Nutrition Status - Rural and Urban Kenya

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RURAL AND URBAN KENYA

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FOREWORD

The number of undernourished people in the world con-
tinues to rise both in absolute terms and as a share of world
population. Estimates suggest that about 1,000 millions may
not get enough food to meet their energy (calorie) require-
ments while 450 million of these, or a quarter of the popula-
tion in the developing market economies, suffer from serious
undernutrition. Hunger, the result of deprivation of food
in adequate quantity, is one manifestation of the nutrition
problem, though by far the most widespread. Raising the food
intake of the over 450 million severely undernourished to the
level of their nutritional requirements would involve the
equivalent of 40-60 million tons of wheat per year. This
amounts to no more than 3-5 percent of the present world
cereal. consumption, or 10-15 percent of the cereals now
being fed to livestock in developed countries. These figures
are just an indication of the present dimensions of hunger
and undernutrition. To solve the problem, one needs to
investigate the whole food and agriculture system. This
would include consideration of many factors including popula-
tion distribution and growth, food distribution and pricing,
environment and health. The central issue here is the inter-
action between food production, distribution, consumption and
economic policies to solve the hunger problem. The basic
requirement is first to identify the population affected by
the hunger problem. Within any one country, there are those
who overeat and those who do not have access to an adequate
quantity of food. A wide variety of social, political and
economic factors are responsible for the skewness of the food
consumption pattern in any one country as well as that at
the international level.

The Food and Agricultural Program at IIASA investigates these issues. Kenya, a market economy has been chosen for an in-depth case study. The results are reported in two working papers. The first paper deals with the quantification of food consumption baskets in various income classes in rural and urban Kenya (Working Paper WP-80-13). The second treats nutritional analysis (Working Paper WP-80-14).

PREFACE

The paper presents a detailed nutritional analysis in the context of the food intake levels of various income groups in rural and urban Kenya. Nutritional surveys covering the majority of the population are not feasible and perhaps not necessary. The main contributions of this study are to provide an overall nutritional picture of Kenya and in particular identify the target groups within the overall population for whom in depth nutritional surveillance may be necessary.

NUTRITIONAL ANALYSIS

1. NUTRITIONAL SITUATION OF THE RURAL POPULATION

Usually two harvests in one year are common in Kenya - the main harvest season being from June to July after the long rains and the minor harvest season in November to December after the short rains. The Integrated Rural Survey was conducted from November 1974 to October 1975 and thus, it includes both harvest seasons. The sample families were surveyed 13 times throughout that year with intervals of exactly 4 weeks, where the enumerator visited the household twice. Therefore, the survey includes the seasonal changes of the food availability; but it has to be kept in mind, that the data represent an agglomeration of the food consumed throughout the whole year. The intakes apply only to a household level.

The nutritional analysis of the food balance sheets derived from this survey was performed as described elsewhere (1) being based mainly on food composition table issued by FAO (2). FAO dietary recommendations (3) and the daily dietary allowances of the National Research Council (4) were mainly used for the interpretations. The requirements of the different groups are listed in Table 1.

It has to be stressed already at this point that the low protein requirement recommended by the FAO Committee (3) are only valid if enough energy is consumed. The very high calcium requirements are based on the American diet with its high meat consumptions; diets in developing countries being mainly vegetarian ones will require probably much lower amounts. However, no recommendations are available for this type of diet.

1.1 The Total Rural Population

The diet of the rural population is a very poor one without many variations. The main staple food is derived from cereals, in particular from maize; only small amounts of millet, wheat and rice are eaten. The preference for cereals is followed by starchy roots mainly cassava* and some potatoes. The consumption of beans is surprisingly low for a typical African diet. As expected, only very few fruits and vegetables are consumed. Also the intake of meat, eggs and fish is quite low, which, however, is a general phenomenon in Africa (1), (Table 2).

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* Cassava is used as a synonym for sweet potatoes, cassava roots and yams, and represents the "other starchy roots", [5].

Provinces	energy[*] (kcal)	protein [high quality] (g)	calcium (mg)	iron (mg)	vita-min A (I.U.)	thiamine (mg)	riboflavin (mg)	niacin (mg)	vita-min C (mg)
I. Rural Population									
A. Moderately Active									
Total Rural	2220	27.8	800	14	4,500	1.11	1.33	14.65	45
Central	2220	27.8	800	14	4,500	1.11	1.33	14.65	45
Coast	2200	27.5	800	14	4,500	1.10	1.32	14.52	45
Eastern	2210	27.6	800	14	4,500	1.11	1.33	14.59	45
Nyanza	2260	28.3	800	14	4,500	1.13	1.36	14.92	45
Rift Valley	2220	27.8	800	14	4,500	1.11	1.33	14.65	45
Western	2210	27.6	800	14	4,500	1.11	1.33	14.65	45
B Very Active									
Total Rural	2400	27.8	800	14	4,500	1.20	1.44	15.84	45
Central	2410	27.8	800	14	4,500	1.21	1.45	15.91	45
Coast	2400	27.5	800	14	4,500	1.20	1.44	15.84	45
Eastern	2360	27.6	800	14	4,500	1.18	1.42	15.58	45
Nyanza	2420	28.3	800	14	4,500	1.21	1.45	15.97	45
Rift valley	2390	27.8	800	14	4,500	1.20	1.43	15.77	45
Western	2370	27.6	800	14	4,500	1.19	1.42	15.64	45
II. Urban Population									
A. Light Activity	2130	26.1	800	14	4,500	1.065	1.28	14.06	45
B. Moderately Active	2260	27.7	800	14	4,500	1.13	1.36	14.92	45

* included additional needs for pregnant and lactating (6 months) women and was calculated from the age structure of the particular population group.

Note: A more detailed description of the nutritional requirements is given by Frohberg, H.C. (1979), IIASA Research Report forthcoming.

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Table 2. Diet Pattern of the Different Rural Income Classes in 1975.

	energy (kcal)	protein		fat (g)	calcium (mg)	iron (mg)	Vitamin A (I.U.)	thiamine (mg)	riboflavin (mg)	niacin (mg)	ascorbic acid (mg)
		crude (g)	high quality (g)								
Total											
cereals	1358	36.3	15.4	13.2	44	6.5	1186	1.20	0.36	4.92	-
starchy roots	239	2.5	1.0	0.2	49	1.2	-	0.12	0.06	1.40	53.3
pulses	105	6.8	2.3	0.5	42	2.1	9	0.17	0.06	0.65	0.9
fruits & vegetable	70	1.4	0.5	0.2	33	0.8	1148	0.06	0.06	0.58	24.2
Meat,egg & fish	70	5.6	3.9	5.1	7	0.7	90	0.02	0.05	1.40	-
milk	84	4.2	2.6	4.6	156	0.1	175	0.04	0.23	0.15	1.4
miscellaneous*	144	0.2	0.1	3.2	15	0.4	21	-	-	-	-
	2069	57.0	25.8	27.1	348	11.8	2629	1.61	0.82	9.10	79.8
Rural Poor											
cereals	1061	28.5	13.2	10.3	47	4.9	888	0.89	0.29	3.68	-
starchy roots	220	2.0	0.8	0.2	48	1.0	-	0.09	0.05	1.01	51.9
pulses	58	3.8	1.3	0.3	23	1.1	5	0.09	0.03	0.36	0.5
fruit & vegetable	30	0.6	0.3	0.1	15	0.4	509	0.02	0.04	0.26	10.7
meat,egg & fish	56	4.4	2.6	4.0	5	0.6	69	0.01	0.03	1.12	-
milk	37	1.9	1.1	2.0	69	0.1	78	0.02	0.09	0.07	0.6
miscellaneous*	116	0.1	0.1	1.9	15	0.6	10	-	-	0.05	-
	1578	41.3	19.4	18.8	222	8.7	1559	1.12	0.53	6.54	63.7
Rural Medium											
cereals	1419	38.0	16.2	13.8	46	6.8	1236	1.26	0.38	5.16	-
starchy roots	249	2.6	1.0	0.3	50	1.3	-	0.12	0.06	1.49	55.0
pulses	116	7.5	2.6	0.6	46	2.3	10	0.18	0.06	0.71	1.0
fruits & vegetable	89	1.8	0.7	0.3	43	1.1	1482	0.07	0.08	0.75	31.3
meat,egg & fish	72	5.8	3.9	5.3	7	0.7	95	0.02	0.04	1.45	-
milk	92	4.6	2.8	3.1	181	0.1	192	0.04	0.25	0.16	1.5
miscellaneous*	151	0.3	0.1	3.5	14	0.4	21	-	-	0.06	-
	2188	60.5	27.3	28.8	387	12.7	3036	1.69	0.87	9.78	88.8
Rural Rich											
cereals	1786	47.6	19.3	17.4	48	9.4	1638	1.69	0.44	6.96	-
starchy roots	252	3.2	1.3	0.3	44	1.6	-	0.17	0.08	2.33	47.6
pulses	224	14.5	4.9	1.1	90	4.4	20	0.36	0.12	1.38	2.0
fruit & vegetable	114	2.2	0.8	0.4	53	1.3	1825	0.08	0.10	0.93	15.9
meat, egg & fish	107	8.6	5.9	7.9	8	1.2	138	0.02	0.07	2.16	-
milk	212	10.5	6.3	11.7	392	0.3	440	0.10	0.57	0.36	3.4
miscellaneous*	215	0.4	0.2	6.0	11	0.1	44	-	-	0.07	-
	2909	87.1	38.7	44.7	646	18.3	4105	2.42	1.38	14.19	92.2

