with the latter groups, to do so would obscure the seasonal patterns present for these groups. However, numbers per income class and per area are too small to permit a further sub-division of the youngest age class. For the same reason, the other two age categories will be grouped together; a procedure that is justified because from Figure 4.3 (page 45) we know that the seasonal patterns regarding both height growth and weight growth are nearly identical for the two age groups.
51 A more detailed analysis reveals that within the CL3 zone household income level is related to the height-for-age. As this relationship is not present in the other zones, it does not show in the combined data (Niemeijer & Klaver, 1990: 55).

Tables 5.6 and 5.7 offer insights into the average weight growth and height growth, the degree of seasonality regarding both growth measures, and the actual seasonal fluctuations of the growth processes. As with the general anthropometric measures, there are no clear relationships between the average growth rates on the one hand and household income level on the other (Table 5.6). The average weight growth is about the same in all income categories, despite the difference in energy intake between richer and poorer households. The same applies to average height growth, with the exception, however, of the children in the highest income category, as the latter children show a higher height growth rate than the children in all other income categories.

Table 5.6
Children 24-119 months: weight growth and height growth, by income class*

income class (KSh/cu):	*0-999*	*1000-1999*	*2000-2999*	*3000+*	*reference***
weight growth					
- average (gr/mth)	145	144	158	144	200
- seasonality index***	.38	.29	.37	.17	
height growth					
- average (cm/mth)	.54	.57	.52	.57	.56
- seasonality index***	.18	.11	.11	.11	

* Because of the small sample sizes, the two highest income classes have been combined.
** Reference value based on Baumgartner et al, 1986.
*** For method of calculation, see box on page 49.
Source: Appendix 40

The relationship between household income and seasonality in growth is more pronounced. Children in the higher income classes (i.e., above KSh.3000/cu) show relatively low degrees of seasonality regarding both weight growth and height growth. Children in households with an income between KSh.1000 and KSh.3000 have a relatively high seasonality in weight growth, but a low seasonality in height growth. Finally, children in the lowest income class are most pronounced in their seasonal growth fluctuations as both weight growth and height growth show high seasonalities. Thus, these 'poor' children grow very unevenly throughout the year.

The actual seasonal fluctuations in height growth and weight growth for each of the household income categories are shown in Table 5.7, page 56. Seasonal fluctuations

Table 5.7
Children 24-119 months: seasonal fluctuations in weight growth and height growth*, by income class**

	August '85> November '85	*December '85> February '86*	*March '86> May '86*	*June '86> September '86*
Weight growth (grams/month)				
KSh.0-999	92	86	249	151
KSh.1000-1999	138	68	220	151
KSh.2000-2999	110	89	223	211
KSh.3000+	126	113	153	183
Height growth (cm/month)				
KSh.0-999	.45	.75	.47	.49
KSh.1000-1999	.56	.69	.51	.52
KSh.2000-2999	.47	.62	.48	.49
KSh.3000+	.54	.69	.54	.50

* Peak growth rates are indicated with an underlined figure.
** Because of the small sample sizes, the two highest income classes have been combined.
Source: Appendix 40

in weight growth are similar for all categories (see also Figure 4.3, page 45) with the exception of the highest income category. During the long rainy season, i.e. from March to May, weight growth accelerates. In the higher income categories a shift towards the June-September period occurs. This shift is notable for children in households with an income between KSh.2000 and KSh.3000, but is much stronger among children in the highest income category. Regarding height growth, the general picture (Figure 4.3) applies to all income categories. During the dry season, i.e. between December and February, a spurt in height growth occurs, while during the rest of the year height growth remains on a substantially lower level.

5.3. Conclusions

Differences in energy intake are influenced by the income level of the households: above an annual income level of KSh.2000/cu, the average energy intake is about 250-300 kcal/cu higher than in households below that level. The composition of the household income is another factor influencing the level of energy intake: in households where farming is relatively important as a source of income, energy intake is higher. This can be related to higher energy requirements due to agricultural labour activities. However, the higher intake does not apply to the poorest households (i.e., with an annual income of less than KSh.1000/cu). In these households, both the income from farming and the income from off-farm employment are too low to permit a reasonable level of energy intake.

Even though energy intake is higher in richer households, this does not prevent the deterioration in the womens' nutritional condition during the rainy season in May-June. Rather surprisingly, it was the women of the poorest households who showed the smallest seasonal fluctuations in weight-for-height, possibly due to the overall low level of food consumption in these households.

The average weight growth and height growth of the children is about the same in all income categories. However, the household categories differ regarding the degree of seasonal fluctuations of the children's growth. In the relatively prosperous households, the children grow quite evenly throughout the year, but in the very poor households, both weight growth and height growth are very uneven indeed. According to current insights (see, e.g., Payne 1989: 25), these children are considered to be more at risk.

6. Research areas

In the preceding chapters, the analysis took place on two aggregated levels, i.e. on the level of the total study population and on the level of household types. In the present chapter, food consumption and nutritional status will be discussed on the level of the six research locations: Bongwe (CL3), Mwatate (CL4) and Kibandaongo (CL5) in Kwale District, and Chilulu (CL3), Kitsoeni (CL4) and Bamba (CL5) in Kilifi District.[52]

6.1. Food consumption

In this section, various aspects of energy intake are presented for the six research areas: the overall average energy intake per consumer unit per day, the composition of the energy intake according to food groups, the energy intake per survey round, the proportion of the energy intake that is home-produced, and the degree of seasonality of both total energy intake and home-produced energy. The basic data are given in Appendices 19-24.

Average energy intake

The overall average energy intake (i.e. the average over the five survey rounds) and the composition of the energy intake over the various food groups are presented in Table 6.1. With about 2850 kcal per consumer unit per day, Mwatate is the area where the overall average energy intake is highest. Still, this is more than 100 kcal below the reference value of 2960 kcal per consumer unit per day. In three areas - Bongwe,

[52] Some more general characteristics, beside district and agro-ecological zone, were presented in Table 1.1 (page 5). Major agricultural data were shown in Table 1.2 (page 11), while Tables 1.3 (page 15) and 1.5 (page 16) contained information on household income in the areas.

Table 6.1
Composition of energy intake, by research area

	Bongwe		*Chilulu*		*Mwatate*		*Kitsoeni*		*Kiband'o**		*Bamba*	
	abs.	%	abs.	%	abs.	%	abs.	%	abs.	%	abs.	%
Total energy intake	2613	100	2394	100	2857	100	2331	100	2662	100	2647	100
Composition:												
Cereals	1413	54	1735	72	2132	75	1810	78	2196	82	2225	84
Legumes	106	4	72	3	113	4	150	6	19	1	204	8
Roots, tubers & st. staples	351	13	241	10	136	5	34	1	83	3	10	0
Vegetables	12	0	24	1	48	2	22	1	74	3	31	1
Fruits	28	1	5	0	20	1	30	1	13	0	1	0
Animal products	224	9	77	3	167	6	79	3	177	7	110	4
Fats	91	3	12	1	57	2	48	2	31	1	7	0
Oil seeds, nuts	128	5	152	6	52	2	110	5	12	0	10	0
Miscellaneous	261	10	75	3	132	5	46	2	58	2	48	2

Source: Appendices 19-24
* Kibandaongo

Kibandaongo and Bamba - the average energy intake lies between 2600 and 2670 kcal per consumer unit, i.e. 300-350 kcal below the reference requirements. Finally, the lowest energy intake was found in Chilulu and Kitsoeni. With 2394 and 2331 kcal, respectively, the average intake in these two areas lies about 600 kcal below the required level.[53]

In all areas, energy is first of all derived from cereals, ranging from 54% in Bongwe to 84% in Bamba. However, compared with the other areas, the consumption of non-cereals in Bongwe is high. This is related to the comparatively high consumption of cassava (explaining the relatively high percentage of energy from roots, tubers and starchy staples), and partly also to the intake of animal products, fats, and the various food items aggregated under the heading 'miscellaneous'. Chilulu is the only other area where at least ten per cent of the total energy is derived from one non-cereal food group (roots, tubers and starchy fruits, i.e. predominantly cassava). Although most food groups contribute only little to the energy intake of the people in Coast Province, there are differences between the several areas; differences that reflect such factors as

[53] These differences do not reflect 'pure' area differences. Other factors, such as household size and household income, operate as confounding variables. As shown at the end of Section 3.2, energy intake per consumer unit and household size are inversely related. In the present survey, one consumer unit more means 73 kcal lower energy intake per consumer unit. And regarding household income, there is a (weak but statistically significant) positive relationship: KSh.1000 more means 74 kcal more. If the average energy intakes for the six areas should be recalculated by keeping such factors constant, one major shift would occur, i.e. the average energy intake in Chilulu would be redressed to the level of Bongwe.

agro-ecological potential, food habits, income level, etc.[54] For instance, legumes are much more consumed in Bamba and in Kitsoeni than in Kibandaongo. Cassava is important in the two CL3-areas, Bongwe and Chilulu, and to some extent also in Mwatate. Animal products are relatively important in Bongwe, Mwatate and Kibandaongo. Oil seeds and nuts are clearly more consumed in Bongwe, Chilulu and Kitsoeni than in the other areas. And, finally, the 'miscellaneous' category is only of some importance in Bongwe and Mwatate. In sum, one can conclude that the dominance of cereals that was already shown for the total population (Figure 2.1), applies to all the research areas, but to a lesser extent in the case of Bongwe.

In Section 3.2 (Table 3.5), it was noted that, on the whole, less than half of the total energy intake was derived from home production. Table 6.2 shows the average home-produced energy for the six areas. It is clear that the areas differ substantially in this respect. Consumption of home-produced food is highest in Kibandaongo, both in absolute terms as in terms of the percentage of total energy intake. In Bongwe, home-produced energy is very low, despite its favourable conditions for agriculture.[55]

Table 6.2
Consumption of home-produced energy, by research area

	Bongwe (CL3)	*Chilulu* (CL3)	*Mwatate* (CL4)	*Kitsoeni* (CL4)	*Kiband'o** (CL5)	*Bamba* (CL5)
- average (kcal/cu/day)	437	821	751	1121	1542	629
- as % of total energy intake	17	34	26	48	58	24

Source: Appendix 19-24 * Kibandaongo

54 Regarding some of the survey rounds, the exact period of interviewing, in relation with the actual harvest time, also plays a role: early fresh maize or legumes may be consumed in one area and not in another, for this reason. For instance, the first survey round in Chilulu took place in July, but in Kitsoeni in August.

55 Cereal production from the long rains and the short rains 1985 amounted only to 9 kg per consumer unit, against an average of 61 kg for the areas combined (see Foeken et al., 1989: 33).
The average percentage of home-produced energy intake in Bamba is much higher than the degree of food self-sufficiency as calculated in Seasonality-Report Part 3 (14%). As will be shown in Figure 6.2, this is due to the fact that the harvest from the long rains in 1985 was bad, compared with 1986, while the harvest from the short rains of 1985 was reasonable. The degree of food self-sufficiency was calculated on the basis of the harvests of long rains and short rains of 1985 only. All the other averages in Table 6.2 (except Chilulu) are lower than the calculated degrees of food self-sufficiency. This is partly due to the different ways of calculation of the two measures. The degree of food self-sufficiency was based on the main staple crops only (cereals, cassava, pulses, bananas), while the percentage home-produced energy intake is based on all consumed food items. See Foeken et al., 1989: 35, 144.

Seasonal fluctuations in energy intake

In this section, the seasonal aspects of energy production and energy intake are discussed. Because of the complexity of the data, the analysis will be presented area-wise. This will be done on the basis of two figures, one comparing the overall energy intake and the overall intake of home-produced energy per survey round (Figure 6.1, page 63) and the other showing the level of home-consumed energy per survey round, subdivided into the main food groups (Figure 6.2, page 64). In addition, the degree of seasonality of both total energy intake and home-produced energy are presented for each area (Table 6.3). At the end of this section, some concluding remarks of a more general nature will be made. Data of a more detailed nature for each of the research areas can be found in Appendix 19-24.

Bongwe

Regarding the seasonality of total energy intake, Bongwe fits well in the general pattern, be it that energy intake during the first survey round is relatively low (Figure 6.1). This is the period of the maize harvest of the long rainy season, but, as we have seen before, maize cultivation is not important in Bongwe. This is clearly shown, for instance, by the almost negligible amount of home-produced intake from cereals (Figure 6.2). Another indication concerns the consumption of fresh maize during the harvest period, which is very low (78 grams per household during the first survey round). The relatively high energy intake peak in May-June is mainly caused by the consumption of cassava (Appendix 19), which is a popular food item among the Digo.[56] In other words, when cassava is available it serves as a substitute for cereals. Because of the very low level of energy intake from home production, almost all food is bought throughout the year.[57] In general, it seems that home-produced food in this area is an addition to the food that is bought. Only in May-June is the ratio between bought energy and home-produced energy significantly lower than in the other rounds, which is due to the high consumption of home-produced cassava in that period of the year.

Chilulu

In contrast with Bongwe, the energy intake during the first survey round in Chilulu is high in comparison with the other rounds (Figure 6.1). The actual interviewing took place in July of that year, i.e. the period of the maize harvest. This is reflected by the

[56] This is shown, for instance, by the fact that during the period that cassava is easily available, i.e. during May-June, almost half of the consumed cassava is bought (see Appendix 19).

[57] According to Oosten (1989: 72), people in Bongwe are not very much interested in agriculture, because of the importance of off-farm employment.

substantial consumption of fresh maize (294 grams per household). The peak in May-June can - as in the case of Bongwe - to a large extent be attributed to the consumption of cassava (Figure 6.2). However, as we will see, the peak is low in comparison with most other areas. This can be interpreted in two ways. First, it can be explained in terms of 'competition' between crops, due to the fact that plots are relatively small.[58] The choice is then mainly between maize, cassava and coconut trees. Both cassava and coconut production are relatively high in Chilulu[59], resulting in a relatively low maize production (Figure 6.2). The second way to explain the modest peak in energy intake in May-June is in terms of required labour inputs. Because plots are small and households are large, labour inputs - and thus energy requirements - are relatively low.[60] According to the data in Seasonality Report 3, both explanations hold. Whatever the explanation, the result is a large discrepancy between energy intake and home production. Food purchases are especially high in July-August (compared with the other rounds in that area and with round one in the other areas). As mentioned before, the survey took place in July and in that month fresh maize was consumed, so it was the time that the new harvest actually took place. The high level of buying indicates that harvesting just started.

Mwatate

As in Bongwe, the general picture regarding total energy intake is clearly visible, but the contrast between the 'dip' in round three and the 'peak' in round four is more pronounced than in all other areas (Figure 6.1). Mwatate is the only area where fresh maize (107 grams/household) was consumed in February-March 1986 (round three), indicating a harvest from the preceding short rainy season. This is confirmed by the relatively high intake of home-produced energy at that time. Finally, the very high energy intake (the highest of all areas) in May-June is less easy to explain.[61]

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[58] The average plot size in Chilulu is 2.8 acres, against 4.0 to 21.0 acres in the other five areas; see Foeken et al., 1989: 93.

[59] See Foeken et al., 1989: 99.

[60] In Chilulu, the amount of farm labour (measured in adult equivalents) per acre is 1.3, against 0.2 to 0.6 in the other five areas. See Foeken et al., 1989: 29. Moreover, planting is spread over various months, which is made possible by the fact that after the long rainy season rainfall continues to a certain extent. This is a typical phenomenon of the coconut-cassava zone.

[61] For instance, it cannot be related to household income. In the first place, the average household income in Mwatate is not the highest of the six areas (Bongwe scores higher; see Foeken et al., 1989: 123). And secondly, if household income is kept constant, the energy intake in Mwatate in round four remains significantly higher.

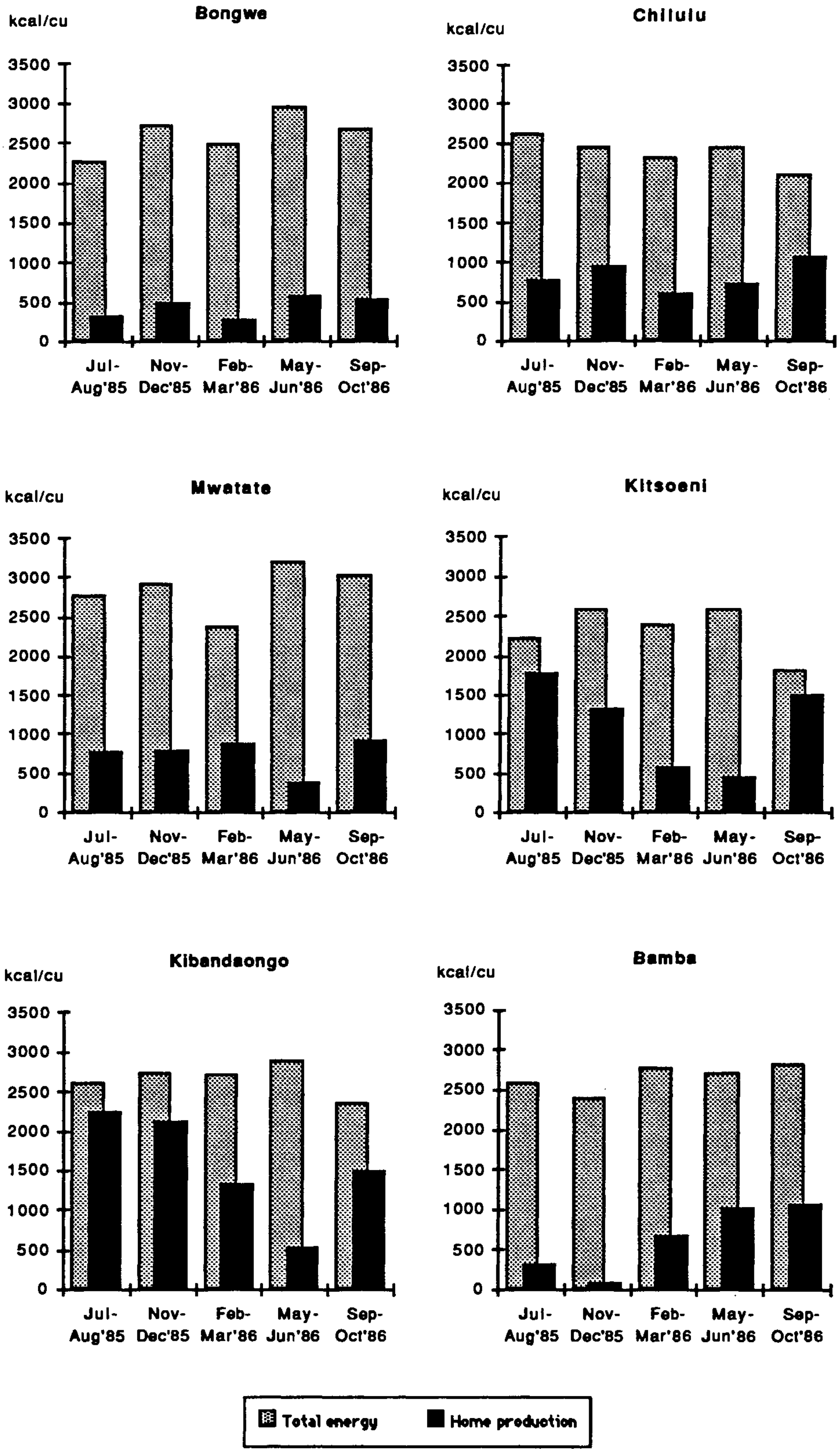

Figure 6.1
Total energy intake and total home-produced energy, by research area and survey round
(Source: Appendices 19-24)

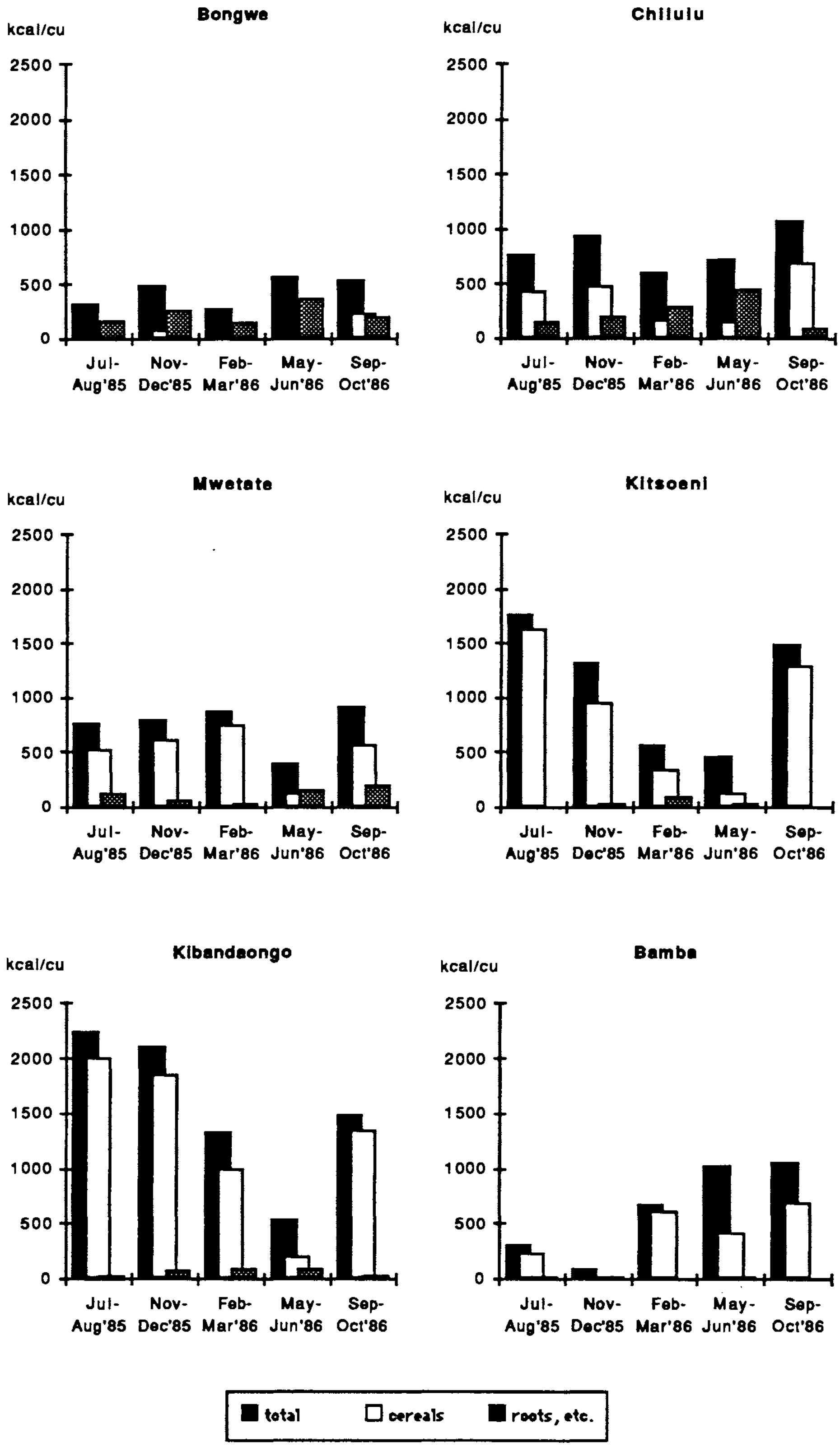

Figure 6.2
Home-produced energy, by research area and survey round
(Source: Appendices 19-24)

Kitsoeni

The seasonal pattern of energy intake in this area resembles that of Chilulu (the two areas are situated not far from each other), except for the first survey round Figure 6.1). This may be due to the fact that interviewing in Chilulu was mainly done in July and in Kitsoeni in August, which is reflected by the relatively high consumption of fresh maize in Chilulu and the very low fresh maize intake in Kitsoeni (only 25 grams/household). In other words, during the first survey round in Kitsoeni, the maize harvest was almost completed and people were mainly relying on their own stocks. The very low energy intake in the fifth survey round in Kitsoeni can be explained in terms of postponing cash expenses: own stocks are still substantial and purchases are limited as much as possible. Kitsoeni shows the 'classic' seasonality picture regarding the households' own food supply, especially as far as maize is concerned (Figure 6.2). Immediately after the long rains' harvest, energy intake comes mainly from own stocks (rounds 1 and 5). During the rest of the year, the amount of home-produced food gradually diminishes and reaches a very low level shortly before the new harvest.

Kibandaongo

Just like Kitsoeni, this is an area with a relatively high maize production, and the seasonal patterns concerning total energy intake and home-produced energy are very much alike (Figure 6.1). Yet, energy intake during the first survey round is much higher in Kibandaongo than in Kitsoeni, despite the fact that in both areas interviewing took place in August. The consumption of fresh maize in Kibandaongo was comparatively high during that period (1279 grams/household), indicating that the maize harvest was still going on, while in Kitsoeni it was almost finished. The high consumption of fresh maize results in very little food purchases at that time. Finally, the figures indicate that the harvest of the long rainy season in 1986 was smaller than in the preceding year.

Bamba

The seasonal patterns in Bamba are different from that in the other areas (Figure 6.1), which can partly be explained in climatological terms. In the first place, the harvest of the long rains of 1985 almost completely failed, due to lack of rainfall. This can be recognized by the very low levels of home-produced energy in the two survey rounds in 1985 (Figure 6.2). Secondly, the short rains of 1985/86 produced a reasonable harvest in Bamba, which is shown by the higher level of home-produced energy in February/March 1986 than during the preceding survey round (Figure 6.2). Moreover, the harvest of the long rainy season in 1986 was relatively good and is also reflected in the consumption of fresh maize as early as June 1986 (784 grams/household). Thus, the average level of energy intake in 1986 was higher than in 1985. Still, the area is too dry to permit a high degree of food self-sufficiency, so most food always has to be purchased.

Conclusions

The general bimodal picture regarding the fluctuations of total energy intake that was presented in Table 3.1 (page 27), readily applies to three of the six research areas: Bongwe, Mwatate and Kibandaongo. In these areas, total energy intake is highest in May-June, relatively low from July to October, slightly higher again in November-December, and lower in February-March. In Kitsoeni, practically the same seasonal pattern can be seen (although the highest peak is not found in May-June), while in Chilulu only the first survey round deviates from the general pattern. In fact then, only Bamba does not fit in the general seasonal picture regarding total energy intake: it has intake peaks in other rounds.

In each survey round, cereals are the dominant energy suppliers, and the more so if one moves from wetter to drier areas (see Table 6.1). The differences in total energy intake can to a large extent be explained by differences in energy intake from cereals. Moreover, the seasonal fluctuations in total energy intake largely reflect the seasonal fluctuations in cereal energy, although there are exceptions (Bongwe and Chilulu in May-June). But in the latter cases, cassava complements the relatively low consumption of cereals.

The level of home-produced energy fluctuates strongly throughout the year (which is to be expected, of course) and shows a much higher degree of seasonality than the level of overall energy intake (Table 6.3). The low seasonality indices regarding total energy intake are caused by the levelling effects of food purchases that can be found in all areas. As expected[62], the two areas with the highest average home

Table 6.3
Degree of seasonality of overall energy intake and home-produced energy, by research area

*Seasonality index**	*Bongwe* (CL3)	*Chilulu* (CL3)	*Mwatate* (CL4)	*Kitsoeni* (CL4)	*Kiband'o*** (CL5)	*Bamba* (CL5)
- overall energy intake	.07	.06	.08	.10	.06	.05
- home-produced energy	.26	.18	.19	.43	.33	.55

* For method of calculation, see box on page 49. ** Kibandaongo
Source: Appendix 19-24

[62] See page 20-21.

production, Kitsoeni and Kibandaongo, show a comparatively high seasonality index regarding home-produced energy. These indices can be regarded as 'normal'. The latter does not apply to the high index for Bamba, which was caused by the failed harvest from the long rains of 1985.

In four of the six research areas - Bongwe, Chilulu, Mwatate and Bamba - there is a large discrepancy between total energy intake and home-produced energy consumption (i.e., less than half of the energy intake is derived from own production) the whole year through. But the causes of the discrepancies differ. In Bongwe, Mwatate and Bamba, off-farm employment plays a dominant role in the local economies; in Bongwe, and to a lesser extent Mwatate, because employment opportunities are near at hand, in Bamba because agricultural production is very much hampered by climatological circumstances. In Chilulu, the low level of home-produced energy is caused by the low agricultural production, due to relatively small plots. Kitsoeni and Kibandaongo - the two 'maize areas' - show a different picture, in the sense that during the months following the main harvest in July-August, energy intake is mainly covered by own produce, but as time goes by home production contributes less and less to energy intake. It is especially in these two areas that the seasonal fluctuation regarding home-produced energy is much higher than the fluctuation regarding total energy intake (Table 6.3).

In sum, various conclusions can be drawn. First, the seasonality of total energy intake is positively related with the seasonality of labour requirements in agriculture. In five of the six areas, this is most clearly shown by the high energy intake in May-June, when labour requirements in agriculture are high, even though cereal stocks are low at the time. Secondly, in the areas with the highest degree of food self-sufficiency (Kitsoeni and Kibandaongo), an inverse relationship exists between total energy intake and energy from home production; this is contrary to the 'classical scenario' found in the literature on seasonality. In the areas with the lowest degree of food self-sufficiency (Bongwe and Bamba), the relationship is positive: home-produced food forms an addition to purchased food. This relationship in the two remaining areas is less clear.

Finally, we may conclude that despite the differences between the areas concerning a) the ratio between bought and home-produced food and b) the seasonal fluctuations regarding both bought and home-produced energy, in all areas the 'average household' is able to buy food if necessary, be it not enough to keep intake levels high throughout the year. In other words, in Kwale and Kilifi Districts income generation is an important mechanism in order to prevent seasonal stress as much as possible, not only for the households in the narrow coastal strip and along the main tarmac roads, but also for those living in the hinterland.

6.2. Anthropometry

The mothers

The seasonal fluctuations of the weight-for-height averages for each of the six research areas are shown in Figure 6.3. In all areas, the dip in May-June 1986 can be seen, but to very different degrees. The strongest seasonal fluctuation regarding the nutritional condition of the mothers occurs in Kibandaongo. This is an area where food production is relatively important[63], which means that the weight-for-height variation may be explained in terms of fluctuations in labour requirements regarding food (and especially maize) production. In Kitsoeni - which is, together with Kibandaongo, also an area where food production is relatively important - the weight-for-height dip in May-June 1986 is less pronounced and of about the same magnitude as in Mwatate, Bongwe and Chilulu. Finally, in Bamba the situation is different. Food production is rather unimportant there and most staple food is bought. As a result, weight-for-height is fairly constant throughout the year but on a rather low level (about 90%). Only when there is an unexpectedly good harvest in this dry area does weight-for-height rise. This was the case during the cropping season of the short rains of 1984, which explains the high starting point in Bamba.[64]

The children[65]

The general nutritional condition of the children in the six research areas is assessed by the averages of the main anthropometric measures, as presented in Table 6.4. A look at the weight-for-age figures shows that the earlier-mentioned finding regarding the better nutritional condition of the children in Kwale compared with Kilifi (Table 4.2) applies to all areas, notwithstanding the fact that the areas within each of the two districts differ

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[63] See Table 1.2, p. 11. Also if food production is measured in harvested kilograms of maize (per consumer unit or per labour equivalent), Kibandaongo scores relatively high; see Foeken et al., 1989: 29, 99.

[64] Taken individually, the strong dip in weight-for-height in Kibandaongo and the high starting point in Bamba are statistically significant. With the small sample sizes per area, W-H differences between survey rounds per area or between areas per survey round must be about 4-5% in order to be statistically significant, at an a=0.01.

[65] In this section, only the children between 24 and 120 months of age are taken into consideration. For a justification, see Chapter 5, page 54, footnote 50.

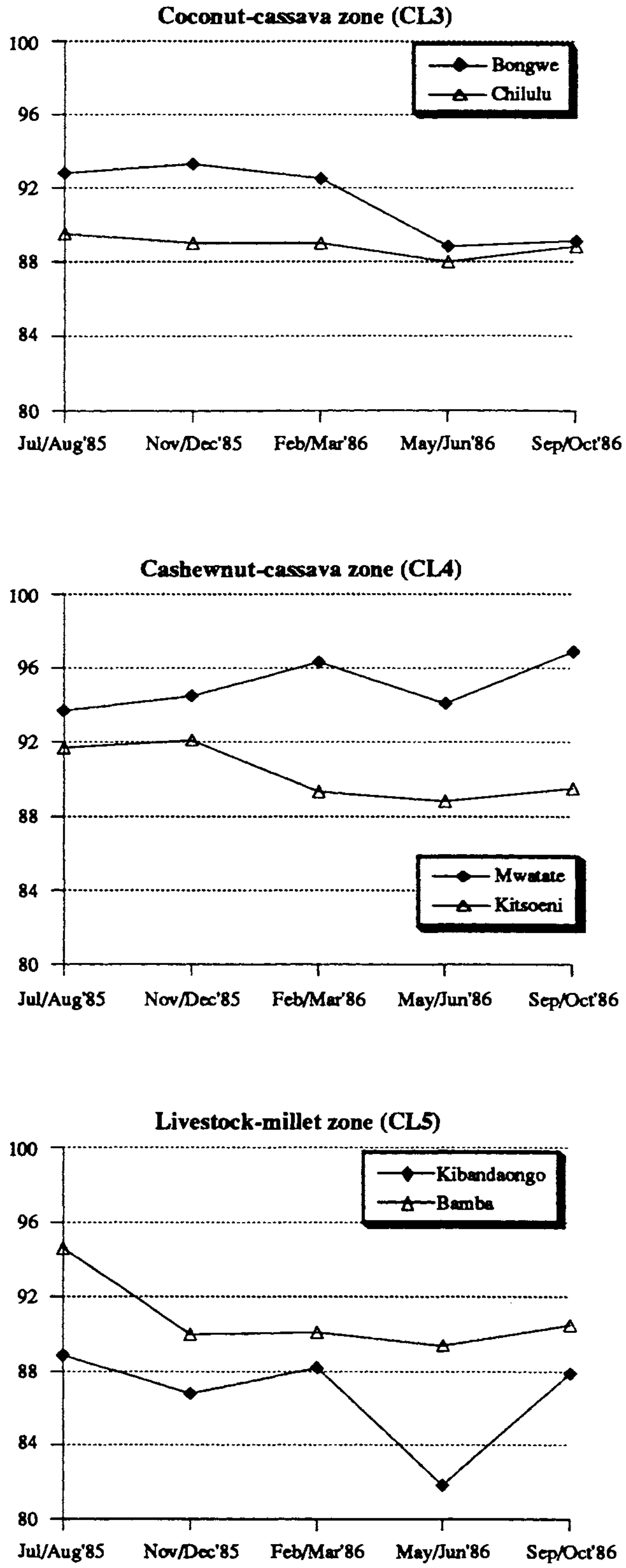

Figure 6.3
Mothers: weight-for-height, by research area and survey round
(Source: Appendix 29)

Table 6.4
Children 24-119 months: main anthropomentric measures, by research area
(averages of all survey rounds)

Research area	*District*	*weight-for-age*	*height-for-age*	*weight-for-height*
Bongwe	Kwale	81.7	94.6	91.1
Chilulu	Kilifi	75.6	90.6	91.2
Mwatate	Kwale	81.8	92.2	95.5
Kitsoeni	Kilifi	77.3	91.8	91.4
Kibandaongo	Kwale	81.8	92.1	95.4
Bamba	Kilifi	78.6	91.6	92.7

Source: Appendix 42

substantially from each other. We can add that this applies also to the children between five and ten years of age. It is interesting to see, however, that the relatively high weight-for-age figure in Bongwe is caused by a high average height-for-age, and in the other two Kwale areas by a high average weight-for-height. Apparently, the children in Bongwe are taller but leaner. This may be related to a more diversified diet in comparison with all other areas. For instance, the consumption of fats is much higher in Bongwe, which is particularly important for the growth of young children.[66]

Table 6.5 shows the average weight growth rates, height growth rates and their degrees of seasonality, while the actual seasonal increments in both weight and height are presented in Table 6.6. The average weight growth during the fourteen months between the beginning and the end of the whole survey was highest in Bongwe and in Kitsoeni (Table 6.5). Bongwe is a relatively prosperous area, with the highest annual income per consumer unit and a relatively high average energy intake. And, as mentioned before, the diet in Bongwe is less one-sided than in the other areas and especially the consumption of fats, which is favourable for the children's growth, is relatively high. The high weight growth rate in Kitsoeni is surprising, because the area is characterized by relatively low incomes and energy intakes. As Table 6.6 shows, it is solely due to the very high growth rate between February-March and May-June (almost 350 grams/month). Before and after this period, the growth rate is very low. As a result, weight growth is very unequal throughout the year, which is reflected in the high

[66] For instance, the youngest children (6-23 months) in Bongwe are comparatively tall: 72.6 cm, against an average of 70.6 cm in all other five areas (while this category of children in Bongwe is on average 6 months younger than the other ones!). So, it seems that young children show a better height growth in Bongwe and keep this lead while becoming older.