* miscellaneous = sugar, fats, nuts, spices, stimulants, alcoholic beverages

Source: M.M. Shah and H. Frohberg (5).

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However, in total, not enough of all these commodities are available for the rural population to meet the caloric requirements; 86-93% of the required energy is supplied depending upon whether the rural population is considered very active or moderately active[1],[2] (Table 3). As mentioned earlier, the energy is mainly derived from cereals (56%) and from starchy roots (12%). Pulses contribute only to 5% of the energy, the commodity group fruits and vegetables as well as the group meat, eggs and fish to 3% each, and milk approximately to 4% of the total consumed energy. The rest is derived from sugar, fats, spices, stimulants and alcoholic beverages.

The protein content of the diet[3] is almost identical with the energy content - it is too low for the rural population. This is especially critical because this estimation did not include any additional need for people with infectious diseases or people contaminated with parasites. Therefore, a high degree of kwashiorkor should be expected among the rural population, especially before the harvest season when food becomes even scarcer among the poorer people who cannot afford to spend more money for food.

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1) The work load of the rural population is very big, especially during the harvest season. Because of the seasonal changes, this cannot be assumed for the whole year, therefore, the activity level will be somewhere between moderately and very active. The total requirements also decrease because of a very high unemployment rate leading to a partially apathetic and sedentary type life in this particular group. On the other hand, the total requirements have to be increased because of the high incidence of infectious diseases and contamination with parasites, malabsorption of nutrients and of metabolic abnormalities. Children may also need additional energy for catch-up growth.

2) Food balance sheets are based on food at the retail level and not on food as consumed. Therefore, food losses should be taken into consideration when calculating the requirements. It was suggested by FAO to increase the requirements by 10% for wastage, (3) which means that a population is adequately nourished when 110% of the requirements are supplied.

3) Even if there is no correlation between energy and protein requirements, it can be assumed that the protein requirement of a healthy population is approximately 5% of the energy considering the population as moderately active. There is no higher use for protein if the population is very active. Therefore, the minimum requirements may be very close to the ones estimated for the moderately active population. The higher needs of people with infectious diseases and parasites and of pregnant women cannot be considered. It has to be kept in mind that each commodity is treated as a separate unit when the high quantity protein is calculated. However, it is well known that an interaction exists between the different items consumed at one time. That can upgrade the total quantity and quality of the protein.

Table 3.   Food Consumption Pattern in Percent of the Nutritional Requirements for the Various Rural Income Classes

| | energy (%) | protein | | fat* (%) | cal-cium (%) | iron (%) | vita-min A (%) | thiamine (%) | riboflavin (%) | niacin (%) | vitamin C (%) |
		crude (%)	high quality (%)								
A. Moderate-ly Active											
Total	93	210	93	11	44	84	58	146	62	61	177
Poor	71	152	70	8	28	62	35	102	40	45	141
Medium	99	222	98	12	48	91	67	154	65	67	197
Rich	131	320	139	18	81	131	91	220	104	97	205
B. Very Active											
Total	86	210	93	10	44	84	58	134	57	57	177
Poor	66	152	70	7	28	62	35	93	37	41	141
Medium	91	222	98	11	48	91	67	141	60	62	197
Rich	121	320	139	17	81	131	91	202	96	90	205

*   percent of total energy requirements

Calculated from Tables 1 and 2.

The fat consumption of the Kenyan rural population is as low as that of the whole continent (1). Hardly any fat is added to the meals and most of it is simply derived from the natural fat content of cereals, especially of maize which is relatively rich in fat. Since the content of essential fatty acids in these oils is quite high, the relatively low fat consumption should not cause any problem in this respect. However, it could impair the vitamin A absorption.

The thiamine content of the diet is of no concern, which is due to the high content of cereals in the diet. Also the losses should be relatively small since maize is generally home pounded without any major extraction[1]. Therefore, the diet should be considered as adequate in thiamine.

Because starchy roots, especially cassava, contribute a major portion to the diet, the vitamin C content of the diet is also of no concern. If cassava is omitted from the diet the amount of vitamin C derived from fruits and vegetables would be too low to fulfil the requirements even before preparation. It has to be kept in mind, that vitamin C is very heat sensitive and can be destroyed very rapidly. Furthermore, ascorbic acid is also destroyed while storing the crops. Therefore, even with the high vitamin C content of the food presently available, this vitamin can be in deficit if the food is not handled in the proper way.

The low fruit and vegetable consumption is also responsible for the exceptionally low vitamin A content of the diet which makes the population quite susceptible to eye and skin lesions and finally to xerophthalmia. The intake is near the minimum dietary level at which clinical symptoms will occur. The vitamin A content of the food may be even worsened by two factors:

a) The variety of maize consumed was considered to be yellow. However, if another variety is eaten, i.e. a white variety, it is very likely that it contains no vitamin A at all. Therefore, the vitamin A content of the food is at the upper limit of the possible amount.

b) The absorption and digestion of vitamin A - a fat soluble vitamin - may be impaired because of the low fat content of the diet. However, no evaluation of this consideration can be given because it cannot be quantified up to now.

The riboflavin intake needs serious attention due to the low consumption of milk and milk products, meat, eggs and fish. It is well below the requirements.