Table 6.5
Children 24-119 months: weight growth and height growth, by research area
(all survey rounds)

	Bongwe	*Chilulu*	*Mwatate*	*Kitsoeni*	*Kib'o***	*Bamba*
weight growth						
- average (gr/mth)	170	139	150	167	125	145
- seasonality index*	.21	.28	.34	.53	.24	.55
height growth						
- average (cm/mth)	.56	.55	.56	.56	.59	.49
- seasonality index*	.14	.20	.15	.14	.11	.18

* For method of calculation, see box on page 49. ** Kibandaongo
Source: Appendix 44

Table 6.6
Children 24-119 months: seasonal increments in weight and height, by research area*

	August '85> November '85	*December '85> February '86*	*March '86> May '86*	*June '86> September '86*
Weight growth (grams/month)				
Bongwe (CL3)	146	124	175	<u>236</u>
Chilulu (CL3)	100	100	<u>188</u>	167
Mwatate (CL4)	92	106	<u>228</u>	175
Kitsoeni (CL4)	161	79	<u>344</u>	82
Kibandaongo (CL5)	117	82	115	<u>184</u>
Bamba (CL5)	81	50	<u>266</u>	183
Height growth (cm/month)				
Bongwe (CL3)	.47	<u>.69</u>	.50	.59
Chilulu (CL3)	.49	<u>.79</u>	.44	.49
Mwatate (CL4)	.59	<u>.70</u>	.49	.47
Kitsoeni (CL4)	.53	<u>.72</u>	.47	.53
Kibandaongo (CL5)	.59	<u>.72</u>	.48	.55
Bamba (CL5)	.37	<u>.60</u>	.56	.44

* Peak growth rates are indicated with an underlined figure.
Source: Appendix 44

seasonality index (Table 6.5). This applies also to Bamba, but in this area the fluctuation regarding the children's weight growth rate is more clearly related to energy intake. Energy intake was relatively low in 1985 - a year in which the harvest of the long rains almost completely failed - and this was reflected in relatively low weight growth rates (Table 6.6). During 1986 - a 'normal' year by Bamba standards - this loss was more or less made up.

The lowest average weight growth was found in Kibandaongo (Table 6.5), despite the relatively high level of energy intake in this area. Moreover, while in most areas the children showed a peak in weight growth between February-March and May-June 1986, weight growth of the children in Kibandaongo was relatively low during that period, to rise only during the next months (Table 6.6).

In Section 4.2 (Figure 4.3, page 45), a clear seasonal pattern regarding weight growth could be discerned: a growth 'dip' during the dry season (December-February), followed by a growth peak during the wet season (March-May). However, Table 6.6 reveals that, separately, the areas show a somewhat less uniform picture. The peak in weight growth during March-May can be recognized in four of the six areas. Remarkable is the (already mentioned) very high growth peak in Kitsoeni. It cannot be explained in terms of benefiting from a very high energy intake in the households during this period of high labour requirements in agriculture, because the average energy intake in Kitsoeni during this period is not higher than in the other areas. Most likely, it must be interpreted as 'catching up' the low growth rate during the previous period.

Why then was the average weight growth in Kitsoeni relatively low between December and February? The same question can be posed regarding Bamba in the same and in the preceding period, and regarding Bongwe and Kibandaongo between March and May. There seems to be an indirect relationship between these low weight growth rates of the children and the development in weight-for-height of the mothers. In all four cases, the low weight growth of the children coincides with a substantial drop of the mothers' weight-for-height (see Figure 6.3). The latter leads to the suggestion, that there is a link through a deterioration of child care, possibly resulting from the time pressure caused by high labour requirements for the mothers (leading, for instance, to less time to prepare meals or to visit health centres). The data do not allow further confirmation of this interpretation, but it is consistent with the finding that the younger children (24-59 months) are more affected than the older children (60-119 months).[67] In

[67] In Bamba, for instance, the average weight growth of the younger children between December and February was 30 g/mth (N=63), against 70 g/mth for the older children (N=74). In Kitsoeni, these figures were 40 g/mth (N=36) and 100 g/mth (N=58), respectively. From data regarding Embu (Kenya),

all four cases, this period of relatively low weight growth is followed by a growth peak (Table 6.6). Regarding Bongwe and Kibandaongo, it explains that the peak in weight growth does not take place between March and May, but during the months thereafter.

Regarding height growth rates - both averages and seasonal fluctuations - the areas show much less variation. Except for Bamba, the average height growth during the whole survey period lay between .55 and .60 cm/month (Table 6.5). The lower average in Bamba was due to the very low height growth during the second half of 1985 (Table 6.6). This can be explained by a combination of relatively poor health (short rains) and food shortage (as mentioned, the harvest of the long rains was very poor in 1985).

The general trend concerning height growth as outlined at the end of Section 4.2 (Figure 4.3, page 45) is found in all areas (Table 6.6). Height growth is at its maximum between December and February, i.e. during the dry season. During the rest of the year, height growth is fairly constant. The degrees of seasonality do not differ much between areas either (Table 6.5). Only in Chilulu and Bamba is the seasonality index somewhat higher than in the other areas. Regarding Chilulu, this is caused by the relatively high growth peak during December-February. In Bamba, the cause must be found in the relatively low growth rate during the second half of 1985. In the first instance, this can be explained by the occurrence of a food shortage (as mentioned, the harvest of the long rains was very bad in 1985). Possibly, there is also a health influence as this is the period of the short rains.

6.3. Conclusions

In this concluding section on the research areas, the main results of the foregoing analysis will be presented area-wise. In doing so, some socio-economic characteristics which are considered to be of importance in understanding the main findings will be included in the discussion.[68]

Bongwe

In Bongwe and its direct environment, opportunities for off-farm employment are plenty, especially for self-employment. As a result, the estimated income (per consumer unit) from off-farm work is the highest of the six areas. Despite the favourable agro-

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Paolisso, Baksh & Thomas (1990) note a strong negative correlation between time spent on child care and time spent on food production, indicating that these two activities may directly compete.

[68] See Foeken et al., 1989, Chapter 7.

ecological circumstances, agriculture is of minor importance. For instance, the level of home-produced energy throughout the year is low: on average 17%, which is the lowest of the six areas. Nevertheless, energy intake shows a peak during May-June (2926 kcal per consumer unit), i.e. the period of the highest labour requirements in agriculture. This peak is mainly caused by the high consumption of cassava. Moreover, the mothers' weight-for-height is relatively low then (88.8%), indicating that during that period the women have more work to do than during other times of the year.[69]

The households in Bongwe are characterized by a relatively high income level, a relatively high energy intake, and, moreover, a relatively varied diet in the sense that, compared with the other areas, the intake of fats is rather high. All these factors - and possibly also the fact that the average height of the mothers is somewhat higher than in the other areas - contribute to the high average height-for-age of the children in this area, compared with the other areas (94.6 and 90.6-92.2, respectively). Energy intake increases during the long rains, and so does the children's weight growth (from 124 g/mth to 175 g/mth). However, compared with the children in the other areas, weight growth in that period is lagging behind, which can be related to the deteriorating condition of the mothers. The actual growth peak (236 g/mth) occurs during the months thereafter.

Chilulu

Both farm income and wage income are low in Chilulu. Although the area is situated in an agro-ecological zone with a fairly high potential (the coconut-cassava zone), the agricultural production is very much hampered by land scarcity. As a result, food self-sufficiency is not high: on average, 34% of the total energy intake is derived from home production, and this percentage does not fluctuate very much during the year. Off-farm work opportunities are limited in the direct environment, so people have to migrate - mainly to Mombasa - in order to find wage labour. On the one hand, this enlarges the chance to find a regular job, but on the other hand, only a small proportion of the income earned will reach the household. The average household in Chilulu is therefore among the poorest of the research population.

Energy intake is low: on average 2394 kcal/cu, i.e. almost 600 kcal below the reference requirements. Moreover, it is low throughout the year; the peak in May-June is very modest and attributable to the relatively high consumption of cassava. Nevertheless, the weight-for-height shows no 'dip' at that time, but remains constant

[69] Bongwe is also the only area where relatively many women are engaged in off-farm employment: 25%, against 4% in the other areas (see Foeken et al., 1989: 113). Thus, although agricultural labour is generally less than in the other areas, it comes on top of the off-farm activities.

(about 89.0) throughout the year. This can be related to the relatively low labour requirements, due to the types of crops grown (many coconut trees and cassava plants, compared with maize), a relative abundance of labour (large households and small plots), and the possibility of extending the planting season. The weight growth of the children is also fairly constant. The highest weight growth (188 g/mth) takes place during the long rains, i.e. during the period of higher energy intake.

Mwatate

Like Bongwe, Mwatate is favourably located in relation with off-farm opportunities. Wage income is about three times higher than the income from farming. Thus, the contribution of own-produced energy to the total energy intake is rather modest (26% on annual basis) and shows relatively small fluctuations. The whole year through, food can be bought, witness the relatively high average energy intake (2857 kcal/cu; still, this is 100 kcal/cu below the reference requirements). Energy intake shows strong fluctuations, but this is mainly due to the very high peak in May-June (3210 kcal/cu).

This high intake during the period of hard labour is sufficient to keep the nutritional condition of the women up to the mark (weight-for-height of 94.1). On average, the women in Mwatate have the best nutritional condition of the six areas. Also the children benefit from the relatively high energy intake in May-June, because their weight growth also shows a clear peak then (228 grams/month).

Kitsoeni

As regards off-farm possibilities, Kitsoeni is comparable with Chilulu: opportunities in the direct environment are limited, so people are forced to migrate to Mombasa. Kitsoeni differs from Chilulu, however, in farm size: plots are almost twice as large. Thus, a fairly high food production (mainly maize) can be realized in Kitsoeni. As a result, almost half (48%) of the total energy intake is derived from home-produced energy, but the level of energy self-sufficiency shows strong fluctuations: it is highest shortly after the maize harvest (79%) and gradually decreases to a minimum shortly before the next harvest (18%).

Despite this higher home production in Kitsoeni compared with Chilulu, the average energy intake is about the same (2331 kcal/cu). Energy intake shows a moderate peak in May-June (2585 kcal/cu). This goes together with a fairly low weight-for-height of the women (88.0%), which suggests a lack of cash. The children's weight growth also shows a peak during that time of the year, but on a surprisingly high level (344 grams/month). One may interpret this high weight growth as a catch-up for the low weight growth during the preceding period (79 grams/month), which coincides with a deterioration of the mothers' condition.

Kibandaongo

Off-farm opportunities are very limited in Kibandaongo, while also the agro-ecological potential is rather low. Nevertheless, in 'good' years, a substantial maize harvest can be realized. This was the case in 1985, which explains the high level of home-produced energy (on average 58%). As in Kitsoeni, energy intake from own stocks fluctuates strongly, being 86% in July-August and 19% in May-June of the year thereafter. But again, despite the low level of food self-sufficiency in the latter period, energy intake shows a peak (2882 kcal/cu). This is not sufficient, however, to prevent a deterioration in the nutritional condition of the women (81.8%, against 87.0-89.0% in the other survey rounds). The hard labour to be fulfilled in this period of the year - including casual labour on farms in the surroundings - takes the heaviest toll on women in this area.

The very low weight-for-height of the mothers in Kibandaongo during the peak labour period in May-June has clear repercussions for the children's weight growth: despite the relatively high household energy intake, the weight growth of the children is low compared with the other areas (115 grams/month). During the following months, this growth retardation is somewhat compensated (184 grams/month), be it that the average weight growth level remains low throughout the year.

Bamba

Bamba is a relatively dry area with a low agro-ecological potential (it is suitable for livestock rearing, although less than half of the households own cattle). Food production is limited and very much dependent on the vagaries of the climate. For instance, the harvest of the long rains of 1985 was bad, but of the short rains of 1985 and the long rains of 1986 it was reasonable. On the whole, the contribution of the own food production to the total energy intake is very limited (24%) throughout the year. Because of these limitations, people are forced to seek off-farm employment. Bamba is a small regional administrative center, so there are some local opportunities regarding off-farm jobs. Still, most people depend on Mombasa as the main source of wage labour. On the whole, some wage income reaches many households, so that food can be bought the whole year through.

As a result, energy intake is fairly constant at a medium level (2647 kcal/cu, on average). The same applies to the nutritional condition of the women (a weight-for-height of about 90.0%), with the exception of the first survey round which showed a much higher average weight-for-height, due to the good harvest from the short rainy season of 1984. The subsequent deterioration of the mothers' condition correlates with the children's weight growth, which was the lowest of the six areas in that period (81 grams/month). Because of the very bad harvest of the long rains in that year, a food shortage occurred, which was reflected in an even lower weight growth of the children (50 grams/month). Afterwards, harvests were better and the condition of the mothers remained steady, resulting in much higher growth rates with the children.

7. Concluding remarks

In general, households seek a balance between their resource base on the one hand and their consumption necessities on the other. In food terms, this means that the level of food consumption is determined by the demand for food on the one hand and the supply of food on the other. The demand for food is a function of the physical needs and fluctuates along with the amount of labour to be done. Labour requirements during the agricultural cycle are the main cause of these fluctuations. Because agricultural labour is mainly done by women (especially food production), women are expected to show the largest fluctuations regarding food requirements. The supply of food is determined by two variables: the household's own food production and the amount of food that can be bought. The latter is a function of the monetary income that can be realized.

In order to find a balance between consumption and supply the whole year through, a household can (theoretically) choose between two different strategies. In the first place, the own food production can be made as large as possible. This implies high labour requirements and high physical needs. Secondly, a household can try to realize a monetary income that is at least enough to cover the aspired consumption level. The choice between the first and the second strategy is a relative choice and depends on various factors, such as the agro-ecological potential, the availability of off-farm employment opportunities, and the labour power within a household.

This study shows, that in the Coastal context, households try to opt for the second strategy. Mainly depending on farming activities in order to prevent seasonal stress is very risky in a region where annual rainfall is very unpredictable and where many households are not able to produce enough food to cover the food consumption necessities for one year, not even in a 'good' year. The second strategy entails reliance on food purchases, which can be spread out according to food needs, so that seasonal fluctuations of energy balance can be mitigated. Yet, because the sample consists only of farmers' households, the own food production still forms the (historical) basis of the food supply, irrespective of the level of wage income. In sum, a household's location in relation with both agro-ecological potential and wage labour opportunities is to a large extent decisive for the degree to which any seasonal fluctuations regarding food consumption and nutritional condition occur.

Despite differences between the areas, some general conclusions can be drawn regarding labour, energy intake and the nutritional condition of the women. First, the seasonality in energy intake is to some extent determined by the seasonality in agricultural labour. Labour requirements are highest in May-June and this proves also to be the period of the highest energy intake (2780 kcal/cu for all households). This is not sufficient, however, to prevent a loss of weight in the women: in this period, the average weight-for-height of all women was 88.4,% against about 90.5% during the rest of the year. This can be interpreted as a seasonal fluctuation of the energy balance, i.e. intake minus expenditure.

This picture is especially applicable to those households and areas in which the own food production is relatively high and farming activities are a relatively important source of the household income. In these households, energy intake during the 'peak season' is much higher than in the other households, but at the same time the weight-for-height of the adult women shows a clear 'dip' at that time.

While household income level does influence the level of household food consumption, it is rather surprising that household income level has no straightforward relationship with the seasonal variability of the energy intake and the nutritional condition of the women. In all distinguished income categories, energy intake in May-June shows a maximum and the women's weight-for-height a minimum. This is most clearly the case for the incomes between KSh.1000/cu and KSh.3000/cu. An interesting finding of this study is that it is less clear for the lowest income category, i.e. with an annual income of less than KSh.1000/cu: for the women in this category, weight-for-height is fairly stable throughout the year, be it on a relatively low level. The same low average level is found among the women in the next income category (KSh.1000-1999/cu), but with a stronger 'dip' in May-June. This is explained by the higher (absolute) food production in the latter category. In general, then, household income level is positively related to average household energy intake. Above a threshold of KSh.1000/cu/year, a higher income level means less seasonality in energy intake. This is not true for the seasonality of weight-for-height of the mothers, only the average level is higher in the higher income categories. These higher averages may however compensate for whatever seasonality experienced by these women, because, as one can argue, the same seasonal fluctuation in maternal weight-for-height constitutes less of a stress at higher average weight-for-height levels.

The poorest households - i.e. those below the supposed minimum level - deviate from these trends. While average energy intake is lowest (as one would expect), seasonal fluctuations are limited. Maternal weight-for-height is rather constant throughout the year and not as low as for the households immediately above the minimum level. This may reflect low productive opportunities for the poorest and a relative inability to escape from their situation of poverty.

The second general conclusion regarding labour and energy intake concerns the relationship between total energy intake and the household's own food production. When the contribution of the own food production to the total energy intake is relatively high, an inverse relationship between total energy intake and home-produced energy intake exists. Kitsoeni and Kibandaongo are clear examples of this pattern: energy intake is relatively low during the periods that food stocks are relatively large, and vice versa. The other pattern - a positive relationship between energy intake and home-produced energy - applies most clearly to Bongwe and Bamba. In these areas, own-produced food figures simply as an addition to the food that is bought the whole year through. Thus, the general statement, made at the beginning of this section, that the household's own food production forms the basis of the household's food supply appears to be dependent on the average level of home-produced energy in relationship with the average level of energy intake: in the households depending most on farming, home production is the basis of the food supply, but the labour inputs required to generate it call for an inversely related consumption pattern.

The nutritional condition and growth development of the children is related to household energy intake, the condition of the mothers and the children's health. The average household energy intake lies far below the estimated requirements. The condition of the mothers gives reasons for concern, in particular during periods of peak labour in agriculture. And the health situation in Coast Province is also unfavourable to growth, judging, for instance, from the high prevalence of malaria. As a result, the nutritional condition of the children in Coast Province is poor. Compared with Kenya as a whole, the percentage of stunted children under five is almost twice as high. Wasted children are about three to four times as frequent.

The seasonal fluctuations regarding the children's weight growth appear to be related to energy intake. The labour situation of the mothers, however, affects this relationship, especially where the younger children are concerned.

Neither the average level of height growth nor its seasonality show clear area differences. In all areas, height growth shows a notable peak between December and February, while during the rest of the year height growth is fairly constant. This suggests a relationship with the health situation of the children, as December-February is the driest and healthiest period of the year. In Bamba, both the average height growth and the peak during the dry season are somewhat lower than in the other areas. This can be related to the relatively bad food situation in 1985.

The income level of the household surprisingly has no clear impact on the average growth level - both weight and height growth - but it does have on the seasonal fluctuations of the children's growth. Children in the households with relatively high incomes have a low degree of seasonality regarding both weight growth and height growth, compared with the children in the poorer households. Thus, the latter children show a very unstable growth pattern, both in weight and in height.

To summarize, this study offers the following insights, which can serve as a valuable complement to the classical seasonality scenario found in the literature:
- the effects of an external factor, such as climatic seasonality, come about in interaction with factors internal to the socio-economic system, i.c. coping behaviour of farming households by trying to secure wage labour;
- energy balance is not just under the influence of a push factor (i.c. food availability), but also of a pull factor (i.c. labour requirements), which may even show an inversely related seasonality;
- there is an apparent threshold phenomenon in the relationship between household income and food intake;
- growth velocities seem to be better indicators about what is going on than indices of attained growth;
- child growth throughout the year is strikingly irregular, with height and weight development showing a compensatory seasonal pattern, apparently under the influence of a differential interplay of food availability, health and child care factors.

Appendices

The appendices presented below contain practically all basic figures from which the figures in the text are derived. The presentation of the appendices is such that it can be used as a book of reference for the reader and is structured as follows:

The following figures in the appendices need clarification:

-	stands for not existing
0	stands for smaller than 0.5
0.0	stands for smaller than 0.05.

In Hoorweg et al., 1991, reference is made to some appendices of which the numbers have been altered. The changes are as follows:

reference nr. in Hoorweg et al.	actual appendix number
23	26
30	33
31	34
33	35
34	25

Appendix 1
Study Population: households, by income class and research area
(N)

	Bongwe	Chilulu	Mwatate	Kitsoeni	Kiband'o	Bamba	Total
*income class (per c.u.)**							
KSh.0-999	12	29	19	22	23	18	123
KSh.1000-1999	8	11	8	17	11	8	63
KSh.2000-2999	14	4	9	4	5	12	48
KSh.3000+	16	6	12	7	10	12	63
Total	50	50	48	50	49	50	297

* C.u. stands for consumer unit.

Note on Consumer Units
For the analysis of survey findings at household level, it is important to standardize household size. The most common way is a straight count of the number of household members, which means that each member receives an equal weight. For certain (e.g., demographic) purposes, this is quite appropriate.

For other purposes, however, a weighted summation is often needed because the requirements of household members differ from each other. For example, the food consumption of a child is less than that of an adult, but this is also true for other needs: shelter, clothing, transport, etc.

An approximation of the relative needs is offered by a physiological weighting, namely according to the nutritional requirements of individual household members. This incorporates various biological characteristics: age, sex, physiological status and physical activity level and it offers a fair approximation of overall requirements, also because food consumption forms a large part of overall consumption.

The weights obtained in this way are expressed as "consumer units". One consumer unit (cu) stands for the consumption equivalent (here: in terms of required energy) of anominal adult male. The reference adult male of 20-29 years of age in the Kenyan coastal areas is estimated to need 2960 kcal per day. All other individuals are expressed as a ratio of this unit (adult male equivalents) on the basis of their estimated nutritional energy requirements. For the calculation of these requirements, the most recent international recommendations were used (WHO,1985). Further assumptions that were made in order to fit the reference standards to the circumstances in Coast Province concerned body size, pregnancy and lactation, activity patterns and disease. The energy requirements of the various age and sex groups, expressed in terms of consumer units, are as follows:

age	*male*	*female*	*age*	*male*	*female*	*age*	*male*	*female*
0yr	0.3cu	0.3cu	8-10yr	0.7cu	0.7cu	30-39yr	1.0cu	0.8cu
1yr	0.4cu	0.4cu	11-16yr	0.8cu	0.7cu	40-59yr	0.9cu	0.7cu
2-4yr	0.5cu	0.5cu	17-19yr	0.9cu	0.7cu	60yr+	0.7cu	0.6cu
5-7yr	0.6cu	0.6cu	20-29yr	1.0cu	0.8cu			

Appendix 2

Study population: mothers and children, by survey round

Survey round:	**1** *Jul/Aug '85*	**2** *Nov/Dec '85*	**3** *Feb/Mar '86*	**4** *May/Jun '86*	**5** *Sep/Oct '86*	*Average*
Mothers	346	349	325	324	315	332
Children						
6-11 months	50	48	56	66	61	56
1 year	90	91	85	88	107	92
2 years	122	119	114	100	78	107
3 years	89	97	105	122	109	104
4 years	60	94	103	91	86	87
5 years	104	106	112	121	84	105
6 years	100	96	98	93	98	97
7 years	83	82	83	90	93	86
8 years	94	95	90	87	81	89
9 years	56	52	54	53	89	61
Total	848	880	900	911	886	885
average age, by age class and survey round						
6-23 months	15.6	14.1	14.4	13.6	14.5	14.4
24-59 months	38.4	40.3	42.5	42.3	41.8	41.1
60-119 months	82.5	86.5	89.4	90.1	87.9	87.3

Appendix 3
Food consumption: Dishes

	Jul-Aug 1985	Nov-Dec 1985	Feb-Mar 1986	May-Jun 1986	Sep-Oct 1986	Average	Dish number
(N=)	(283)	(278)	(272)	(269)	(266)	(274)	(see App. 4)
% households consuming dish listed							
uji	49.1	39.6	46.3	46.5	46.2	45.5	10
ugali	98.2	93.2	96.0	91.5	97.0	95.2	11
other cereal dishes	8.8	12.2	7.0	12.3	14.7	11.0	12-14,21,40,41
legume dishes	14.1	19.1	15.1	28.3	28.2	21.0	30-33
roots & tuber dishes	7.1	10.1	7.7	19.0	5.3	9.8	50-55
vegetable dishes	69.6	59.4	31.6	59.5	50.4	54.1	60-66
fish/meat/egg dishes	34.6	34.5	47.1	30.5	38.0	36.9	44-48
single food items [2]	63.3	61.9	66.2	59.5	59.0	62.0	99
snacks [3]	7.8	7.6	3.3	5.2	1.9	5.2	15-20
tea	44.9	42.4	37.5	38.3	46.6	41.9	1
miscellaneous [4]	3.5	8.6	5.1	4.8	0.7	4.5	2-5,80-84
average amount consumed per household (grams)							
uji	242	197	196	220	222	215	10
ugali	2593	2397	2662	2429	2319	2480	11
other cereal dishes	103	169	80	129	191	134	12-14,21,40,41
legume dishes	116	178	131	386	300	222	30-33
roots & tuber dishes	152	188	200	482	104	225	50-55
vegetable dishes	715	559	262	680	428	529	60-66
fish/meat/egg dishes	247	268	293	228	254	258	44-48
single food items [2]	902	746	678	901	483	742	99
snacks [3]	91	104	47	70	26	68	15-20
tea	205	223	169	158	178	187	1
miscellaneous [4]	5	16	13	16	2	10	2-5,80-84

Notes: [1] Includes cooked/steamed banana dishes.
[2] Food items taken singly, such as maize cobs.
of cassava and yam, fruits, bread, milk and sodas.
[3] Specially prepared snacks: includes chapati, maandazi, etc.
[4] Includes minor sidedishes, coffee, cocoa.

Appendix 4

Food consumption: List of dishes

Dish nr.	Dish
1	tea
2	coffee
3	cocoa
4	treetop
5	milk (diluted or made from powder)
10	uji
11	ugali
12	whole maize
13	pilau
14	other cereals
15	chapati
16	maandazi
17	scones
18	kaimati
19	mahamri
20	ricebread
21	pasta
30	peas or beans
31	peas or beans with vegetables
32	green grams
33	cooked bambaranuts/groundnuts
40	rice with peas/beans + green grams
41	maize with peas/beans/bambaranuts
44	fish, cooked
45	fish, fried or roasted
46	meat/poultry, cooked
47	meat/poultry, roasted
48	eggs, fried
50	banana/cassava
51	cassava with beans/peas
52	cassava with vegetables
53	fried cassava
54	mabunbunda
55	cooked/fried Irish potatoes, jam
60	vegetables
61	mango
62	tomatoes
63	brinjals
64	pumpkin, etc.
65	ocra
66	roasted vegetables
80	pilipili
81	roasted seeds or nuts
82	mbilimbi
83	soup/sauce from other dishes
84	tambi
99	any ingredient taken by itself, or with addition of only salt, mostly used for uncooked foods, like fruits, bread, biscuits, and sweets, and also used for some root dishes.

Appendix 5

Food consumption: Ingredients

(% households consuming ingredients listed)

	Jul-Aug 1985	Nov-Dec 1985	Feb-Mar 1986	May-Jun 1986	Sep-Oct 1986	Average	Ingredient number
(N=)	(283)	(278)	(272)	(269)	(266)	(274)	(see App. 7)
Cereals							
maize: fresh	20.1	1.1	1.1	4.5	1.5	5.7	1
maize: dry	3.9	5.8	3.7	5.6	6.0	5.0	2
maize flour	98.6	95.0	98.5	95.5	97.4	97.0	3
rice & rice flour	4.9	6.1	4.4	5.2	8.3	5.8	4,5
millet & millet flour	8.1	8.3	3.3	11.2	1.9	6.6	6,9
wheat & wheat flour	-	0.4	-	0.7	1.1	0.4	10,11
cereal products: bread	15.2	16.2	12.9	13.0	15.4	14.5	13
cereal products: other	14.8	15.1	14.7	13.0	19.9	15.5	12,14-17,84
Grain legumes							
beans	4.2	2.9	5.5	10.0	6.0	5.7	22
green grams	2.1		1.1	3.0	3.0	1.8	23
cow peas	8.5	16.5	9.9	17.1	24.4	15.3	21
pigeon peas	1.4	1.1	0.7	0.4	1.9	1.1	20
other	-	0.7	-	-	-	0.1	24,25
Roots, tubers & starchy staples							
cooking banana	0.4	3.6	2.9	0.4	1.9	1.8	37
cassava	17.7	18.7	16.5	29.7	7.9	18.1	35
cassava flour	0.7	0.4	0.7	1.1	1.5	0.9	36
Irish potato	7.8	4.0	7.0	4.1	2.6	5.1	39
other	0.7	-	-	0.4	1.5	0.5	38,40,41
Vegetables							
cabbage	3.5	3.6	2.2	0.7	2.3	2.5	64
green leaves	64.0	54.7	26.8	56.9	39.9	48.5	60
pumpkin, squash	1.1	-	-	1.1	0.4	0.5	66,67
tomato	31.1	16.2	15.1	5.6	35.7	20.7	63
other	3.9	3.2	0.4	2.2	2.6	2.5	61,62,65,68
Fruits							
sweet banana	1.1	6.8	1.5	1.1	2.3	2.6	70
citrus	3.2	4.7	5.1	3.7	9.8	5.3	74,75
guava, passion fruit	-	-	-	-	1.9	0.4	78,79
mango	4.2	7.9	8.8	18.2	0.4	7.9	71
pawpaw	0.7	6.8	-	1.5	1.5	2.1	72
pineapple	-	0.4	-	-	-	0.1	73
sugar cane	-	1.4	-	-	0.4	0.4	77
other	-	2.5	2.2	1.1	1.9	1.5	42,43,76,80,81

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Appendix 5, continued

Food consumption: Ingredients

(% households consuming ingredients listed)

	Jul-Aug 1985	Nov-Dec 1985	Feb-Mar 1986	May-Jun 1986	Sep-Oct 1986	Average	Ingredient number
(N=)	(283)	(278)	(272)	(269)	(266)	(274)	(see App. 7)
Meats & animal products							
chicken, poultry	3.9	5.4	2.6	4.1	3.4	3.9	48
eggs	0.4	0.7	0.7	1.1	0.8	0.7	49
fish: fresh	5.3	6.8	10.7	6.3	6.0	7.0	54
fish: dry	29.3	24.1	50.7	23.8	36.5	32.9	55
fish: other	3.9	7.6	5.9	6.3	4.5	5.6	56,57
milk: fresh (cow)	18.4	29.5	24.6	15.2	19.2	21.4	50
milk: other	-	-	0.4	1.5	0.4	0.5	51-53
meat: beef	12.0	11.2	9.9	10.0	9.8	10.6	45
meat: other	0.7	1.1	1.5	-	1.1	0.9	46,47,58
Seeds & nuts							
coconut	43.5	39.6	43.8	52.8	44.4	44.8	30
cashewnut	-	1.4	0.4	0.4	-	0.4	31
other	0.4	1.4	0.4	-	-	0.4	32
Miscellaneous							
oils, fats, margarine	23.7	19.1	11.0	14.5	10.9	15.8	93,94
sodas, syrup	-	-	0.4	-	0.4	0.2	90,91
sugar	49.8	49.6	44.5	44.6	51.1	47.9	85
other	3.2	3.2	1.5	2.6	0.8	2.3	86-89,92,95

Appendix 6

Food consumption: Ingredients

(average amount consumed per consumer unit, in grams)

	Jul-Aug 1985	Nov-Dec 1985	Feb-Mar 1986	May-Jun 1986	Sep-Oct 1986	Average	Ingredient number (see App. 7)
(N=)	(283)	(278)	(272)	(269)	(266)	(274)	
Cereals							
maize: fresh	71	2	9	17	6	21	1
maize: dry	8	10	9	8	14	10	2
maize flour	485	481	523	482	444	483	3
rice & rice flour	13	17	9	7	20	13	4,5
millet & millet flour	18	22	6	14	2	12	6,9
wheat & wheat flour	-	0	-	1	1	0	10,11
cereal products: bread	16	22	15	16	22	18	13
cereal products: other	12	16	16	10	20	15	12,14-17,84
Grain legumes							
beans	6	4	5	13	6	7	22
green grams	2	-	1	3	3	2	23
cow peas	11	22	15	41	36	25	21
pigeon peas	1	2	2	0	2	1	20
other	-	1	-	-	-	0	24,25
Roots, tubers & starchy fruits							
cooking banana	2	9	3	0	4	4	37
cassava	68	72	81	160	45	85	35
cassava flour	0	0	1	1	2	1	36
Irish patoto	9	4	9	4	4	6	39
other	2	-	-	6	5	3	38,40,41
Vegetables							
cabbage	8	7	4	1	4	5	64
green leaves	95	97	39	121	50	80	60
pumpkin, squash	4	-	-	8	2	3	66,67
tomato	29	8	6	2	27	14	63
other	3	5	0	3	3	3	61,62,65,68
Fruits							
sweet banana	1	8	3	1	5	4	70
citrus	1	1	1	2	8	3	74,75
guava, passion fruit	-	-	-	-	3	1	78,79
mango	3	8	9	51	0	14	71
pawpaw	2	13	-	3	5	5	72
pineapple	-	2	-	-	-	0	73
sugar cane	-	1	-	-	0	0	77
other	-	1	0	0	0	0	42,43,76,80,81

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Appendix 6, continued

Food consumption: Ingredients

(average amount consumed per household, in grams)

	Jul-Aug 1985	Nov-Dec 1985	Feb-Mar 1986	May-Jun 1986	Sep-Oct 1986	Average	Ingredient number
(N=)	(283)	(278)	(272)	(269)	(266)	(274)	(see App. 7)
Meats & animal products							
chicken, poultry	7	6	3	3	3	4	48
eggs	0	0	0	0	1	0	49
fish: fresh	5	8	10	8	12	9	54
fish: dry	7	8	17	5	8	9	55
fish: other	4	7	6	6	5	6	56,57
milk: fresh (cow)	38	60	54	28	38	44	50
milk: other	-	-	0	1	0	0	51-53
meat: beef	14	19	13	24	16	17	45
meat: other	1	3	5	-	1	2	46,47,58
Seeds & nuts							
coconut	27	23	24	38	34	29	30
cashewnut	-	0	0	1	-	0	31
other	0	1	0	-	-	0	32
Miscellaneous							
oils, fats, margarine	7	8	2	5	2	5	93,94
sodas, syrup	-	-	1	-	1	0	90,91
sugar	30	30	21	28	26	27	85
other	0	0	0	0	0	0	86-89,92,95

Appendix 7
Food consumption: List of ingredients

Ingr. nr.	Ingredient	Ingr. nr.	Ingredient
1	maize, fresh	53	lactogen
2	maize, dry	54	fish, fresh
3	maize flour	55	fish, dried
4	rice	56	fish, fried
5	rice flour	57	fish, roasted
6	wheat	58	other types of meat
9	wheat flour	60	leaf vegetables
10	millet	61	brinjal
11	millet flour	62	ocra
12	cerelac	63	tomato
13	bread	64	cabbage
14	biscuits	65	carrot
15	toast	66	gourd, squash, marrow
16	cake	67	pumpkin
17	weetabix	68	sweet pepper (green/red)
20	pigeon peas	70	sweet banana
21	cow peas	71	mango
22	beans	72	pawpaw
23	green grams	73	pineapple
24	ground nut	74	citrus (whole)
25	bambara nut	75	citrus (juice)
30	coconut	76	cashew apple
31	cashewnut	77	sugar cane
32	simsim	78	passion fruit
35	cassava	79	guava
36	cassava flour	80	mbirimbi
37	cooking banana	81	tamarind
38	sweet potato	84	buiton
39	Irish potato	85	sugar, glucose
40	yam	86	sweets
41	arrowroot	87	cocoa
45	beef	88	milo
46	goat/sheep	89	roiko mix
47	dikdik & antilope	90	sodas
48	poultry	91	sirup (treetop)
49	eggs	92	pilipili
50	milk, cow (fresh & sour)	93	blueband
51	milk powder	94	fat, oil
52	milk, goat	95	yeast

Appendix 8
Food consumption: Food groups (grams)

	Jul-Aug 1985	Nov-Dec 1985	Feb-Mar 1986	May-Jun 1986	Sep-Oct 1986	Average
(N=)	(283)	(278)	(272)	(269)	(266)	(274)
Average amount consumed per household						
Cereals	3354	2942	3022	2917	2842	3015
Legumes	88	158	119	339	298	200
Roots, tubers, starchy staples	408	383	504	780	211	457
Vegetables	707	566	260	645	422	520
Fruits	17	153	52	246	85	111
Animal products	392	510	474	373	322	414
Fats	27	37	12	26	10	22
Oil seeds & nuts	153	127	120	171	203	155
Miscellaneous	144	130	105	126	113	124
Total	5290	5006	4668	5623	4502	5018
Average amount consumed per consumer unit						
Cereals	600	555	562	545	528	558
Legumes	17	29	22	54	47	34
Roots, tubers, starchy staples	77	86	93	171	60	97
Vegetables	135	118	48	135	87	105
Fruits	4	34	13	56	20	25
Animal products	72	107	100	72	83	87
Fats	5	8	2	5	2	4
Oil seeds & nuts	27	23	23	39	34	29
Miscellaneous	27	28	21	28	26	26
Total	964	988	884	1105	887	966

Appendix 9

Food Consumption: Nutrients
(per consumer unit)

		Jul-Aug 1985	Nov-Dec 1985	Feb-Mar 1986	May-Jun 1986	Sep-Oct 1986	Average
	(N=)	(283)	(278)	(272)	(269)	(266)	(274)
Energy							
	Average (Kcal)	2511	2632	2507	2780	2458	2578
	Distribution: % of requirements [1]						
	100+	29	32	29	37	28	31
	80-99.9	17	20	22	23	18	20
	60-79.9	29	21	20	17	26	23
	<60	25	27	29	23	28	26
		100	100	100	100	100	100
Proteins							
	Average (grams)	69	73	71	75	72	72
	Distribution: % of minimum level [2]						
	100+	69	67	68	70	65	68
	80-99.9	13	12	11	10	16	12
	60-79.9	8	9	11	9	10	9
	<60	10	12	11	12	9	11
		100	100	101	101	100	100
Fat							
	Average (grams)	35	40	30	35	35	35

Notes:

[1] Energy requirements are put at 2960 kcal/cu/day (see Foeken et al., 1989: 146).