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1) It should be pointed out, that the amount of vitamins and minerals corresponds to the food on a retail level. The actual content of the consumed food may be much lower due to too long and inappropriate cooking habits which destroy and/or dilute the nutrients. However, the actual nutrient level cannot be evaluated. Therefore, the present examination of the Kenyian diet will refer to the maximum amount of a nutrient that people can receive with the diet.
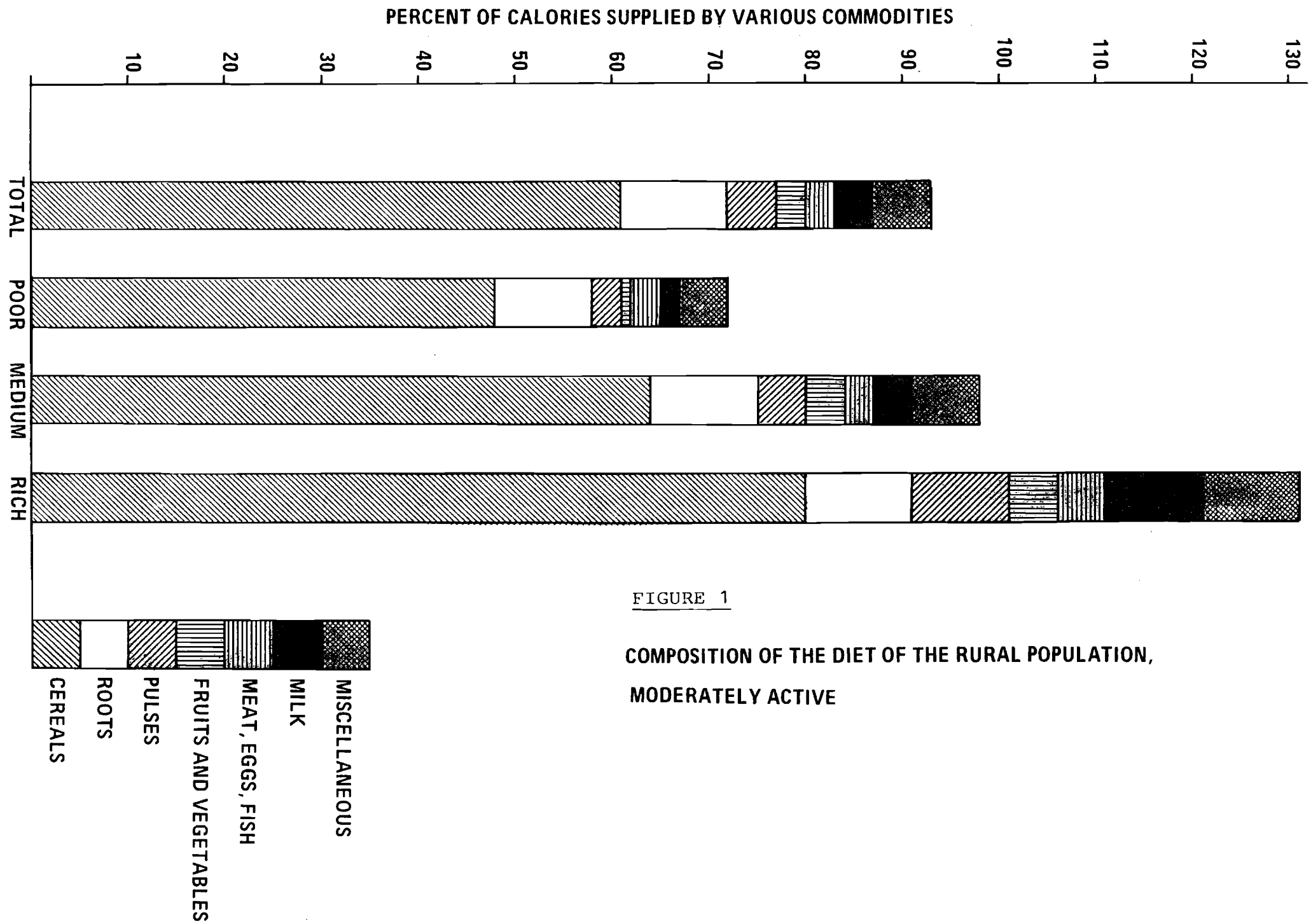
PERCENT OF CALORIES SUPPLIED BY VARIOUS COMMODITIES

FIGURE 1

COMPOSITION OF THE DIET OF THE RURAL POPULATION, MODERATELY ACTIVE

CEREALS
ROOTS
PULSES
FRUITS AND VEGETABLES
MEAT, EGGS, FISH
MILK
MISCELLANEOUS

TOTAL
POOR
MEDIUM
RICH

Considerably below the requirements is the niacin content
of the diet, which is deduced from the low meat content of the
diet and from the absence of nuts in the diet. It also cannot
be expected that tryptophan is transferred into niacin because
it is a limiting amino acid in the diet by itself (most of
the protein comes from maize, and the limiting amino acids
in maize are lysine and tryptophan).

The low niacin intake (4.1 mg/1000 kcal) is quite critical
because it is below the minimum dietary level that will prevent
clinical symptoms (below 4.4 mg/1000 kcal).   A high incidence
of dermatitis, stomatitis, diarrhea and mental depression can
be expected among the rural population (and especially the poorer
ones which will be seen later in this report), providing that
they do not consume other niacin sources (i.e. nuts) as being
represented in this survey.

The proportion of the requirements for calcium cannot be
evaluated as strictly as the other nutrients, because it is not
known how much of the mineral is consumed with drinking water
and how much is really needed on a low animal protein diet.
Since up to now no clinical evidence of calcium deficiencies
could be found even when the intake was below 300 mg no immediate
concern has to be given to this mineral.

1.2   The Rural Population divided into 4 Income Classes

Dividing the total rural population into 4 groups according
to their income - poor, medium, rich, and very rich (which will
not be covered in this report) - clearly demonstrates the differ-
ent consumption pattern depending upon the amount of money spent
on food (Figure 1). However, as indicated in Figure 1, the
quality and variety of the food commodity classes purchased does
not change dramatically with the increasing money spent for food,
the differences in the diet will be more a matter of quantity.

The amount of cereals consumed increases sharply with having
more money available to spend on food, whereas the consumption
of starchy roots remains independent of the income (Figure 1).
In addition, it is of interest that within one commodity group
changes occur with increasing the food expenditures. The maize
flour and millet consumption is shifting more towards wheat flour,
bread and rice consumption which are the more expensive items.
The poor man's starchy root is cassava whereas the rich class
consumes more potatoes; the rich people obtain their required
vitamin C by a much higher consumption of fruits and vegetables.
The increase of beans consumed with increasing income influences
positively the thiamine, riboflavin and niacin content of the
upper class' diet. The dependency is the highest for milk
consumption, 5 times more milk products are eaten in the rich
income class as compared to the poor class. This high milk
consumption explains the relatively high calcium content of the
rich class's diet. It has to be pointed out that only the rich
class consumes enough food to meet the energy and protein
requirements (considering an additional 10% of the requirements

for losses) regardless whether the population is considered as
moderately active or very active in respect to their requirements -
these are 10% of the total rural population and 8% of the total
Kenyian population.

All the variations in the diet pattern discussed before do
not cause considerable variations in the relative caloric content
derived from the protein, fat, sugar and starch of the food eaten
by the poor and the rich classes. The general food pattern is
still the same for all income groups (Figure 2). Basically, the
rich class is only able to buy some additional fat, a fairly
expensive item, whereas almost all the fat consumed by the poor
class is dervied from the cereals. The animal protein intake is
not more than slightly elevated when more money is spent for food,
because it is not popular to eat much meat, fish and eggs among
the rural population. The percentage of the vegetable protein in
the diet does not change considerably with the income; 9-10% of the
energy is derived form vegetable protein by all income classes.
The consumption of refined sugar, another fairly expensive item,
is proportional with the increase of fat, and refined sugar in the
diet, the content of starch will decrease. It is worthwhile to
stress more deeply that the percentage of supplied calories in the
daily food intake derived from protein and especially from vegetable
protein increases only slightly with increasing income, which is
consistent with the observation throughout the whole world (6).
Also developed countries do not consume a higher percentage of
energy derived from total protein (calculated from (7)), the
difference can be only found in the proportion of vegetable and
animal proteins.

The income and food expenditures of different rural groups
are listed in Table 4. On average, 75% of the income is spent
for food, slightly more by the poor and slightly less by the rich
part of the population. These spending practices are character-
istic of low income countries throughout the whole world.

1.3   The rural population divided into 7 income classes.

The rural population is further subdivided into 7 income groups
(R11-R17), where the poor group consists of R12, the medium group
of R11, R13 and R14, and the rich group of R15-R17. Considering
the amount of energy supplied in respect to the income, an
exponential development with increasing income is observed which
exactly behaves as a priori assumed (Figure 3). It can be deduced
(providing no major change in the behaviour of the population)
that an income of 650 KSh/year/caput (assuming constant prices) is
enough to meet the energy requirements and the food losses for a
moderatively active group of people. If the population is very
active, they need about 100 KSh more per year to receive an adequate
caloric diet. According to these standards, 28 or 13% respectively,
of the rural population are able to purchase an adequate amount of
food; R14 has to be considered as being the break-even group between
the two extremata.