[2] A safe level of protein intake is estimated at 50 g/cu/day (see WHO/FAO/UNU, 1985: 133).

Note on the calculation of a safe level of protein consumption per consumer unit

The study results on one-day protein intake per consumer unit have been derived from aggregate household food consumption data, and as such indicate only how much dietary protein was available from the pot; they do not correct in any way for (interindividual) distribution of protein between household members. Hence, the proposed procedure for the calculation of the protein allowance for a household (WHO/FAO/UNU, 1985: Table 55) could be followed here.

The procedure is, to derive first an average protein requirement and then to add a margin for statistical uncertainty (conventionally: + 2 standard deviations). While the coefficient of variation (CV) of individual protein requirements is estimated to be 12.5%, the CV for aggregate household requirement is much less, as summing up of individual variances gives a lower overall variance (op cit., table 55). On the basis of a model household with about 6 consumer units, a CV of aggregate household protein requirement of about 4.5% can be derived.

One consumer unit corresponds to an energy intake of 2960 kcal (for a nominal adult male). The same male needs on average 0.6 g reference (ideal) protein per kg body weight. Assuming a protein digestibility of 88%, his average requirement in terms of dietary protein (body weight: 60.3 kg) would be 41.4 g (5.55% of the energy). His individual "save level" of protein would be that amount plus 2 times the CV of 12.5% (see above), that is 51.4 g, which represents 6.94% of the energy. However, members of the vulnerable groups (children below 3, adolescents, women and the elderly) have relatively higher protein requirements within a given amount of energy; besides, children and adolescents have relatively high requirements of the essential amino acids, so that their requirements have to be corrected upwards to account for protein quality.

Therefore, an average requirement of dietary protein of 6% of the energy has been chosen here (this corresponds to a "safe level" of 7.5% on an individual basis). The safe amount per consumer unit (supposing ideal distribution among individuals; see above) becomes then 6% of 2960 kcal, that is 44.4 g dietary protein, plus two times the CV of 4.5%, that makes a "safe household level per consumer unit" of 48.4 g dieatry protein. This figure has been rounded to 50 g.

Appendix 10

Food Consumption: Composition energy

(kcal/day/consumer unit)

	Jul-Aug 1985	Nov-Dec 1985	Feb-Mar 1986	May-Jun 1986	Sep-Oct 1986	Average
(N=)	(283)	(278)	(272)	(269)	(266)	(274)
Food Groups						
Cereals	1948	1940	1956	1872	1836	1910
Legumes	52	97	74	180	155	112
Roots, tubers, starchy staples	113	125	138	257	89	144
Vegetables	52	41	13	43	22	34
Fruits	2	22	10	34	13	16
Animal products	111	159	154	132	132	138
Fats	49	68	17	40	21	39
Oil seeds & nuts	75	67	65	112	86	81
Miscellaneous	108	113	81	110	103	103
Total	2511	2632	2507	2780	2458	2578
Home-produced						
Cereals	811	659	469	162	790	578
Legumes	19	55	19	86	96	55
Roots, tubers, starchy staples	82	108	114	190	85	116
Vegetables	45	36	10	40	19	30
Fruits	2	15	9	34	11	14
Animal products	22	24	37	30	12	25
Fats	-	2	1	1	0	1
Oil seeds & nuts	49	51	51	71	72	59
Miscellaneous	0	1	0	1	1	1
Total	1030	953	710	616	1087	879

Appendix 11

Food Consumption: Composition proteins
(grams/day/consumer unit)

	Jul-Aug 1985	Nov-Dec 1985	Feb-Mar 1986	May-Jun 1986	Sep-Oct 1986	Average
(N=)	283	278	272	269	266	273.6
Food Groups						
Cereals	47.5	46.3	46.0	43.4	44.0	45.4
Legumes	3.5	6.3	4.9	11.9	10.2	7.4
Roots, tubers, starchy staples	0.6	0.7	0.8	1.3	0.5	0.8
Vegetables	4.9	3.7	1.0	3.6	1.6	3.0
Fruits	0.0	0.2	0.1	0.3	0.2	0.2
Animal products	11.0	14.6	17.4	12.1	13.8	13.8
Fats	-	-	-	-	-	-
Oil seeds & nuts	1.3	1.2	1.1	1.9	1.4	1.4
Miscellaneous	-	-	-	-	-	-
Total	68.8	73.0	71.2	74.6	71.8	71.9
Home-produced						
Cereals	21.5	17.0	12.2	4.3	20.3	15.1
Legumes	1.2	3.5	1.2	5.6	6.3	3.6
Roots, tubers, starchy staples	0.4	0.5	0.5	1.0	0.5	0.6
Vegetables	4.4	3.4	0.8	3.3	1.4	2.7
Fruits	0.0	0.2	0.1	0.3	0.1	0.1
Animal products	2.1	1.9	4.1	2.7	1.1	2.4
Fats	-	-	-	-	-	-
Oil seeds & nuts	0.8	0.9	0.9	1.3	1.2	1.0
Miscellaneous	-	-	-	-	-	-
Total	30.5	27.4	19.8	18.5	30.9	25.4

Appendix 12

Food Consumption: energy intake, by household size

(kcal/cu/day)

	Jul-Aug 1985	Nov-Dec 1985	Feb-Mar 1986	May-Jun 1986	Sep-Oct 1986	Average
Nr. of consumer units						
<3	2767	3048	2771	3252	2994	2966
3-5.9	2646	2753	2539	2675	2413	2605
6-8.9	2294	2428	2367	2741	2304	2427
9-11.9	2171	1972	2148	2208	1962	2092
12+	2111	1921	2399	2223	2075	2146
N's						
<3	52	58	57	64	55	57
3-5.9	122	122	120	107	113	117
6-8.9	67	58	59	69	67	64
9-11.9	25	24	27	19	19	23
12+	17	16	9	10	12	13

Appendix 13

Food Consumption: Income class 1 (KSh. 0-999/cu)

	Jul-Aug 1985	Nov-Dec 1985	Feb-Mar 1986	May-Jun 1986	Sep-Oct 1986	Average
(N=)	(118)	(117)	(115)	(110)	(113)	(115)
Food Groups: grams/consumer unit						
Cereals	589	528	558	534	534	549
Legumes	16	17	17	54	47	30
Roots, tubers, starchy staples	57	87	114	186	40	97
Vegetables	148	120	49	145	98	112
Fruits	0	13	5	46	12	15
Animal products	46	65	69	32	60	54
Fats	5	4	0	1	2	2
Oils seeds & nuts	23	23	22	33	39	28
Miscellaneous	18	19	12	14	23	17
Total	902	876	846	1045	855	905
Nutrients (average/consumer unit)						
Energy (kcal)	2355	2372	2454	2611	2366	2432
Protein (grs)	66	65	71	69	66	67
Fat (grs)	31	30	26	27	32	29
Contribution macro-nutrients to energy intake						
Carbohydrates	1814	1841	1937	2093	1815	1900
Fats	278	272	234	240	286	262
Proteins	263	260	283	278	265	270
Energy by food group (kcal/cu)						
Cereals	1912	1862	1967	1838	1847	1885
Legumes	52	58	59	180	146	99
Roots, tubers, starchy staples	83	127	172	277	57	143
Vegetables	57	42	14	46	27	37
Fruits	0	8	3	28	10	10
Animal products	75	102	127	71	94	94
Fats	41	34	4	12	14	21
Oils seeds & nuts	63	64	62	104	86	76
Miscellaneous	71	76	46	54	85	66
Total	2355	2372	2454	2611	2366	2432
Home-produced energy by food group (kcal/cu)						
Cereals	879	652	437	176	763	581
Legumes	26	36	8	118	92	56
Roots, tubers, starchy staples	62	113	157	219	56	121
Vegetables	52	37	11	46	25	34
Fruits	0	5	3	28	9	9
Animal products	10	8	42	15	4	16
Fats	-	-	1	-	1	0
Oils seeds & nuts	41	49	48	78	76	58
Miscellaneous	0	0	-	0	0	0
Total	1069	902	708	680	1027	877

Appendix 14

Food Consumption: Income class 2 (KSh. 1000-1999/cu)

	Jul-Aug 1985	Nov-Dec 1985	Feb-Mar 1986	May-Jun 1986	Sep-Oct 1986	Average
(N=)	(62)	(57)	(56)	(58)	(54)	(57)
Food Groups: grams/consumer unit						
Cereals	598	586	530	576	470	552
Legumes	22	52	14	32	47	33
Roots, tubers, starchy staples	96	94	83	151	81	101
Vegetables	120	102	56	168	99	109
Fruits	5	18	18	103	21	33
Animal products	34	84	48	85	34	57
Fats	6	12	3	4	2	5
Oil seeds & nuts	36	34	27	39	35	34
Miscellaneous	24	26	19	27	18	23
Total	941	1008	798	1185	807	948
Nutrients (average/consumer unit)						
Energy (kcal)	2503	2841	2314	2870	2229	2551
Protein (grs)	66	80	61	75	65	69
Fat (grs)	35	46	26	36	31	35
Contribution macro-nutrients to energy intake						
Carbohydrates	1926	2108	1839	2245	1686	1961
Fats	313	413	232	326	283	313
Proteins	264	319	243	300	261	277
Energy by food group (kcal/cu)						
Cereals	1946	2047	1867	2023	1647	1906
Legumes	55	176	46	107	160	109
Roots, tubers, starchy staples	144	138	119	226	114	148
Vegetables	48	34	16	54	26	36
Fruits	3	8	11	65	10	19
Animal products	56	134	74	146	91	100
Fats	52	106	28	32	14	46
Oils seeds & nuts	105	94	76	109	97	96
Miscellaneous	94	104	78	107	71	91
Total	2503	2841	2314	2870	2229	2551
Home-produced energy by food group (kcal/cu)						
Cereals	937	772	513	189	854	653
Legumes	24	113	18	32	100	57
Roots, tubers, starchy staples	110	132	96	165	111	123
Vegetables	42	29	12	45	22	30
Fruits	3	8	11	65	10	19
Animal products	23	11	12	40	0	17
Fats	-	10	-	1	-	2
Oils seeds & nuts	73	83	66	84	84	78
Miscellaneous	0	5	0	0	-	1
Total	1212	1163	729	621	1181	981

Appendix 15

Food Consumption: Income class 3 (KSh. 2000-2999/cu)

	Jul-Aug 1985	Nov-Dec 1985	Feb-Mar 1986	May-Jun 1986	Sep-Oct 1986	Average
(N=)	(47)	(46)	(46)	(44)	(42)	(45)
Food Groups: grams/consumer unit						
Cereals	541	581	589	568	573	570
Legumes	8	33	31	76	49	39
Roots, tubers, starchy staples	55	101	96	153	69	95
Vegetables	105	116	53	120	73	93
Fruits	6	39	9	45	9	22
Animal products	79	150	130	96	112	113
Fats	8	9	3	11	2	7
Oil seeds & nuts	27	18	15	45	35	28
Miscellaneous	39	39	32	43	30	37
Total	868	1086	958	1157	952	1004
Nutrients (average/consumer unit)						
Energy (kcal)	2444	2869	2690	3055	2718	2755
Protein (grs)	65	79	77	84	78	77
Fat (grs)	37	48	34	44	41	41
Contribution macro-nutrients to energy intake						
Carbohydrates	1849	2123	2075	2325	2032	2081
Fats	336	430	306	396	372	368
Proteins	259	315	309	334	314	306
Energy by food group (kcal/cu)						
Cereals	1851	2010	2039	1973	2004	1975
Legumes	26	103	105	257	165	131
Roots, tubers, starchy staples	83	150	138	232	105	142
Vegetables	40	42	14	39	16	30
Fruits	4	26	8	25	5	14
Animal products	142	243	196	141	192	183
Fats	70	83	29	94	16	58
Oils seeds & nuts	75	55	42	125	97	79
Miscellaneous	153	156	120	170	118	143
Total	2444	2869	2690	3055	2718	2755
Home-produced energy by food group (kcal/cu)						
Cereals	447	535	412	188	753	467
Legumes	-	53	19	124	80	55
Roots, tubers, starchy staples	50	97	77	146	97	93
Vegetables	33	37	12	36	12	26
Fruits	3	14	8	23	4	10
Animal products	16	52	20	16	12	23
Fats	-	-	-	0	1	0
Oils seeds & nuts	35	35	25	52	84	46
Miscellaneous	0	0	0	-	6	1
Total	586	823	573	586	1050	724

Appendix 16

Food Consumption: Income class 4 (KSh. 3000-3999/cu)

	Jul-Aug 1985	Nov-Dec 1985	Feb-Mar 1986	May-Jun 1986	Sep-Oct 1986	Average
(N=)	(27)	(29)	(28)	(29)	(29)	(28)
Food Groups: grams/consumer unit						
Cereals	686	602	569	516	507	576
Legumes	8	30	27	58	57	36
Roots, tubers, starchy staples	90	57	21	250	78	99
Vegetables	150	110	47	79	79	93
Fruits	14	142	14	52	46	54
Animal products	129	135	109	118	100	118
Fats	3	9	3	11	2	6
Oil seeds & nuts	28	27	29	48	29	32
Miscellaneous	47	48	35	49	47	45
Total	1155	1160	854	1181	945	1059
Nutrients (average/consumer unit)						
Energy (kcal)	2858	2942	2556	3021	2564	2788
Protein (grs)	77	82	75	82	76	78
Fat (grs)	40	48	36	54	34	42
Contribution macro-nutrients to energy intake						
Carbohydrates	2196	2183	1928	2204	1953	2093
Fats	355	432	327	489	308	382
Proteins	306	327	300	328	303	313
Energy by food group (kcal/cu)						
Cereals	2180	2072	1985	1701	1761	1940
Legumes	26	100	91	186	192	119
Roots, tubers, starchy staples	131	86	22	372	121	146
Vegetables	54	37	12	22	20	29
Fruits	8	98	10	31	37	37
Animal products	170	199	201	277	145	198
Fats	22	81	28	103	21	51
Oils seeds & nuts	79	79	66	133	81	88
Miscellaneous	188	190	141	196	186	180
Total	2858	2942	2556	3021	2564	2788
Home-produced energy by food group (kcal/cu)						
Cereals	839	949	467	81	725	612
Legumes	26	18	24	54	133	51
Roots, tubers, starchy staples	56	82	13	298	103	110
Vegetables	47	34	6	20	11	24
Fruits	8	79	8	30	19	29
Animal products	32	7	24	68	11	28
Fats	-	-	-	3	-	1
Oils seeds & nuts	63	48	52	70	49	56
Miscellaneous	-	0	-	12	0	2
Total	1071	1217	594	636	1051	914

Appendix 17

Food Consumption: Income class 5 (KSh. 4000+/cu)

	Jul-Aug 1985	Nov-Dec 1985	Feb-Mar 1986	May-Jun 1986	Sep-Oct 1986	Average
(N=)	(29)	(29)	(27)	(28)	(28)	(28)
Food Groups: grams/consumer unit						
Cereals	670	511	595	514	570	572
Legumes	32	25	38	59	38	38
Roots, tubers, starchy staples	139	67	98	96	67	93
Vegetables	153	150	20	113	51	97
Fruits	5	32	42	23	45	29
Animal products	199	227	285	112	211	207
Fats	8	11	2	2	8	6
Oil seeds & nuts	21	10	32	39	20	24
Miscellaneous	34	33	27	37	32	33
Total	1261	1066	1139	995	1042	1101
Nutrients (average/consumer unit)						
Energy (kcal)	2951	2578	2771	2573	2778	2730
Protein (grs)	87	74	81	73	92	81
Fat (grs)	48	44	47	34	44	43
Contribution macro-nutrients to energy intake						
Carbohydrates	2176	1882	2022	1971	2015	2013
Fats	428	400	424	310	393	391
Proteins	347	297	324	291	369	326
Energy by food group (kcal/cu)						
Cereals	2043	1801	1920	1710	1983	1891
Legumes	109	86	128	201	129	131
Roots, tubers, starchy staples	205	91	151	158	115	144
Vegetables	56	55	5	39	10	33
Fruits	3	26	40	13	23	21
Animal products	270	259	314	175	260	256
Fats	70	98	19	18	74	56
Oils seeds & nuts	58	29	88	109	55	68
Miscellaneous	137	133	106	150	129	131
Total	2951	2578	2771	2573	2778	2730
Home-produced energy by food group (kcal/cu)						
Cereals	828	370	613	95	899	561
Legumes	7	60	62	44	96	54
Roots, tubers, starchy staples	176	83	139	92	111	120
Vegetables	46	49	3	37	7	28
Fruits	2	10	34	9	22	15
Animal products	66	85	108	53	66	76
Fats	-	4	-	-	-	1
Oils seeds & nuts	37	25	77	51	40	46
Miscellaneous	-	4	-	-	0	1
Total	1162	690	1036	381	1241	901

Appendix 18
Food Consumption: household economies

	Jul-Aug 1985	Nov-Dec 1985	Feb-Mar 1986	May-Jun 1986	Sep-Oct 1986	Average
Grams/consumer unit						
Poor	900	875	846	1046	854	904
Farmers	968	1000	757	1230	921	975
Wage earners	887	1019	866	1067	879	944
Mixed economies	1032	1160	928	1264	878	1052
Rich	1260	1067	1136	996	1042	1100
Total energy intake (kcal/cu)						
Poor	2355	2372	2454	2611	2366	2432
Farmers	2601	2832	2183	3053	2543	2642
Wage earners	2373	2734	2476	2688	2420	2538
Mixed economies	2727	3044	2698	3233	2489	2838
Rich	2951	2579	2771	2572	2776	2730
N's						
Poor	118	117	115	110	113	115
Farmers	30	29	27	28	24	28
Wage earners	56	53	54	55	52	54
Mixed economies	50	50	49	48	49	49
Rich	29	29	27	28	28	28