The rural population approaches only very slowly the stage,
where people buy more expensive food as for example, fat, with
increasing income - they are still quite strongly linked to their
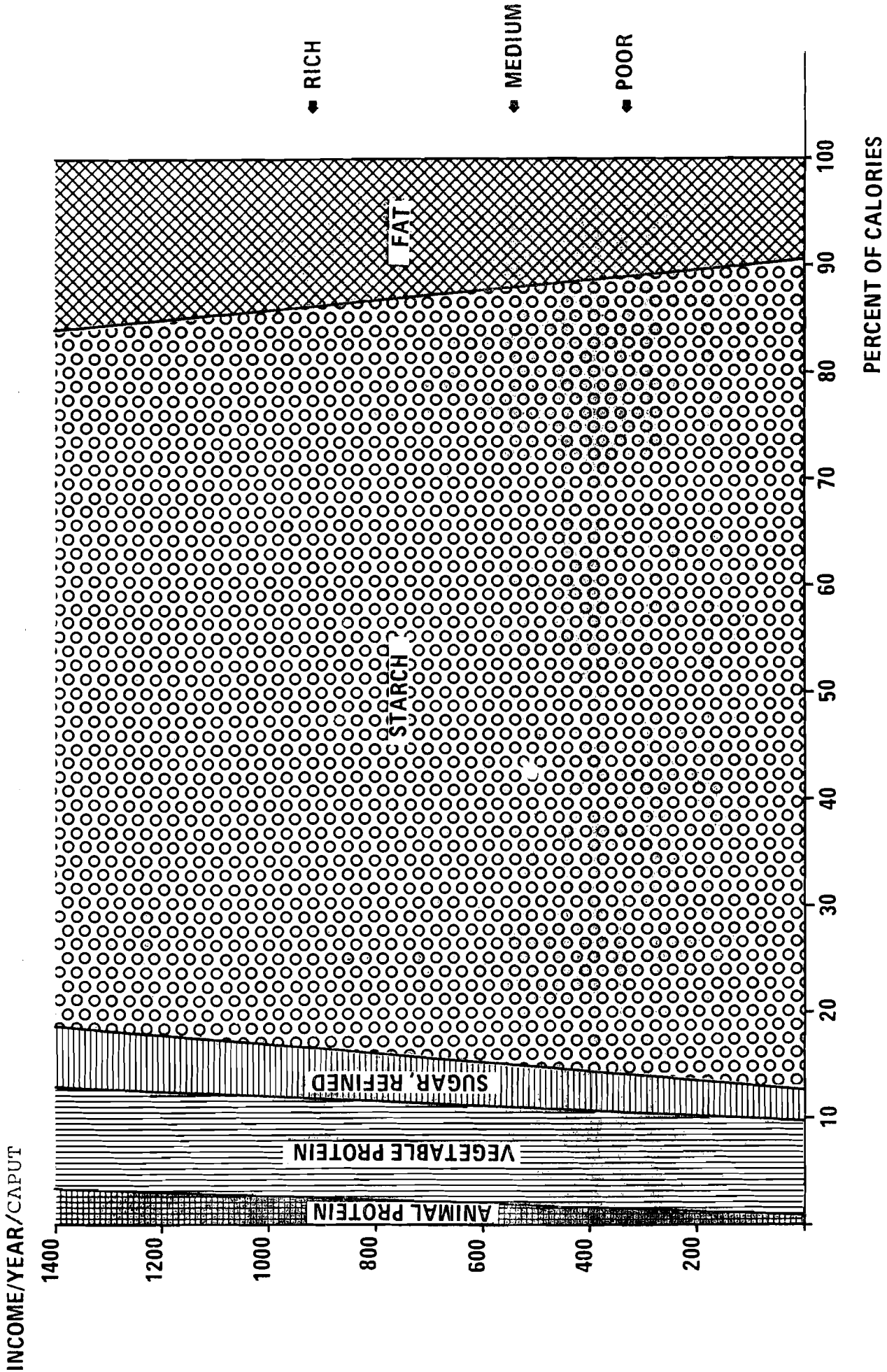
FIGURE 2   COMPOSITION OF THE DIET OF THE RURAL POPULATION (MODERATELY ACTIVE) DEPENDING ON THE FOOD EXPENDITURE

Table 4. <u>Income and Population distribution of the Rural Population in year 1975</u>

Population group	Income/year (KSh)	Food expenditure/ year (KSh)	percent of total rural population	percent of total pop.	household size	percent of salary spent on food
Total rural pop.	494.99	372.31	100	88	6.97	75
Poor rural pop.	326.04	251.54	34	30	7.45	77
Medium rural pop.	533.58	400.44	43	38	6.88	75
Rich rural pop.	911.71	665.05	10	8	5.98	73
<u>Rural population by income groups</u>						
R11	566.50	371.16	6	5	6.54	66
R12	326.04	251.54	39	34	7.45	77
R13	479.86	369.72	32	28	7.10	77
R14	651.45	489.16	13	11	6.55	75
R15	833.60	616.56	5	4	6.34	74
R16	881.36	623.73	2	2	5.90	71
R17	1035.18	755.54	4	3	5.60	73
<u>Rural population by provinces</u>						
Central	643.60	448.63	16	15	6.95	70
Coast	390.42	325.00	7	6	8.04	83
Eastern	596.44	455.19	19	17	6.74	76
Nyanza	386.93	309.88	22	19	6.58	80
Rift Valley	456.19	341.41	22	20	7.51	75
Western	377.42	283.33	14	12	7.44	62

SUPPLY OF CALORIC REQUIREMENTS IN PERCENT

INCOME/YEAR
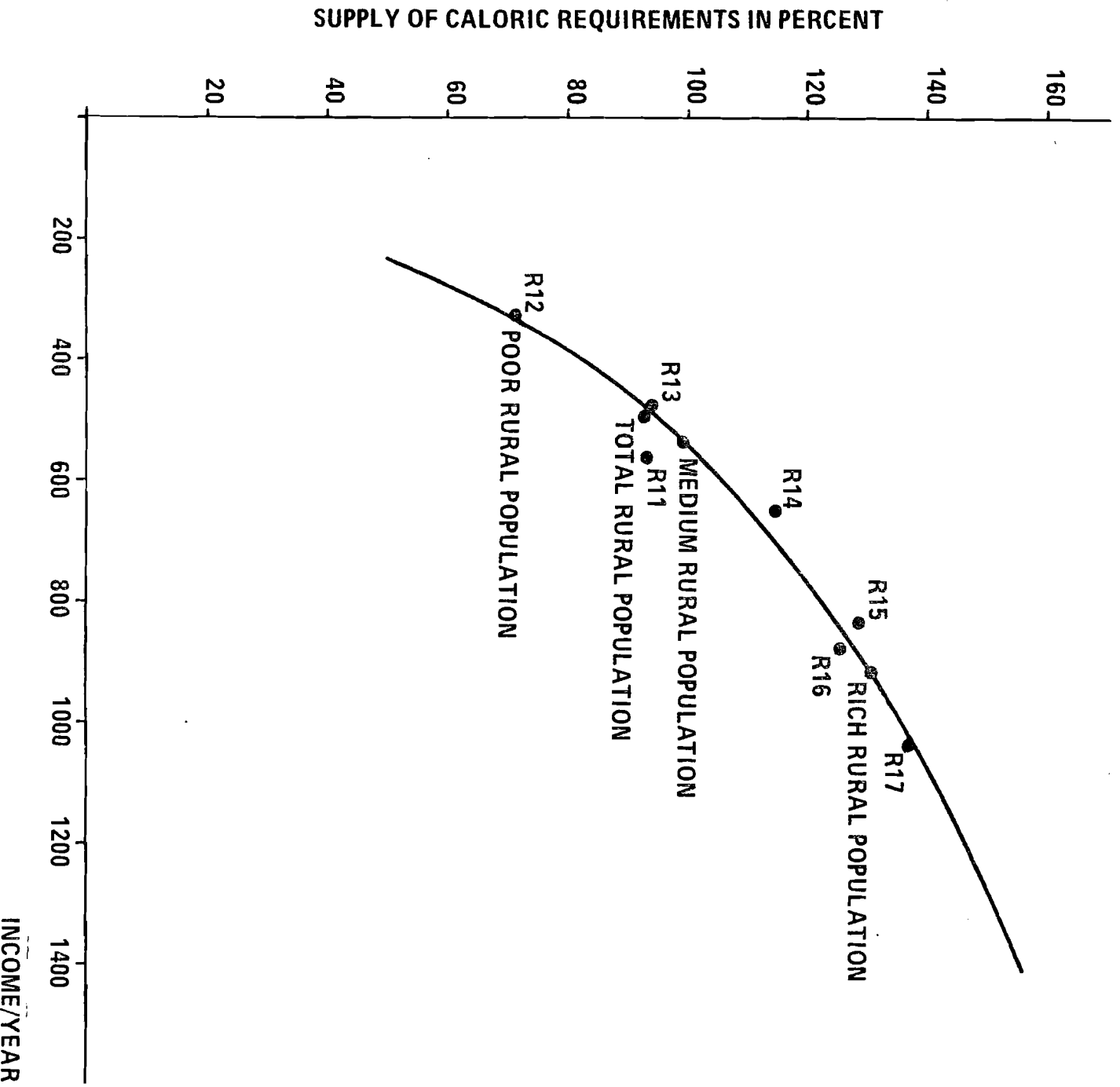
SOURCE: Shah M.M. and H. Frohberg [5].