Appendix 19
Food Consumption: Bongwe

	Jul-Aug 1985	Nov-Dec 1985	Feb-Mar 1986	May-Jun 1986	Sep-Oct 1986	Average
(N=)	(45)	(47)	(46)	(45)	(45)	(46)
Food Groups: grams/consumer unit						
Cereals	406	438	461	291	488	417
Legumes	2	25	28	81	26	32
Roots, tubers, starchy staples	181	232	180	425	125	229
Vegetables	55	63	24	14	40	39
Fruits	20	83	11	100	19	47
Animal products	89	126	154	134	170	135
Fats	10	17	5	9	9	10
Oils seeds & nuts	35	29	28	97	36	45
Miscellaneous	73	70	48	76	66	67
Total	871	1083	939	1227	979	1020
Nutrients (average/consumer unit)						
Energy (kcal)	2262	2710	2493	2926	2670	2612
Protein (grs)	48	63	69	76	68	65
Fat (grs)	40	56	41	64	52	51
Contribution macro-nutrients to energy intake						
Carbohydrates	1712	1954	1848	2049	1930	1899
Fats	359	504	367	573	466	454
Proteins	191	252	278	304	273	260
Energy by food group (kcal/cu)						
Cereals	1334	1471	1581	998	1674	1412
Legumes	8	75	94	268	87	106
Roots, tubers, starchy staples	273	344	271	656	211	351
Vegetables	20	20	5	4	9	12
Fruits	12	53	8	57	10	28
Animal products	137	221	227	285	248	224
Fats	91	154	45	84	81	91
Oils seeds & nuts	96	94	80	270	102	128
Miscellaneous	292	279	183	303	248	261
Total	2262	2710	2493	2926	2670	2612
Home-produced energy by food group (kcal/cu)						
Cereals	32	81	33	9	238	79
Legumes	1	35	25	6	11	16
Roots, tubers, starchy staples	174	259	156	363	204	231
Vegetables	12	9	-	3	2	5
Fruits	12	31	4	52	8	21
Animal products	13	9	1	2	1	5
Fats	-	-	-	2	-	0
Oils seeds & nuts	76	59	57	136	69	79
Miscellaneous	-	1	0	-	-	0
Total	319	484	275	572	533	437

Appendix 20
Food Consumption: Chilulu

	Jul-Aug 1985	Nov-Dec 1985	Feb-Mar 1986	May-Jun 1986	Sep-Oct 1986	Average
(N=)	(50)	(49)	(48)	(50)	(50)	(49)
Food Groups: grams/consumer unit						
Cereals	601	505	485	476	434	500
Legumes	13	37	7	22	27	21
Roots, tubers, starchy staples	121	135	198	301	58	163
Vegetables	95	51	64	87	92	78
Fruits	1	11	0	1	26	8
Animal products	27	33	44	21	24	30
Fats	4	2	0	1	0	1
Oil seeds & nuts	58	52	43	34	87	55
Miscellaneous	25	14	15	23	17	19
Total	945	840	857	966	765	875
Nutrients (average/consumer unit)						
Energy (kcal)	2629	2448	2327	2449	2115	2394
Protein (grs)	66	65	59	57	59	61
Fat (grs)	37	36	27	22	38	32
Contribution macro-nutrients to energy intake						
Carbohydrates	2032	1867	1850	2020	1534	1861
Fats	334	321	242	202	346	289
Proteins	263	260	235	226	236	244
Energy by food group (kcal/cu)						
Cereals	2007	1776	1708	1659	1523	1735
Legumes	44	125	25	75	91	72
Roots, tubers, starchy staples	176	204	294	446	86	241
Vegetables	35	15	18	24	28	24
Fruits	0	5	0	1	21	5
Animal products	64	113	109	49	54	78
Fats	38	13	1	6	-	12
Oils seeds & nuts	168	139	111	97	245	152
Miscellaneous	97	56	60	91	68	74
Total	2629	2448	2327	2449	2115	2394
Home-produced energy by food group (kcal/cu)						
Cereals	436	482	165	151	687	384
Legumes	-	98	4	-	8	22
Roots, tubers, starchy staples	155	203	289	444	85	235
Vegetables	31	14	13	24	24	21
Fruits	0	5	0	1	21	5
Animal products	13	3	13	11	5	9
Fats	-	11	-	-	-	2
Oils seeds & nuts	130	126	109	97	245	141
Miscellaneous	1	-	0	0	5	1
Total	764	942	593	728	1080	821

Appendix 21
Food Consumption: Mwatate

	Jul-Aug 1985	Nov-Dec 1985	Feb-Mar 1986	May-Jun 1986	Sep-Oct 1986	Average
(N=)	(44)	(44)	(44)	(42)	(42)	(43)
Food Groups: grams/consumer unit						
Cereals	614	658	580	663	625	628
Legumes	30	20	18	58	42	34
Roots, tubers, starchy staples	107	60	39	136	162	101
Vegetables	119	172	49	233	131	141
Fruits	2	41	51	12	41	29
Animal products	70	110	75	65	114	87
Fats	8	6	4	10	4	6
Oils seeds & nuts	23	8	16	28	20	19
Miscellaneous	30	33	29	38	37	33
Total	1003	1108	861	1243	1176	1078
Nutrients (average/consumer unit)						
Energy (kcal)	2765	2916	2383	3210	3033	2861
Protein (grs)	76	88	70	86	90	82
Fat (grs)	40	33	30	38	42	37
Contribution macro-nutrients to energy intake						
Carbohydrates	2099	2264	1834	2530	2299	2205
Fats	361	300	268	338	375	328
Proteins	305	353	281	343	359	328
Energy by food group (kcal/cu)						
Cereals	2033	2291	1894	2314	2139	2134
Legumes	101	67	62	195	144	114
Roots, tubers, starchy staples	159	74	44	194	215	137
Vegetables	50	64	15	79	31	48
Fruits	1	28	36	8	26	20
Animal products	168	185	140	100	240	167
Fats	70	54	33	92	35	57
Oils seeds & nuts	63	21	45	78	55	52
Miscellaneous	119	132	114	150	147	132
Total	2765	2916	2383	3210	3033	2861
Home-produced energy by food group (kcal/cu)						
Cereals	524	614	756	118	568	516
Legumes	39	16	5	-	85	29
Roots, tubers, starchy staples	125	62	30	161	193	114
Vegetables	41	56	12	67	26	40
Fruits	1	25	34	8	14	16
Animal products	12	10	8	13	14	11
Fats	-	3	-	0	-	1
Oils seeds & nuts	22	11	27	21	28	22
Miscellaneous	-	-	-	8	-	2
Total	764	797	872	396	928	751

Appendix 22
Food Consumption: Kitsoeni

	Jul-Aug 1985	Nov-Dec 1985	Feb-Mar 1986	May-Jun 1986	Sep-Oct 1986	Average
(N=)	(48)	(45)	(48)	(48)	(44)	(47)
Food Groups: grams/consumer unit						
Cereals	520	505	541	584	408	512
Legumes	41	70	46	11	56	45
Roots, tubers, starchy staples	7	20	66	20	0	23
Vegetables	92	43	3	137	88	73
Fruits	0	22	5	206	7	48
Animal products	23	84	29	24	36	39
Fats	6	16	0	6	0	6
Oils seeds & nuts	32	45	39	50	44	42
Miscellaneous	9	22	11	9	8	12
Total	730	827	740	1047	647	798
Nutrients (average/consumer unit)						
Energy (kcal)	2236	2600	2387	2585	1821	2326
Protein (grs)	67	79	68	64	62	68
Fat (grs)	37	55	26	34	25	35
Contribution macro-nutrients to energy intake						
Carbohydrates	1636	1792	1885	2026	1348	1737
Fats	331	493	231	303	225	317
Proteins	269	315	272	257	248	272
Energy by food group (kcal/cu)						
Cereals	1830	1782	1911	2054	1440	1803
Legumes	138	238	155	38	189	152
Roots, tubers, starchy staples	7	29	100	30	-	33
Vegetables	34	12	1	37	26	22
Fruits	0	14	2	129	3	30
Animal products	51	165	68	55	62	80
Fats	51	145	-	46	2	49
Oils seeds & nuts	89	125	109	161	65	110
Miscellaneous	36	89	42	34	33	47
Total	2236	2600	2387	2585	1821	2326
Home-produced energy by food group (kcal/cu)						
Cereals	1625	953	339	118	1289	865
Legumes	57	146	44	16	109	74
Roots, tubers, starchy staples	-	27	99	29	-	31
Vegetables	30	11	1	33	23	20
Fruits	0	12	2	129	3	29
Animal products	2	63	2	7	10	17
Fats	-	-	-	-	2	0
Oils seeds & nuts	53	99	88	123	51	83
Miscellaneous	-	6	-	0	-	1
Total	1768	1317	575	456	1488	1121

Appendix 23
Food Consumption: Kibandaongo

	Jul-Aug 1985	Nov-Dec 1985	Feb-Mar 1986	May-Jun 1986	Sep-Oct 1986	Average
(N=)	(47)	(46)	(43)	(43)	(40)	(44)
Food Groups: grams/consumer unit						
Cereals	815	635	632	644	575	660
Legumes	5	3	0	3	18	6
Roots, tubers, starchy staples	34	55	64	106	15	55
Vegetables	333	246	73	248	140	208
Fruits	1	40	13	4	32	18
Animal products	113	143	186	106	117	133
Fats	4	5	2	0	1	2
Oils seeds & nuts	4	2	11	15	2	7
Miscellaneous	14	17	9	11	21	14
Total	1323	1146	990	1137	921	1103
Nutrients (average/consumer unit)						
Energy (kcal)	2601	2741	2719	2882	2345	2658
Protein (grs)	83	81	88	82	69	81
Fat (grs)	36	40	36	36	28	35
Contribution macro-nutrients to energy intake						
Carbohydrates	1948	2058	2048	2232	1819	2021
Fats	321	358	320	322	251	314
Proteins	332	325	351	328	275	322
Energy by food group (kcal/cu)						
Cereals	2195	2255	2250	2282	1977	2192
Legumes	15	12	-	10	61	20
Roots, tubers, starchy staples	49	83	95	162	24	83
Vegetables	122	100	19	89	32	72
Fruits	0	27	15	2	20	13
Animal products	112	146	251	246	135	178
Fats	40	41	22	43	5	30
Oils seeds & nuts	12	9	29	4	7	12
Miscellaneous	55	69	38	43	85	58
Total	2601	2741	2719	2882	2345	2658
Home-produced energy by food group (kcal/cu)						
Cereals	1999	1856	995	198	1343	1278
Legumes	15	12	-	-	29	11
Roots, tubers, starchy staples	36	82	93	97	24	66
Vegetables	118	99	18	88	32	71
Fruits	0	18	15	2	20	11
Animal products	65	41	187	123	35	90
Fats	-	-	3	-	-	1
Oils seeds & nuts	8	8	15	32	5	14
Miscellaneous	-	-	-	-	-	-
Total	2240	2116	1325	540	1488	1542

Appendix 24
Food Consumption: Bamba

	Jul-Aug 1985	Nov-Dec 1985	Feb-Mar 1986	May-Jun 1986	Sep-Oct 1986	Average
(N=)	(49)	(47)	(43)	(41)	(45)	(45)
Food Groups: grams/consumer unit						
Cereals	640	595	691	636	658	644
Legumes	9	19	30	161	114	67
Roots, tubers, starchy staples	18	4	0	10	0	6
Vegetables	118	138	81	108	39	97
Fruits	1	5	0	0	0	1
Animal products	116	150	126	93	49	107
Fats	1	1	0	1	1	1
Oils seeds & nuts	7	2	1	3	5	4
Miscellaneous	15	13	12	9	10	12
Total	925	927	941	1021	876	938
Nutrients (average/consumer unit)						
Energy (kcal)	2574	2400	2770	2701	2816	2652
Protein (grs)	73	63	75	88	85	77
Fat (grs)	23	19	24	19	23	22
Contribution macro-nutrients to energy intake						
Carbohydrates	2074	1977	2251	2174	2273	2150
Fats	209	169	218	174	203	195
Proteins	291	254	301	353	340	308
Energy by food group (kcal/cu)						
Cereals	2254	2093	2452	1993	2326	2224
Legumes	7	66	102	539	356	214
Roots, tubers, starchy staples	28	5	-	16	-	10
Vegetables	51	38	22	33	9	31
Fruits	0	6	-	-	-	1
Animal products	142	126	141	66	68	109
Fats	11	6	4	11	4	7
Oils seeds & nuts	20	6	2	8	15	10
Miscellaneous	61	53	48	36	39	47
Total	2574	2400	2770	2701	2816	2652
Home-produced energy by food group (kcal/cu)						
Cereals	229	8	603	405	686	386
Legumes	4	24	33	539	338	188
Roots, tubers, starchy staples	6	4	-	9	-	4
Vegetables	41	32	19	33	8	27
Fruits	-	1	-	-	-	0
Animal products	26	20	22	33	10	22
Fats	-	-	-	1	1	0
Oils seeds & nuts	1	1	-	-	5	1
Miscellaneous	-	2	-	-	-	0
Total	307	92	677	1021	1048	629

Appendix 25
Health

Number of days ill, children by age group and mothers

	Jul/Aug '85	*Nov/Dec '85*	*Feb/Mar '86*	*May/Jun '86*	*Sep/Oct '86*	*Average*
A) 6-23 months						
- N	128	127	124	129	139	129
- average (+ s.d.)	4.3 (4.2)	4.7 (4.7)	4.1 (4.4)	4.6 (4.5)	4.3 (4.5)	4.4 (4.5)
- distribution (%):						
0 days	28.9	31.5	32.3	29.5	32.4	30.9
1-7 days	58.6	50.4	55.7	55.8	53.2	54.7
8-14 days	12.5	18.1	12.1	14.7	14.4	14.4
	100	100	100	100	100	100
B) 24-59 months						
- N	241	274	273	265	223	255
- average (+ s.d.)	3.3 (4.0)	3.0 (4.2)	3.2 (4.3)	2.8 (3.9)	2.8 (3.8)	3.0 (4.0)
- distribution (%):						
0 days	37.8	49.6	49.1	47.2	52.5	47.2
1-7 days	51.5	40.2	40.3	45.3	40.4	43.5
8-14 days	10.8	10.2	10.6	7.6	7.2	9.3
	100	100	100	100	100	100
C) 60-119 months						
- N	366	366	365	379	373	370
- average (+ s.d.)	2.2 (3.4)	2.4 (3.9)	2.1 (3.6)	1.5 (2.9)	1.9 (3.7)	2.0 (3.5)
- distribution (%):						
0 days	54.9	61.8	63.0	67.6	69.7	63.4
1-7 days	39.3	30.9	30.7	29.0	23.6	30.7
8-14 days	5.7	7.4	6.3	3.4	6.7	5.9
	100	100	100	100	100	100
D) Mothers						
- N	322	337	296	316	306	315
- average (+ s.d.)	3.7 (4.3)	3.6 (5.0)	2.8 (4.4)	2.7 (4.3)	2.7 (4.3)	3.1 (4.5)
- distribution (%):						
0 days	39.8	54.6	59.8	57.8	62.0	54.8
1-7 days	47.5	29.7	29.7	33.0	28.2	33.6
8-14 days	12.7	15.7	10.5	9.2	9.8	11.6
	100	100	100	100	100	100

Children: average number of days ill, by age group and income class

	KSh.0-999	*KSh.1000-1999*	*KSh.2000-2999*	*KSh.3000-3999*	*KSh.4000+*
Days ill					
6-23 months	4.5	4.1	5.0	4.1	4.4
24-59 months	2.8	2.7	3.4	3.8	3.8
60-119 months	1.8	2.1	2.2	2	2.7
N's					
6-23 months	279	158	98	65	47
24-59 months	574	324	168	125	85
60-119 months	796	461	356	158	78

Appendix 26
Mothers: anthropometry

	Jul/Aug '85	*Nov/Dec '85*	*Feb/Mar '86*	*May/Jun '86*	*Sep/Oct '86*	*Average*
Weight						
- N	346	349	325	324	314	332
- average (+ s.d.)	48.6 (7.1)	47.9 (7.1)	48.1 (7.3)	47.1 (7.3)	48.2 (7.3)	48.0 (7.2)
- distribution (%):						
<40	8.4	11.2	10.8	13.6	9.6	10.7
40-45	22.8	24.1	24.9	27.8	24.8	24.9
45-50	32.1	29.2	29.9	29.3	30.6	30.2
50-60	31.2	30.4	29.2	25.6	29.0	29.1
60+	5.5	5.2	5.2	3.7	6.1	5.1
	100	100	100	100	100	100
Height						
- N	347	348	325	326	314	332
- average (+ s.d.)	153.2 (5.9)	153.3 (5.9)	153.7 (6.1)	153.8 (6.0)	154.2 (6.2)	153.6 (6.0)
- distribution (%):						
<145	8.1	6.6	7.1	5.8	4.8	6.5
145-150	21.3	21.8	19.4	19.0	20.7	20.4
150-155	34.0	33.6	32.6	35.9	34.1	34.0
155-160	21.9	22.7	23.4	23.0	22.0	22.6
160+	14.7	15.2	17.5	16.3	18.5	16.4
	100	100	100	100	100	100
Weight-for-Height						
- N	344	347	324	324	314	331
- average (+ s.d.)	92.1 (11.4)	90.6 (11.3)	90.5 (11.5)	88.4 (11.5)	90.2 (11.4)	90.4 (11.4)
- distribution (%):						
<80	13.1	17.0	15.1	23.2	15.6	16.8
80-85	14.2	18.2	20.7	19.4	19.4	18.4
85-90	17.4	17.0	17.3	17.0	18.5	17.4
90-95	18.0	18.4	17.9	18.2	19.1	18.3
95-100	17.2	12.1	11.7	7.4	10.5	11.8
100+	20.1	17.3	17.3	14.8	16.9	17.3
	100	100	100	100	100	100