FIGURE 3   SUPPLY OF CALORIC REQUIREMENTS OF RURAL POPULATION
(MODERATELY ACTIVE) DEPENDING ON INCOME

Table 5. Diet Pattern of the Rural Population by Income Classes (absolute values)

	energy (kcal)	protein crude (g)	protein high quality (g)	fat (g)	calcium (mg)	iron (mg)	vitamin A (I.U.)	thiamine (mg)	riboflavin (mg)	niacin (mg)	vitamin C (mg)
Rural 11											
cereals	1353	36.6	15.6	12.8	49	6.5	1091	1.15	0.36	4.89	-
starchy roots	251	2.5	0.9	0.3	53	1.3	-	0.12	0.05	1.34	57.3
pulses	64	4.2	1.4	0.3	26	1.3	6	0.10	0.03	0.39	0.6
fruit & veg.	58	1.2	0.4	0.2	28	0.7	992	0.05	0.05	0.51	21.0
meat egg,fish	65	5.3	3.7	4.8	6	0.7	85	0.02	0.04	1.27	-
milk	66	3.3	2.0	3.6	124	0.1	139	0.03	0.17	0.13	1.1
miscellaneous*	197	0.3	0.1	4.9	18	0.5	22	-	-	0.07	-
Rural 12											
cereals	1061	28.5	13.2	10.3	47	4.9	888	0.89	0.29	3.68	-
starchy roots	220	2.0	0.8	0.2	48	1.0	-	0.09	0.05	1.01	51.9
pulses	58	3.8	1.3	0.3	23	1.1	5	0.09	0.03	0.36	0.5
fruit & veg.	30	0.6	0.3	0.1	15	0.4	509	0.02	0.04	0.26	10.7
meat,egg.fish	56	4.4	2.6	4.0	5	0.6	69	0.01	0.03	1.12	-
milk	37	1.9	1.1	2.0	69	0.1	78	0.02	0.09	0.07	0.6
miscellaneous*	116	0.1	0.1	1.9	15	0.6	10	-	-	0.05	-
Rural 13											
cereals	1331	36.7	15.5	12.9	45	6.3	1139	1.15	0.35	4.78	-
starchy roots	262	2.7	1.0	0.3	54	1.3	-	0.13	0.06	1.49	59.0
pulses	111	7.2	2.4	0.6	45	2.2	10	0.18	0.06	0.68	1.0
fruit & veg.	86	1.7	0.7	0.3	42	1.1	1465	0.07	0.08	0.75	31.1
meat,egg,fish	67	5.2	3.5	4.9	7	0.7	85	0.02	0.03	1.33	-
milk	88	4.4	2.6	4.9	163	0.1	183	0.04	0.24	0.15	1.4
miscellaneous*	134	0.2	0.1	2.8	14	0.4	14	-	-	0.06	-
Rural 14											
cereals	1615	43.1	17.6	16.1	42	10.0	1528	1.53	0.41	6.09	-
starchy roots	291	3.2	1.2	0.3	58	1.5	-	0.15	0.07	1.86	63.3
pulses	152	9.1	3.4	0.8	61	3.0	13	0.24	0.08	0.94	1.3
fruit & veg.	111	2.1	0.8	0.4	53	1.3	1813	0.08	0.10	0.92	38.7
meat,egg,fish	93	7.3	5.0	6.7	7	1.0	118	0.02	0.05	1.82	-
milk	115	5.7	3.4	6.3	213	0.2	239	0.05	0.30	0.20	1.8
miscellaneous*	171	0.3	0.2	4.8	13	0.3	28	-	-	0.07	-
Rural 15											
cereals	1707	45.6	18.5	16.7	44	8.8	1567	1.63	0.42	6.59	-
starchy roots	316	4.2	1.5	0.4	56	1.9	-	0.21	0.09	2.79	61.2
pulses	267	17.3	5.9	1.3	107	5.2	23	0.42	0.14	1.64	2.3
fruit & veg	99	1.9	0.8	0.3	46	1.2	1592	0.08	0.10	0.83	34.5
meat,egg,fish	100	8.0	5.5	7.3	8	1.0	132	0.02	0.06	2.05	-
milk	172	8.5	5.1	9.5	319	0.3	358	0.08	0.46	0.29	2.7
miscellaneous*	207	0.3	0.2	6.1	11	0.1	35	-	-	0.02	-
Rural 16											
cereals	1745	46.5	18.7	17.4	43	9.2	1673	1.68	0.43	6.71	-
starchy roots	185	2.6	0.9	0.2	31	1.2	-	0.13	0.06	1.78	34.5
pulses	198	12.8	4.4	1.0	79	3.9	17	0.31	0.10	1.22	1.7
fruit & veg.	101	1.9	0.8	0.7	47	1.2	1618	0.08	0.10	1.84	34.9
meat,egg,fish	77	6.0	4.1	5.6	7	0.8	92	0.02	0.04	1.52	-
milk	280	13.8	8.3	15.5	516	0.4	578	0.13	0.75	0.45	4.4
miscellaneous*	204	0.4	0.2	5.9	10	0.1	53	-	-	0.06	-
Rural 17											
cereals	1920	50.8	20.8	21.9	52	9.8	1711	1.78	0.47	7.59	-
starchy roots	207	3.0	1.1	0.2	34	1.3	-	0.15	0.06	2.06	37.5
pulses	184	11.9	4.0	0.9	74	3.6	16	0.29	0.10	1.13	1.6
fruit & veg.	140	2.7	1.1	0.4	64	1.6	2256	0.11	0.12	1.15	48.6
meat,egg,fish	137	11.0	7.5	10.1	11	1.5	172	0.03	0.09	2.72	-
milk	221	11.0	6.6	12.2	411	0.3	461	0.11	0.59	0.37	3.5
miscellaneous*	228	0.4	0.2	5.8	11	0.1	53	-	-	0.08	-

* miscellaneous = sugar, fats, nuts, spices, stimulants, alcoholic beverages
SOURCE: M.M. Shah and H. Frohberg [5]

Table 6. Diet Pattern of the Rural Population by Income Classes in 1975

Income Group	Energy (kcal)	protein crude (g)	protein high quality (g)	fat (g)	calcium (mg)	iron (mg)	vita-min A (I.U.)	thiamin (mg)	ribo-flavin (mg)	niacin (mg)	vitamin C (mg)
A. Absolute Values											
R 11	2055	53.0	24.1	26.9	304	11.1	2335	1.47	0.70	8.65	80.0
R 12	1578	41.3	19.4	18.8	222	8.7	1559	1.12	0.53	6.54	63.7
R 13	2077	57.0	25.8	26.5	370	12.1	2896	1.59	0.82	9.24	92.5
R 14	2545	71.6	31.6	35.3	447	15.6	3739	2.07	1.01	11.91	105.1
R 15	2867	85.9	37.2	41.5	591	18.5	3707	2.44	1.27	14.26	100.7
R 16	2788	84.1	37.4	45.9	733	16.8	4031	2.35	1.48	12.58	75.5
R 17	3036	90.7	41.3	48.0	657	18.2	4669	2.47	1.43	15.10	91.2
B. Relative Values (in percent of requirements) – moderately Active											
R 11	93	195	87	11	38	79	52	132	53	59	178
R 12	71	152	70	8	28	62	35	101	41	45	136
R 13	94	210	93	11	46	86	64	143	62	63	206
R 14	115	263	114	14	36	111	83	186	76	81	234
R 15	129	316	134	17	74	132	82	200	95	97	224
R 16	126	309	135	19	92	120	90	218	111	86	168
R 17	137	333	149	19	82	130	104	223	108	103	203
C. Relative Values (in percent of requirements) – very active											
R 11	86	195	87	10	38	79	52	123	49	55	178
R 12	66	152	70	7	28	62	35	93	38	41	136
R 13	87	210	93	10	46	86	64	133	60	58	206
R 14	106	263	114	13	56	111	83	173	70	75	234
R 15	120	316	134	16	74	132	82	203	88	90	224
R 16	116	309	135	17	92	120	90	196	103	79	168
R 17	127	333	149	18	82	130	104	206	99	95	203

Calculated from Tables 55 and 59.

traditional food pattern (Table 5 and 6). Only the richest group (R17) has an adequate supply of all examined minerals and vitamins; however, their diet cannot be classified as an excellent one either, because they are way above their caloric requirements. As a consequence, the food losses in this income group may be higher than in the average. These people also may develop a tendency towards obesity. Their consumption of cereals is relatively too high, whereas they still eat too little fruit and vegetables, milk products and nuts in order to have a "well balanced" diet, because otherwise the major nutrients would also be above the requirements.

It should actually be assumed that the more money people of the same cultural and regional background spend on food, the better the quality of their diet should become. However, that may be only true within certain limitations, and surely will not hold for all countries, especially not for the developed ones. This statement is also justified only with some restrictions for the rural population in Kenya (Figure 4). As already mentioned, the caloric content of the diet increases proportionally with the amount of money spent on food, however the composition of the purchased food changes only minimally in proportion with the caloric content. This expresses strongly that people do not buy different food commodity groups while spending more money on it, they simply purchasemore food of the same variety. This allows some generalizations about the diet of the rural population. Providing enough money is spent on food (more than 500 KSh/capita on 1975 prices), a sufficient amount of calories (the requirements of a moderately active group of people and the food losses) is obtained. This diet will be sufficient in protein, thiamine, vitamin C, and in iron; the latter one is still in the limitation of the error at this point of the curve. However, deficiencies in riboflavin, niacin, vitamin A and calcium will occur. If the most limited nutrients - niacin and vitamin A (calcium is not the most limited one because of reasons mentioned already earlier) - are considered as the essential factors of a sufficient diet, approximately 750 KSh/person would be needed. However, this diet would be too rich in energy [by 30-40%] and if all food is eaten as assumed, the whole population would become obese. On the other hand, if a sufficient amount of thiamine is the limiting factor, only approximately 300 KSh would have to be spent; however, the diet would be sufficient only in thiamine and vitamin C, all the other nutrients would be too low, some of them even below the minimum dietary level that would prevent clinical symptoms. This indicates that the average diet of the rural population is not a balanced one. Therefore, a typical diet adequate in calories and protein should contain approximately 6-7% less cerealsor about 30% less starchy roots[1]. It should be increased by 50% in the total vegetable and fruit consumption. In addition, about 20-30g of nuts should be eaten per capita per day in order to obtain an adequate niacin intake. Some nuts are probably eaten anyhow which simply have not been elaborated on in this survey; in the provisional food balance sheets given by the FAO for the same

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[1] From a nutritional point of view, it may be much better to decrease the starchy root consumption than the cereal consumption since the nutritive value of the latter commodity is higher.
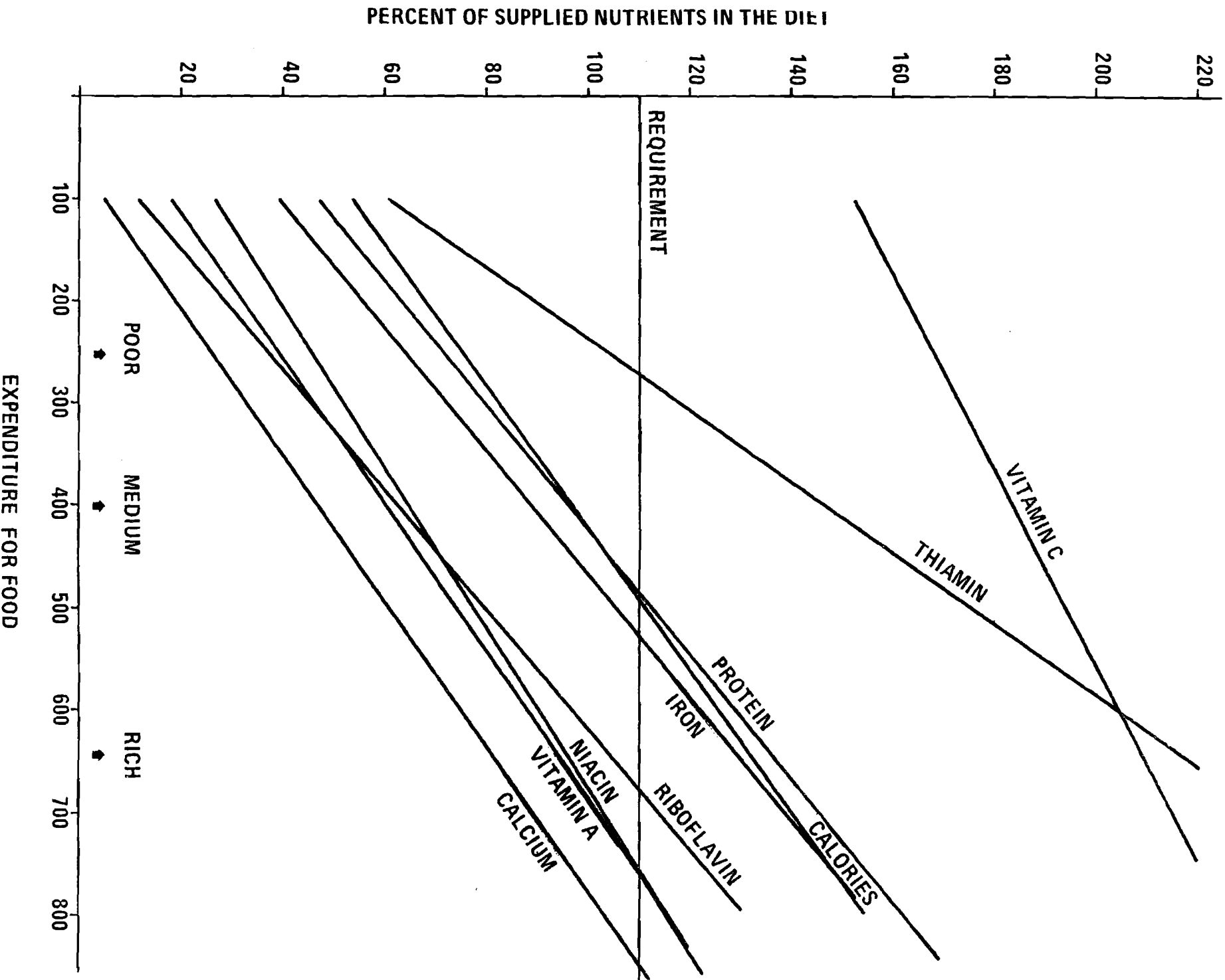
FIGURE 4 DEPENDENCE OF THE QUALITY OF THE DIET UPON FOOD EXPENDITURE FOR RURAL POPULATION (MODERATELY ACTIVE)

period (8), 11.6 g nuts and oilseeds are eaten by the total Kenyian population per capita per day. Thus, the niacin content of the diet may actually be of no concern; however, it will need further investigation not only from the view of the food analysis, but also from a clinical point of view. More serious is the low vegetable and fruit consumption - it will need more education of the people to show the importance of these items in the diet in order to make them grow more of this commodity for home consumption.