Appendix 27

Mothers: anthropometry, by income class

	Jul/Aug '85	Nov/Dec '85	Feb/Mar '86	May/Jun '86	Sep/Oct '86	Average
Sh. 0-999						
- N	156	151	142	140	140	146
- weight-for-height: aver.	91.0	89.5	89.7	88.6	90.1	89.8
- weight-for-height: s.d.	9.4	9.7	10.4	10.5	10.2	10.0
Sh. 1,000-1,999						
- N	79	77	78	73	73	76
- weight-for-height: aver.	91.8	89.1	88.3	85.7	87.3	88.4
- weight-for-height: s.d.	11.5	10.0	9.8	9.5	9.4	10.0
Sh. 2,000-2,999						
- N	54	57	49	54	49	52
- weight-for-height: aver.	93.3	92.0	92.0	89.1	93.9	92.1
- weight-for-height: s.d.	13.1	12.1	11.7	11.5	16.0	12.9
Sh. 3,000-3,999						
- N	33	35	33	33	28	32
- weight-for-height: aver.	92.5	94.2	93.2	88.8	89.8	91.7
- weight-for-height: s.d.	13.9	15.4	16.3	16.8	11.7	14.8
Sh. 4,000+						
- N	22	27	22	24	24	24
- weight-for-height: aver.	96.7	93.3	95.5	93.7	92.5	94.3
- weight-for-height: s.d.	14.9	13.6	13.4	12.0	10.3	12.8

Appendix 28

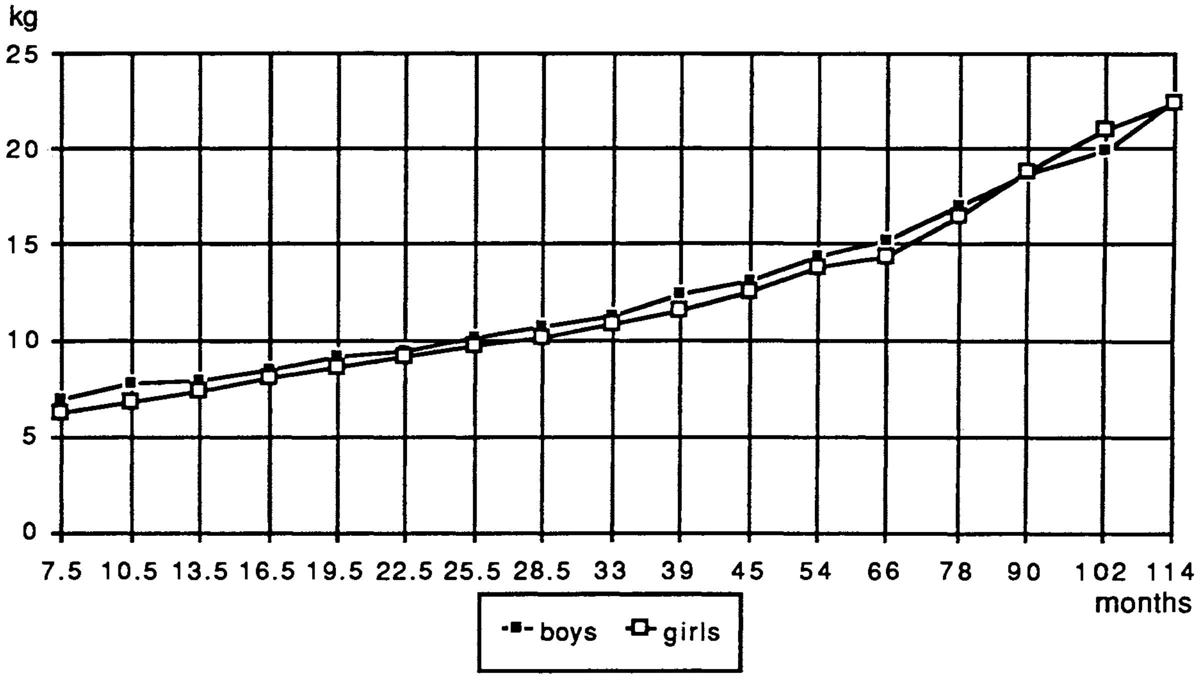
Mothers: weight-for-height, by household economy

	Jul/Aug'85	*Nov/Dec'85*	*Feb/Mar'86*	*May/Jun'86*	*Sep/Oct'86*	*Average*
Poor						
N	156	151	142	140	140	
weight-for-height	91.0	89.5	89.7	88.6	90.1	89.8
s.d.	9.4	9.7	10.4	10.5	10.2	10.0
Farmers						
N	30	32	35	38	30	
weight-for-height	93.4	90.2	89.7	86.7	88.0	89.6
s.d.	11.1	10.6	11.6	10.8	11.3	11.1
Wage earners						
N	75	73	71	66	66	
weight-for-height	92.1	90.9	89.7	87.1	88.7	89.7
s.d.	12.6	12.1	11.4	10.9	10.9	11.6
Mixed economies						
N	61	64	54	56	54	
weight-for-height	92.4	91.8	91.9	88.5	92.5	91.4
s.d.	13.1	12.9	13.2	14.0	14.7	13.6
Rich						
N	22	27	22	24	24	
weight-for-height	96.7	93.3	95.5	93.7	92.5	94.3
s.d.	14.9	13.6	13.4	12.0	10.3	12.8

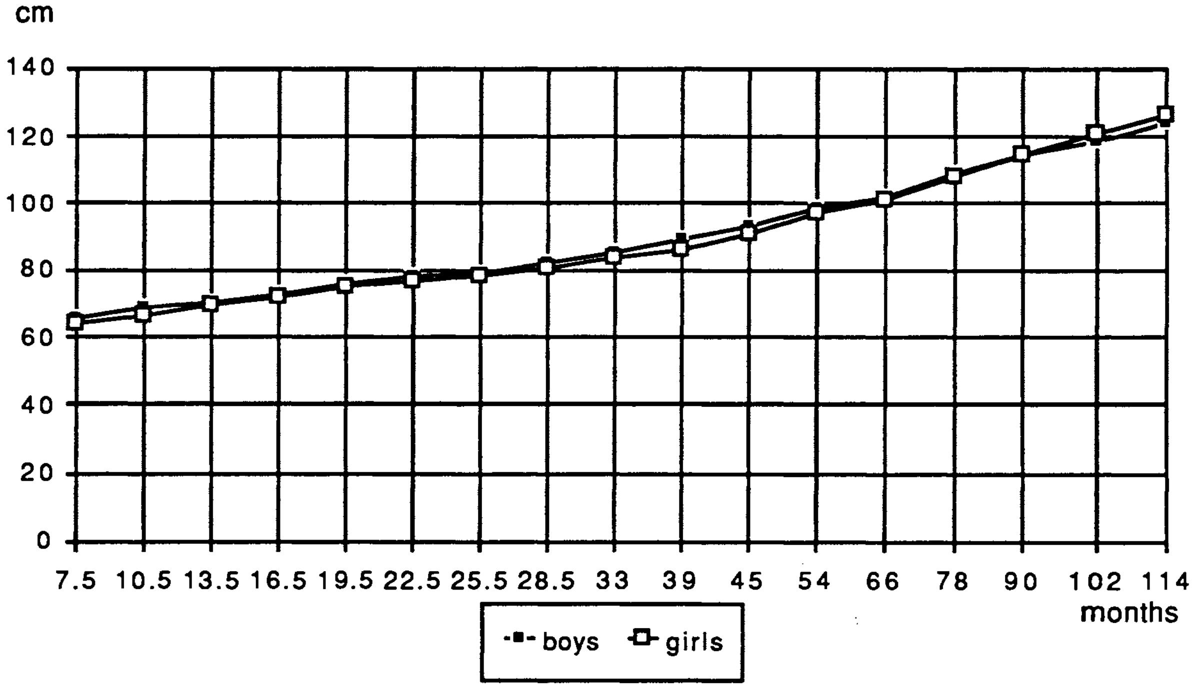
Appendix 29
Mothers: anthropometry, by research area

	Jul/Aug '85	*Nov/Dec '85*	*Feb/Mar '86*	*May/Jun '86*	*Sep/Oct '86*	*Average*
Bongwe						
-N	35	41	40	38	35	38
- weight-for-height: aver.	92.8	93.3	92.5	88.8	89.1	91.3
- weight-for-height: s.d.	15.9	15.8	16.4	17.2	14.0	15.9
Chilulu						
-N	67	67	63	62	61	64
- weight-for-height: aver.	89.5	89.0	89.0	88.0	88.8	88.9
- weight-for-height: s.d.	8.6	9.0	9.2	8.4	9.2	8.9
Mwatate						
-N	39	41	38	39	36	39
- weight-for-height: aver.	93.7	94.5	96.3	94.1	96.9	95.1
- weight-for-height: s.d.	11.6	12.1	12.8	12.6	14.4	12.7
Kitsoeni						
-N	56	56	56	57	55	56
- weight-for-height: aver.	91.7	92.1	89.3	88.8	89.5	90.3
- weight-for-height: s.d.	9.5	9.4	9.0	10.0	8.0	9.2
Kibandaongo						
-N	47	51	49	46	43	47
- weight-for-height: aver.	88.9	86.8	88.2	81.8	87.9	86.7
- weight-for-height: s.d.	8.6	8.5	9.5	8.7	10.6	9.2
Bamba						
-N	100	91	78	82	84	87
- weight-for-height: aver.	94.6	90.0	90.1	89.4	90.5	90.9
- weight-for-height: s.d.	12.7	11.7	11.5	10.5	11.7	11.6

Appendix 30
Children: weight, by age and sex



Children: height, by age and sex



Appendix 31

Children: weight by sex and 3-12 months age groups (in kg)

	boys		age		girls	
N	average	s.d.	(months)	N	average	s.d.
57	6.9	1.0	6-9	63	6.3	0.9
49	7.7	1.2	9-12	61	6.8	0.9
50	7.9	1.2	12-15	59	7.4	0.9
49	8.5	1.4	15-18	56	8.0	1.0
44	9.1	1.7	18-21	54	8.6	1.2
42	9.5	1.4	21-24	49	9.2	1.3
50	10.1	1.3	24-27	62	9.7	1.6
50	10.7	1.6	27-30	64	10.2	1.5
119	11.3	1.5	30-36	122	10.8	1.8
123	12.3	1.5	36-42	121	11.5	1.7
101	13.0	1.6	42-48	114	12.5	1.7
196	14.3	2.0	48-60	194	13.8	2.2
252	15.1	2.0	60-72	218	14.3	2.2
227	17.0	2.5	72-84	188	16.4	2.3
202	18.6	2.9	84-96	175	18.8	2.6
220	19.9	2.6	96-108	181	21.0	3.7
164	22.5	3.6	108-120	103	22.4	3.8

Children: height by sex and 3-12 months age groups (in cm)

	boys		age		girls	
N	average	s.d.	(months)	N	average	s.d.
56	65.4	3.0	6-9	63	64.1	3.3
49	68.7	3.1	9-12	61	66.5	3.1
50	70.7	3.3	12-15	59	69.5	3.5
49	73.0	3.0	15-18	57	72.0	3.7
45	75.5	4.5	18-21	54	75.0	3.8
43	78.0	3.2	21-24	49	76.5	4.5
50	79.4	3.8	24-27	63	78.5	5.1
49	82.3	4.5	27-30	63	80.9	5.3
118	85.0	5.1	30-36	122	83.9	5.8
123	89.3	4.9	36-42	121	86.4	5.8
101	93.1	5.3	42-48	114	91.0	5.6
197	98.4	6.9	48-60	194	96.9	7.3
252	101.9	7.1	60-72	216	100.9	7.1
228	109.4	7.1	72-84	188	108.2	7.0
201	114.4	8.0	84-96	175	114.3	6.6
220	118.2	6.6	96-108	180	120.8	7.8
164	124.0	6.6	108-120	107	126.4	7.8

Appendix 32

Anthropometry children: weight-for-age by age group

	Jul/Aug '85	*Nov/Dec '85*	*Feb/Mar '86*	*May/Jun '86*	*Sep/Oct '86*	*Average*
A) 6-23 months						
- N	126	126	119	124	136	126
- average (+ s.d.)	81.4 (11.9)	79.5 (10.5)	76.1 (10.1)	76.0 (10.7)	75.9 (11.6)	77.8 (11.0)
- distribution (%):						
<60	4.0	4.0	5.9	8.0	7.4	5.9
60-69	11.1	12.7	19.3	18.6	23.5	17.0
70-79	29.4	32.5	44.5	40.3	34.6	36.3
80-89	32.5	37.3	23.5	25.0	25.0	28.7
90-99	17.5	9.5	5.9	5.7	5.2	8.8
100+	5.6	4.0	0.8	2.4	4.4	3.4
	100	100	100	100	100	100
B) 24-59 months						
- N	248	283	281	272	232	263
- average (+ s.d.)	81.7 (12.2)	81.5 (11.8)	79.8 (11.1)	81.2 (10.8)	80.3 (11.4)	80.9 (11.5)
- distribution (%):						
<60	3.6	4.2	3.2	2.6	3.5	3.4
60-69	10.5	11.3	15.0	12.5	12.9	12.4
70-79	30.2	30.0	34.5	31.3	35.3	32.3
80-89	34.3	30.7	28.8	33.5	29.7	31.4
90-99	14.5	18.4	14.2	17.3	14.7	15.8
100+	6.9	5.3	4.3	2.9	3.9	4.7
	100	100	100	100	100	100
C) 60-119 months						
- N	386	389	382	390	382	386
- average (+ s.d.)	79.1 (12.6)	77.5 (11.5)	76.4 (11.1)	77.0 (11.3)	78.1 (11.1)	77.6 (11.5)
- distribution (%):						
<60	4.9	4.4	7.1	5.1	4.2	5.1
60-69	19.4	21.1	22.0	20.0	17.3	20.0
70-79	32.1	35.7	34.3	38.0	38.0	35.6
80-89	24.6	27.0	27.0	26.2	27.0	26.4
90-99	13.5	7.7	7.1	8.0	11.0	9.5
100+	5.4	4.1	2.6	2.8	2.6	3.5
	100	100	100	100	100	100

Appendix 33
Anthropometry children: weight-for-height by age group

	Jul/Aug '85	Nov/Dec '85	Feb/Mar '86	May/Jun '86	Sep/Oct '86	Average
A) 6-23 months						
- N	126	126	119	123	135	126
- average (+ s.d.)	94.0 (10.0)	94.2 (9.7)	90.6 (8.6)	91.1 (9.0)	92.8 (11.5)	92.5 (9.8)
- distribution (%):						
<80	7.1	4.8	10.9	9.8	12.6	9.0
80-84	8.7	13.5	7.6	9.8	5.9	9.1
85-89	19.1	14.3	30.3	27.6	18.5	22.0
90-94	19.8	24.6	25.2	22.0	22.2	22.8
95-99	19.1	13.5	14.3	16.3	19.3	16.5
100+	26.2	29.4	11.8	14.6	21.5	20.7
	100	100	100	100	100	100
B) 24-59 months						
- N	245	282	281	272	232	262
- average (+ s.d.)	94.7 (9.3)	94.4 (9.0)	91.6 (7.6)	93.2 (7.5)	93.5 (8.3)	93.5 (8.4)
- distribution (%):						
<80	5.3	4.3	5.7	4.8	6.9	5.4
80-84	8.2	7.1	13.5	9.2	7.8	9.2
85-89	15.1	15.6	24.9	19.5	19.0	18.8
90-94	25.7	27.0	26.0	24.3	22.8	25.2
95-99	18.0	22.0	15.0	25.4	20.7	20.2
100+	27.8	24.1	15.0	16.9	22.8	21.3
	100	100	100	100	100	100
C) 60-119 months						
- N	382	388	381	389	382	384
- average (+ s.d.)	93.7 (8.1)	92.8 (6.9)	90.9 (6.9)	92.0 (7.1)	92.4 (6.8)	92.4 (7.2)
- distribution (%):						
<80	2.9	2.3	3.7	4.1	2.9	3.2
80-84	8.6	11.3	16.3	10.3	10.0	11.3
85-89	21.2	21.9	28.1	26.5	26.2	24.8
90-94	25.1	27.3	24.7	27.0	26.4	26.1
95-99	20.7	20.9	16.3	19.0	19.9	19.4
100+	21.5	16.2	11.0	13.1	14.7	15.3
	100	100	100	100	100	100

Appendix 34

Anthropometry children: height-for-age by age group

	Jul/Aug '85	*Nov/Dec '85*	*Feb/Mar '86*	*May/Jun '86*	*Sep/Oct '86*	*Average*
A) 6-23 months						
- N	126	127	120	125	135	127
- average (+ s.d.)	92.8 (4.8)	91.9 (4.5)	91.5 (4.4)	91.3 (4.2)	90.4 (4.7)	91.6 (4.5)
- distribution (%):						
<85	5.6	5.5	6.7	4.8	9.6	6.4
85-89	19.8	26.0	24.2	34.4	35.6	28.0
90-94	46.0	48.0	46.7	37.6	37.8	43.2
95-99	19.1	15.0	20.0	22.4	14.1	18.1
100+	9.5	5.5	2.5	0.8	3.0	4.3
	100	100	100	100	100	100
B) 24-59 months						
- N	247	282	281	273	232	263
- average (+ s.d.)	91.6 (6.4)	91.7 (6.0)	92.1 (5.7)	92.2 (5.5)	91.4 (5.3)	91.8 (5.8)
- distribution (%):						
<85	13.4	13.8	9.3	8.4	10.3	11.0
85-89	25.9	23.4	24.9	23.4	30.6	25.6
90-94	33.6	34.4	35.6	38.8	32.8	35.0
95-99	16.2	19.9	21.4	22.3	21.1	20.2
100+	10.9	8.5	8.9	7.0	5.2	8.1
	100	100	100	100	100	100
C) 60-119 months						
- N	386	390	382	390	382	386
- average (+ s.d.)	91.7 (6.3)	91.6 (5.7)	92.0 (5.4)	91.9 (5.5)	92.3 (5.4)	91.9 (5.7)
- distribution (%):						
<85	13.0	12.8	10.2	11.0	8.6	11.1
85-89	27.5	24.9	23.6	23.1	22.8	24.4
90-94	32.6	35.9	39.5	39.7	40.6	37.7
95-99	18.1	19.7	20.2	19.5	19.9	19.5
100+	8.8	6.7	6.5	6.7	8.1	7.4
	100	100	100	100	100	100