1.4 The Rural Population Divided by Provinces

In a further study, the rural population was divided by provinces in order to establish the most critical area from a nutritional point of view. Two different assumptions were made when calculating the consumption baskets in these provinces:

Set 1: The same food prices were applied in all provinces. They are the same ones as used to calculate the food balance sheets of the rural population divided by income classes.

Set 2: Different prices were applied in the different provinces.

These two groups were evaluated separately; however, they will be considered as one group further on, because the differences between both groups are within the error limit of the nutritional analysis. Slightly different requirements have to be considered for the essential nutrients in the various provinces because of differences in the population stucture (Table 1).

1.4.1 Western Province

The per capita income in the Western Province is the lowest in comparison to all other provinces (Table 4). In addition, their preference for food (especially of high quality food) must be relatively low, because they spend only 62% of their income on food whereas the national total of the rural population for food expenditure can be found around 75%. Therefore, as can be predicted by Figure 4, their diet is an insufficient one, the most insufficient one of all the provinces. Indeed, the energy and protein intake of the whole province (not divided into income groups!) is almost as low as the one of the poor income class discussed in [5] (Table 7 and 8). Therefore, it can be expected that the diet of the poor class in this province is even below the one of the national rural poor class. The energy and protein intake is far below the acceptable range which is mainly due to their comparatively low cereal and starchy root consumption; the other food commodities are also below the consumption level of the rural population (Table 9 , Figure 5). Consequently, their diet is insufficient in all essential nutrients except thiamine and vitamin C which are still in a tolerable range at the retail level, but even which may become critical after preparation of the food. The amount of protein in the diet is too low, which is partly due to the relatively low cereal consumption as well as to the low intake of pulses and milk products; on the other hand, the consumption of meat is fairly high in comparison to the other provinces. The same

Table 7. Dietary Intake of the Various Rural Provinces (absolute values) in 1975.

Province	energy (kcal)	protein crude (g)	protein high quality (g)	fat (g)	calcium (mg)	iron (mg)	vita-min A (I.U.)	thiamine (mg)	ribo-flavin (mg)	niacin (mg)	vita-min C (mg)
Set 1											
Central	2236	59.8	26.9	30.0	440	12.9	3010	1.67	0.93	9.90	99.4
Coast	1964	48.6	22.5	21.1	224	9.8	2027	1.34	0.59	7.99	95.8
Eastern	2386	67.8	28.3	27.0	475	15.9	3079	1.91	0.97	11.66	129.1
Nyanza	1864	50.8	23.8	26.0	246	10.3	2487	1.40	0.66	8.20	60.0
Rift Valley	2013	56.3	26.7	33.9	536	9.5	2352	1.56	1.07	7.09	46.2
Western	1686	45.7	21.3	22.4	188	9.0	2100	1.27	0.54	6.87	50.0
Set 2											
Central	2376	63.9	28.6	30.9	424	13.8	3136	1.82	0.96	10.53	100.0
Coast	2060	51.3	23.6	21.9	217	10.4	1978	1.45	0.60	8.27	91.8
Eastern	2449	70.1	29.9	28.1	482	16.2	3176	1.95	1.00	11.38	125.4
Nyanza	1837	50.1	23.7	26.5	253	9.9	2331	1.38	0.66	8.06	55.5
Rift Valley	1941	53.4	25.2	31.2	462	8.7	2205	1.49	0.95	6.36	45.5
Western	1684	45.6	21.5	22.6	195	9.1	2096	1.25	0.55	6.89	50.0

SOURCE: M.M. Shah and H. Frohberg [5].

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Table 8. Dietary Intake of the Various Rural Provinces Relative to the Nutritional Requirements.

Province	energy (%)	protein crude (%)	protein high quality (%)	fat* (%)	calcium (%)	iron (%)	vita- min A (%)	thiamin (%)	ribo- flavin (%)	niacin (%)	vita- min C (%)
I. Set 1											
A. Moderately Active											
Central	101	220	97	12	55	92	67	150	70	68	221
Coast	89	180	81	9	28	70	45	122	45	55	213
Eastern	108	250	102	11	59	114	68	172	73	80	287
Nyanza	82	183	84	10	31	74	55	124	49	55	133
Rift Valley	91	207	96	14	67	68	52	141	80	48	103
Western	76	169	77	9	24	64	47	114	41	47	111
B. Very Active											
Central	93	220	97	11	55	92	67	138	65	62	221
Coast	82	180	81	8	28	70	45	112	41	50	213
Eastern	101	250	102	10	59	114	68	162	68	75	287
Nyanza	77	183	84	10	31	74	55	116	46	51	133
Rift Valley	84	202	96	13	67	68	52	130	75	45	103
Western	71	169	77	9	24	64	47	107	38	44	111
II. Set 2											
A. Moderately Active											
Central	108	235	103	13	53	99	70	164	72	72	222
Coast	94	190	85	9	27	74	44	132	45	57	204
Eastern	111	259	108	11	60	116	71	176	75	78	279
Nyanza	81	181	79	11	32	71	52	122	49	54	123
Rift Valley	87	196	91	13	58	62	49	134	71	43	101
Western	76	168	77	9	24	65	47	113	41	47	111
B. Very Active											
Central	99	235	103	12	53	99	70	150	66	66	222
Coast	86	190	85	8	27	74	44	121	42	52	204
Eastern	104	259	108	11	60	116	71	165	70	73	279
Nzanza	76	181	79	10	32	71	52	114	46	50	123
Rift Valley	81	196	91	12	58	62	49	124	66	40	101
Western	71	168	77	9	24	65	47	105	39	44	111

* percent of total energy requirements

Calculated from Table 7 and Table 1.