Appendix 35

*Anthropometry children: H-A * W-H classification, by age group*

			Jul/Aug '85	*Nov/Dec '85*	*Feb/Mar '86*	*May/Jun '86*	*Sep/Oct '86*	*Average*
A) 6-23 months								
	h-a	w-h						
malnourished	<90	<85	3.2	4.8	5.0	8.1	9.6	6.1
wasted	>=90	<85	12.7	13.5	13.5	11.4	8.9	12.0
stunted	<90	>=85	22.2	27.0	25.2	30.9	35.6	28.2
normal	>=90	>=85	61.9	54.8	56.3	49.6	46.0	53.7
			100	100	100	100	100	100
B) 24-59 months								
	h-a	w-h						
malnourished	<90	<85	6.1	6.7	8.2	7.4	9.5	7.6
wasted	>=90	<85	7.4	4.6	11.0	6.6	5.2	7.0
stunted	<90	>=85	33.1	30.5	26.0	24.6	31.5	29.1
normal	>=90	>=85	53.5	58.2	54.8	61.4	53.9	56.4
			100	100	100	100	100	100
C) 60-119 months								
	h-a	w-h						
malnourished	<90	<85	4.5	5.4	5.3	5.4	3.4	4.8
wasted	>=90	<85	7.1	8.3	14.7	9.0	9.4	9.7
stunted	<90	>=85	36.4	32.5	28.4	28.8	28.0	30.8
normal	>=90	>=85	52.1	53.9	51.7	56.8	59.2	54.7
			100	100	100	100	100	100

Appendix 36

Anthropometry children: weight growth, by age group

	Jul/Aug '85 - Nov/Dec '85	*Nov/Dec '85 - Feb/Mar '86*	*Feb/Mar '86 - May/Jun '86*	*May/Jun '86 - Sep/Oct '86*	*average*
A) 6-23 months					
- N	114	106	108	114	111
- average in g/mth (+ s.d.)	167 (191)	98 (176)	173 (251)	172 (184)	153 (201)
- distribution (%):					
<0 g.	10.5	22.6	15.7	12.3	15.3
0-149 g.	37.7	42.3	19.4	30.7	32.5
150-299 g.	39.5	26.4	41.7	40.4	37.0
300-449 g.	7.9	5.7	15.7	10.5	10.0
450-599 g.	0.9	1.9	4.6	5.3	3.2
600+ g.	3.5	0.9	2.8	0.9	2.0
	100	100	100	100	100
B) 24-59 months					
- N	226	252	255	240	243
- average in g/mth (+ s.d.)	124 (206)	64 (184)	202 (244)	144 (184)	134 (205)
- distribution (%):					
<0 g.	19.0	34.1	14.1	16.7	21.0
0-149 g.	40.3	38.1	25.5	37.9	35.5
150-299 g.	29.2	17.9	31.0	31.3	27.4
300-449 g.	7.5	7.9	15.3	10.0	10.2
450-599 g.	1.3	1.2	8.2	2.5	3.3
600+ g.	2.7	0.8	5.9	1.7	2.8
	100	100	100	100	100
C) 60-119 months					
- N	350	347	347	345	347
- average in g/mth (+ s.d.)	102 (219)	101 (250)	241 (301)	181 (225)	156 (249)
- distribution (%):					
<0 g.	26.6	29.1	17.3	14.5	21.9
0-149 g.	38.0	28.8	20.2	31.0	29.5
150-299 g.	23.4	24.8	22.2	31.3	25.4
300-449 g.	8.0	11.0	17.9	15.1	13.0
450-599 g.	1.4	3.8	12.1	4.4	5.4
600+ g.	2.6	2.6	10.4	3.8	4.9
	100	100	100	100	100

Appendix 37

Anthropometry children: height growth by age group

	Jul/Aug '85 - Nov/Dec '85	*Nov/Dec '85 - Feb/Mar '86*	*Feb/Mar '86 - May/Jun '86*	*May/Jun '86 - Sep/Oct '86*	*Average*
A) 6-23 months					
- N	114	108	111	115	112
- average in cm/mth (+ s.d.)	.64 (.50)	.78 (.55)	.72 (.50)	.62 (.46)	.69 (.50)
- distribution (%):					
<0 cm	7.0	3.7	6.3	2.6	4.9
0-0.4 cm	36.8	29.6	27.0	43.5	34.2
0.5-0.9 cm	33.3	35.2	36.0	39.1	35.9
1.0-1.4 cm	16.7	22.2	24.3	12.2	18.9
1.5+ cm	6.1	9.3	6.3	2.6	6.1
	100	100	100	100	100
B) 24-59 months					
- N	229	254	259	245	247
- average in cm/mth (+ s.d.)	.57 (.37)	.80 (.39)	.56 (.37)	.53 (.31)	.62 (.36)
- distribution (%):					
<0 cm	3.1	1.6	3.1	3.7	2.9
0-0.4 cm	38.0	16.9	37.5	38.0	32.6
0.5-0.9 cm	47.6	57.9	51.7	53.1	52.6
1.0-1.4 cm	10.5	20.1	6.6	4.9	10.5
1.5+ cm	0.9	3.5	1.2	0.4	1.5
	100	100	100	100	100
C) 60-119 months					
- N	352	356	355	352	354
- average in cm/mth (+ s.d.)	.45 (.32)	.63 (.31)	.43 (.35)	.48 (.30)	.50 (.32)
- distribution (%):					
<0 cm	2.6	2.5	5.6	3.1	3.5
0-0.4 cm	58.0	29.2	55.8	47.7	47.7
0.5-0.9 cm	37.5	59.0	33.5	47.4	44.4
1.0-1.4 cm	1.1	8.4	4.2	0.9	3.7
1.5+ cm	0.9	0.8	0.9	0.9	0.9
	100	100	100	100	100

Appendix 38

Children 24-119 months: main anthropometric measures, by income class and survey round

	Jul/Aug'85	Nov/Dec'85	Feb/Mar'86	May/Jun'86	Sep/Oct'86	Average
<Sh.1000/cu						
N	281	297	295	297	280	290
age (months)	64.7	66.0	68.1	69.3	68.7	67.4
height-for-age	91.4	91.2	91.7	91.6	91.4	91.5
weight-for-height	94.6	93.7	91.3	92.9	93.3	93.2
weight-for-age	80.4	79.0	77.6	78.6	78.7	78.9
Sh.1000-1999/cu						
N	162	160	165	161	142	158
age (months)	63.8	67.9	69.5	71.9	70.3	68.7
height-for-age	92.0	91.9	92.4	92.3	92.7	92.3
weight-for-height	94.5	93.9	91.2	92.8	92.3	92.9
weight-for-age	80.9	80.0	78.4	79.3	79.8	79.7
Sh.2000-2999/cu						
N	105	118	109	112	102	109
age (months)	70.5	73.4	77.0	74.7	77.2	74.6
height-for-age	91.6	91.5	92.1	92.1	91.9	91.8
weight-for-height	92.4	91.9	89.6	91.0	92.2	91.4
weight-for-age	78.1	77.2	75.9	77.4	77.9	77.3
Sh.3000-3999/cu						
N	55	57	58	55	55	56
age (months)	62.4	61.5	67.2	67.6	71.2	66.0
height-for-age	91.9	92.1	92.4	92.3	92.1	92.2
weight-for-height	93.4	94.9	92.7	92.0	92.9	93.2
weight-for-age	80.3	81.1	80.0	78.6	79.0	79.8
Sh.4000+/cu						
N	28	39	35	36	35	35
age (months)	64.6	60.5	64.1	66.1	68.3	64.7
height-for-age	92.6	93.4	92.5	93.3	92.8	92.9
weight-for-height	93.6	92.8	92.5	93.3	92.5	92.9
weight-for-age	80.1	80.6	79.5	81.4	79.9	80.3

Appendix 39
Children: average growth, by income class

		KSh.0-999	*KSh.1000-1999*	*KSh.2000-2999*	*KSh.3000-3999*	*KSh.4000+*
Height growth (cm/mth)						
(a) 6-23 months		.66	.74	.68	.69	.69
(b) 24-59 months		.60	.66	.56	.61	.69
(c) 60-119 months		.50	.50	.49	.48	.54
Weight growth (g/mth)						
(d) 6-23 months		144	164	168	157	140
(e) 24-59 months		125	137	163	110	156
(f) 60-119 months		158	151	156	165	149
N's	(a)	206	102	64	46	30
	(b)	460	244	131	91	61
	(c)	626	332	283	111	63
	(d)	202	100	64	44	32
	(e)	449	243	129	90	62
	(f)	617	327	276	109	60

Appendix 40

Anthropometry children 24-119 months: weight growth and height growth, by income class

	Jul/Aug '85 - Nov/Dec '85	*Nov/Dec '85 - Feb/Mar '86*	*Feb/Mar '86 - May/Jun '86*	*May/Jun '86 - Sep/Oct '86*	*Average*
Sh.0-999					
- N (+ av. age in mths)*	260/263 (64.7)	274/278 (66.0)	265/272 (68.1)	267/273 (69.3)	267/272 (67.0)
- weight growth (g/mth)	92	86	249	151	145
- weight growth: s.d.	225	218	285	205	233
- height growth (cm/mth)	.45	.75	.47	.49	.54
- height growth: s.d.	.35	.38	.33	.30	.34
Sh.1,000-1,999					
- N (+ av. age in mths)*	139/141 (63.8)	146/148 (67.9)	153/153 (69.5)	132/134 (71.9)	143/144 (68.3)
- weight growth (g/mth)	138	68	220	151	144
- weight growth: s.d.	201	237	273	203	229
- height growth (cm/mth)	.56	.69	.51	.52	.57
- height growth: s.d.	.39	.29	.33	.25	.32
Sh.2,000-2,999					
- N (+ av. age in mths)*	103/104 (70.5)	100/104 (73.4)	100/102 (77.0)	102/104 (74.7)	101/104 (73.9)
- weight growth (g/mth)	110	89	223	211	158
- weight growth: s.d.	197	239	282	245	241
- height growth (cm/mth)	.47	.62	.48	.49	.49
- height growth: s.d.	.28	.34	.30	.41	.41
Sh.3,000-3,999					
- N (+ av. age in mths)*	47/46 (62.4)	48/48 (61.5)	53/55 (67.2)	51/53 (67.6)	50/51 (64.7)
- weight growth (g/mth)	130	104	122	202	140
- weight growth: s.d.	222	224	264	178	222
- height growth (cm/mth)	.51	.67	.52	.47	.54
- height growth: s.d.	.29	.39	.53	.22	.36
Sh.4,000+					
- N (+ av. age in mths)*	27/27 (64.6)	31/32 (60.5)	31/32 (64.1)	33/33 (66.1)	31/31 (63.8)
- weight growth (g/mth)	119	128	208	153	152
- weight growth: s.d.	221	194	233	180	207
- height growth (cm/mth)	.59	.72	.58	.56	.61
- height growth: s.d.	.32	.34	.58	.34	.40

* Number of cases concerning weight growth and height growth, respectively;
average age concerns more cases.

Appendix 41

Anthropometry children 24-119 months: weight growth and height growth, by household economy

	Jul/Aug '85 - Nov/Dec '85	*Nov/Dec '85 - Feb/Mar '86*	*Feb/Mar '86 - May/Jun '86*	*May/Jun '86 - Sep/Oct '86*	*Average*
Poor					
- N (+ av. age in mths)*	260/263 (64.7)	274/278 (66.0)	265/272 (68.1)	267/273 (69.3)	
- weight growth (g/mth)	92	86	249	151	145
- weight growth: s.d.	225	218	285	205	233
- height growth (cm/mth)	.45	.75	.47	.49	.54
- height growth: s.d.	.35	.38	.33	.30	.34
Farmers					
- N (+ av. age in mths)*	64/66 (66.3)	(69/70 (70.4)	78/79 (71.0)	65/66 (74.1)	
- weight growth (g/mth)	149	97	188	174	152
- weight growth: s.d.	176	224	300	224	231
- height growth (cm/mth)	.50	.74	.45	.51	.55
- height growth: s.d.	.40	.31	.35	.28	.34
Wage earners					
- N (+ av. age in mths)*	133/132 (64.7)	131/130 (68.2)	130/130 (72.2)	123/126 (72.1)	
- weight growth (g/mth)	105	85	221	199	153
- weight growth: s.d.	171	231	259	219	220
- height growth (cm/mth)	.45	.63	.53	.51	.53
- height growth: s.d.	.30	.36	.44	.36	.37
Mixed economies					
- N (+ av. age in mths)*	92/93 (66.9)	94/100 (68.3)	98/101 (71.2)	97/99 (70.5)	
- weight growth (g/mth)	142	64	194	163	141
- weight growth: s.d.	254	249	280	208	248
- height growth (cm/mth)	.64	.64	.50	.48	.57
- height growth: s.d.	.33	.30	.25	.26	.29
Rich					
- N (+ av. age in mths)*	27/27 (64.6)	31/32 (60.5)	31/32 (64.1)	33/33 (66.1)	31/31 (63.8)
- weight growth (g/mth)	119	128	208	153	152
- weight growth: s.d.	221	194	233	180	207
- height growth (cm/mth)	.59	.72	.58	.56	.61
- height growth: s.d.	.32	.34	.58	.34	.40

* Number of cases concerning weight growth and height growth, respectively;
average age concerns more cases.

Appendix 42

Children 24-119 months: main anthropometric measures, by research area and survey round

	Jul/Aug'85	*Nov/Dec'85*	*Feb/Mar'86*	*May/Jun'86*	*Sep/Oct'86*	*Average*
Bongwe						
N	59	70	64	61	53	61
age (months)	64.0	67.2	71.5	72.3	73.1	69.6
height-for-age	94.0	93.7	94.5	95.0	95.6	94.6
weight-for-height	91.6	92.0	90.1	90.6	91.2	91.1
weight-for-age	81.7	81.1	80.7	81.7	83.5	81.7
Chilulu						
N	132	143	145	142	136	140
age (months)	68.0	68.3	69.2	72.4	71.3	69.8
height-for-age	89.9	90.4	91.0	90.8	90.7	90.6
weight-for-height	92.4	91.8	89.6	90.5	91.6	91.2
weight-for-age	76.0	76.0	75.0	75.2	75.9	75.6
Mwatate						
N	85	92	91	93	80	88
age (months)	65.5	67.6	71.0	72.7	73.5	70.1
height-for-age	92.2	91.7	92.4	92.6	92.2	92.2
weight-for-height	97.6	95.1	94.0	95.0	95.7	95.5
weight-for-age	84.1	80.9	80.3	81.7	81.8	81.8
Kitsoeni						
N	100	104	107	114	109	107
age (months)	65.7	66.5	69.4	69.5	69.8	68.2
height-for-age	91.3	91.5	92.2	91.9	92.3	91.8
weight-for-height	91.8	92.1	89.3	92.7	91.1	91.4
weight-for-age	77.2	77.5	76.1	78.2	77.7	77.3
Kibandaongo						
N	94	103	101	103	84	97
age (months)	66.7	69.3	72.0	73.3	71.0	70.5
height-for-age	91.8	91.8	92.3	92.2	92.2	92.1
weight-for-height	98.5	97.0	94.2	93.5	93.9	95.4
weight-for-age	84.3	82.7	80.9	80.2	80.7	81.8
Bamba						
N	161	159	154	149	152	155
age (months)	62.1	64.4	67.1	65.5	68.3	65.5
height-for-age	92.2	91.6	91.6	91.5	91.3	91.6
weight-for-height	93.4	93.2	90.8	92.7	93.5	92.7
weight-for-age	80.2	79.0	76.9	78.4	78.5	78.6

Appendix 43
Children: average growth, by research area

	Bongwe	Chilulu	Mwatate	Kitsoeni	Kibandaongo	Bamba
Height growth (cm/mth)						
(a) 6-23 months	.73	.65	.57	.86	.70	.59
(b) 24-59 months	.68	.64	.67	.59	.69	.51
(c) 60-119 months	.48	.50	.49	.54	.51	.48
Weight growth (g/mth)						
(d) 6-23 months	167	148	186	185	148	119
(e) 24-59 months	172	124	158	140	113	124
(f) 60-119 months	168	149	146	187	131	158

		Bongwe	Chilulu	Mwatate	Kitsoeni	Kibandaongo	Bamba
N's	(a)	42	91	39	89	77	110
	(b)	95	192	135	154	160	251
	(c)	132	329	199	244	210	301
	(d)	42	91	40	87	73	109
	(e)	95	190	131	157	157	253
	(f)	127	325	199	238	206	294

Appendix 44

Anthropometry children 24-119 months: weight growth and height growth, by research area

	Jul/Aug '85 - Nov/Dec '85	Nov/Dec '85 - Feb/Mar '86	Feb/Mar '86 - May/Jun '86	May/Jun '86 - Sep/Oct '86	Average
Bongwe					
- N (+ av. age in mths)*	56/57 (64.0)	56/58 (67.2)	56/58 (71.5)	54/54 (72.3)	56/57 (68.8)
- weight growth (g/mth)	146	124	175	236	170
- weight growth: s.d.	139	264	165	172	185
- height growth (cm/mth)	.47	.69	.50	.59	.56
- height growth: s.d.	.25	.32	.31	.30	.30
Chilulu					
- N (+ av. age in mths)*	122/121 (68.0)	130/133 (68.3)	133/134 (69.2)	130/133 (72.4)	129/130 (69.4)
- weight growth (g/mth)	100	100	188	167	139
- weight growth: s.d.	182	204	254	182	206
- height growth (cm/mth)	.49	.79	.44	.49	.55
- height growth: s.d.	.34	.34	.31	.21	.30
Mwatate					
- N (+ av. age in mths)*	76/78 (65.5)	89/88 (67.6)	83/86 (71.0)	82/82 (72.7)	83/84 (69.5)
- weight growth (g/mth)	92	106	228	175	150
- weight growth: s.d.	182	203	261	167	203
- height growth (cm/mth)	.59	.70	.49	.47	.56
- height growth: s.d.	.34	.31	.29	.28	.31
Kitsoeni					
- N (+ av. age in mths)*	90/94 (65.7)	94/95 (66.5)	102/105 (69.4)	99/104 (69.5)	96/100 (67.8)
- weight growth (g/mth)	161	79	344	82	167
- weight growth: s.d.	250	231	324	215	255
- height growth (cm/mth)	.53	.72	.47	.53	.56
- height growth: s.d.	.34	.30	.32	.24	.30
Kibandaongo					
- N (+ av. age in mths)*	87/87 (66.7)	93/98 (69.3)	97/98 (72.0)	86/87 (73.3)	91/93 (70.3)
- weight growth (g/mth)	117	82	115	184	125
- weight growth: s.d.	234	179	289	204	227
- height growth (cm/mth)	.59	.72	.48	.55	.59
- height growth: s.d.	.30	.30	.30	.28	.30
Bamba					
- N (+ av. age in mths)*	145/144 (62.1)	137/138 (64.4)	131/133 (67.1)	134/137 (65.5)	137/138 (64.8)
- weight growth (g/mth)	81	50	266	183	145
- weight growth: s.d.	236	261	267	252	254
- height growth (cm/mth)	.37	.60	.56	.44	.49
- height growth: s.d.	.39	.44	.52	.43	.45

* Number of cases concerning weight growth and height growth, respectively; average age concerns more cases.

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