TABLE 9: DIETARY PATTERNS OF THE RURAL POPULATION OF THE VARIOUS PROVINCES

1. Set 1
2. Set 2

	calories (kcal)		crude protein (g)		high quality protein (g)		fat (g)		calcium (mg)		iron (mg)		vitamin A (I.U.)		thiamine (mg)		riboflavin (mg)		niacin (mg)		vitamin C (mg)	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Central																						
Cereals	1328	1455	35.5	38.9	15.5	16.8	12.7	14.1	48	50	6.2	6.8	1088	1232	1.14	1.26	0.35	0.19	4.71	5.18	-	-
Starchy roots	306	311	3.5	3.8	1.3	1.4	0.3	0.3	58	58	1.8	1.8	-	-	0.18	0.19	0.08	0.08	2.30	2.38	63.3	63.8
Pulses	137	154	8.9	10.0	3.0	3.4	0.7	0.8	55	62	2.7	3.0	12	14	0.22	0.24	0.07	0.08	0.84	0.95	1.2	1.4
Vegetables & Fruits	94	74	1.8	1.8	0.8	0.8	0.3	0.3	44	44	1.1	1.1	1581	1569	0.07	0.07	0.09	0.09	0.79	0.79	33.1	33.1
Meat, Eggs, Fish	52	51	4.1	4.0	2.7	2.9	3.9	3.8	4	4	0.5	0.5	82	78	0.02	0.01	0.04	0.04	0.91	0.99	-	-
Milk	112	104	5.6	5.2	3.4	3.1	6.2	5.7	209	194	0.2	0.2	233	217	0.05	0.05	0.30	0.28	0.20	0.19	1.8	1.7
Miscellaneous*	208	208	0.3	0.3	0.2	0.2	6.0	6.0	12	12	0.4	0.4	26	26	-	-	-	-	0.05	0.05	-	-
Coast																						
Cereals	1365	1476	36.9	39.8	15.9	17.1	12.4	13.6	56	58	6.5	7.0	1066	1091	1.13	1.24	0.36	0.39	4.93	5.34	-	-
Starchy Roots	306	306	2.5	2.5	1.0	1.0	0.3	0.3	70	70	1.4	1.4	-	-	0.11	0.11	0.06	0.06	1.11	1.11	75.2	75.2
Pulses	11	18	0.7	1.2	0.3	0.4	0.1	0.1	5	7	0.2	0.3	1	2	0.02	0.03	0.01	0.01	0.07	0.11	0.1	0.2
Vegetables & Fruits	62	47	1.1	0.9	0.4	0.4	0.2	0.1	26	21	0.6	0.5	905	739	0.05	0.04	0.05	0.04	0.49	0.38	20.1	16.0
Meat, Eggs, Fish	68	65	5.9	5.6	4.0	3.9	4.8	4.6	6	6	0.6	0.7	90	88	0.02	0.02	0.05	0.05	1.29	1.23	-	-
Milk	25	22	1.3	1.1	0.8	0.7	1.3	1.2	49	43	-	-	54	47	0.01	0.01	0.06	0.05	0.06	0.06	0.4	0.4
Miscellaneous*	126	126	0.2	0.2	0.1	0.1	2.1	2.1	12	12	0.5	0.5	11	11	-	-	-	-	0.04	0.04	-	-
Eastern																						
Cereals	1344	1426	36.2	38.4	15.5	16.4	12.6	13.5	49	51	6.4	6.8	1062	1148	1.14	1.22	0.35	0.37	4.88	5.17	-	-
Starchy Roots	429	395	5.0	4.3	1.8	1.6	0.5	0.4	90	79	2.4	2.1	-	-	0.24	0.20	0.11	0.10	3.12	2.55	89.6	85.8
Pulses	245	253	15.9	16.4	5.4	5.6	1.2	1.3	99	102	4.8	5.0	22	22	0.39	0.40	0.13	0.13	1.51	1.56	2.2	2.2
Vegetables & Fruits	101	101	2.0	2.0	0.8	0.8	0.3	0.3	49	49	1.3	1.3	1704	1704	0.08	0.08	0.10	0.10	0.86	0.86	35.8	35.8
Meat, Eggs, Fish	52	50	4.0	3.9	2.1	2.6	3.7	3.6	4	4	0.5	0.5	76	72	0.02	0.01	0.04	0.04	1.03	0.97	-	-
Milk	90	97	4.4	4.8	2.6	2.8	4.9	5.3	166	179	0.1	0.1	186	201	0.04	0.04	0.24	0.26	0.16	0.17	1.5	1.6
Miscellaneous*	127	127	0.3	0.3	0.1	0.1	3.7	3.7	18	18	0.4	0.4	29	29	-	-	-	-	0.10	0.10	-	-
Nyanza																						
Cereals	1334	1322	35.6	36.6	15.0	14.8	13.3	13.2	39	36	6.5	6.5	1246	1243	1.21	1.21	0.35	0.34	4.86	4.84	-	-
Starchy Roots	150	150	1.2	1.2	0.5	0.5	0.1	0.1	34	34	0.7	0.7	2	-	0.05	0.05	0.03	0.03	0.55	0.55	36.8	36.8
Pulses	26	16	1.7	1.1	0.6	0.4	0.1	0.1	10	7	0.5	0.3	-	1	0.04	0.03	0.01	0.01	0.16	0.10	0.1	0.1
Vegetables & Fruits	68	50	1.2	1.0	0.4	0.4	0.2	0.2	29	23	0.7	0.6	1005	822	0.05	0.04	0.06	0.04	0.54	0.42	22.1	17.5
Meat, Eggs, Fish	99	100	8.0	8.0	5.4	5.4	7.1	7.2	8	8	1.1	1.0	104	110	0.01	0.02	0.06	0.06	1.94	1.98	-	-
Milk	58	69	2.9	3.4	1.8	2.1	3.2	3.8	109	128	0.1	0.1	121	142	0.03	0.03	0.15	0.18	0.10	0.11	0.9	1.1
Miscellaneous*	129	129	0.2	0.2	0.1	0.1	2.0	2.0	17	17	0.7	0.7	13	12	-	-	-	-	0.05	0.05	-	-
Rift Valley																						
Cereals	1410	1382	37.3	36.6	15.4	15.1	14.8	14.4	28	29	7.4	6.9	1519	1458	1.36	1.31	0.35	0.35	5.21	5.09	-	-
Starchy Roots	151	151	1.2	1.2	0.5	0.5	0.1	0.1	34	34	0.7	0.7	-	-	0.05	0.05	0.03	0.03	0.05	0.05	36.9	36.9
Pulses	6	4	0.4	0.2	0.1	0.1	-	-	2	1	0.1	-	-	-	0.01	0.01	-	0.01	0.04	0.02	0.1	-
Vegetables & Fruits	15	15	0.1	0.1	0.1	0.1	0.1	0.1	7	7	0.1	0.1	240	248	0.01	0.01	0.01	0.01	0.13	0.13	5.4	5.4
Meat, Eggs, Fish	63	60	4.8	4.7	3.3	3.2	4.9	4.4	5	3	0.6	0.3	74	69	0.02	0.01	0.03	0.06	1.23	0.70	-	-
Milk	243	204	12.0	10.1	7.2	6.1	13.5	11.3	449	377	0.4	0.3	502	422	0.11	0.11	0.65	0.55	0.39	0.33	3.8	3.2
Miscellaneous*	125	127	0.2	0.2	0.1	0.1	0.8	0.8	11	8	0.7	0.4	8	8	-	-	-	-	0.05	0.04	-	-
Western																						
Cereals	1205	1203	32.2	32.1	13.8	13.1	11.2	11.9	37	37	5.7	5.7	1099	1005	1.07	1.05	0.31	0.32	4.31	4.28	-	-
Starchy Roots	112	132	1.1	1.1	0.4	0.4	0.1	0.1	30	30	0.6	0.6	-	-	0.05	0.05	0.02	0.02	0.05	0.05	32.3	32.3
Pulses	48	42	3.1	2.7	1.1	0.9	0.2	0.2	19	17	0.9	0.8	4	4	0.08	0.07	0.03	0.02	0.30	0.26	0.4	0.4
Vegetables & Fruits	47	47	1.0	1.0	0.4	0.4	0.2	0.2	22	22	0.6	0.6	797	797	0.04	0.04	0.04	0.04	0.40	0.40	16.7	16.7
Meat, Eggs, Fish	54	60	6.4	6.6	4.4	4.4	6.6	6.1	4	6	0.9	0.9	116	117	0.02	0.02	0.05	0.05	1.70	1.72	-	-
Milk	34	38	1.7	1.9	1.1	1.2	1.8	2.1	63	72	-	0.1	72	81	0.01	0.02	0.09	0.10	0.07	0.07	0.6	0.6
Miscellaneous*	125	126	0.5	0.5	0.1	0.1	1.8	1.8	11	11	0.4	0.4	13	13	-	-	-	-	0.04	0.04	-	-

* Miscellaneous = sugar, fats, nuts, stimulants, alcoholic beverages
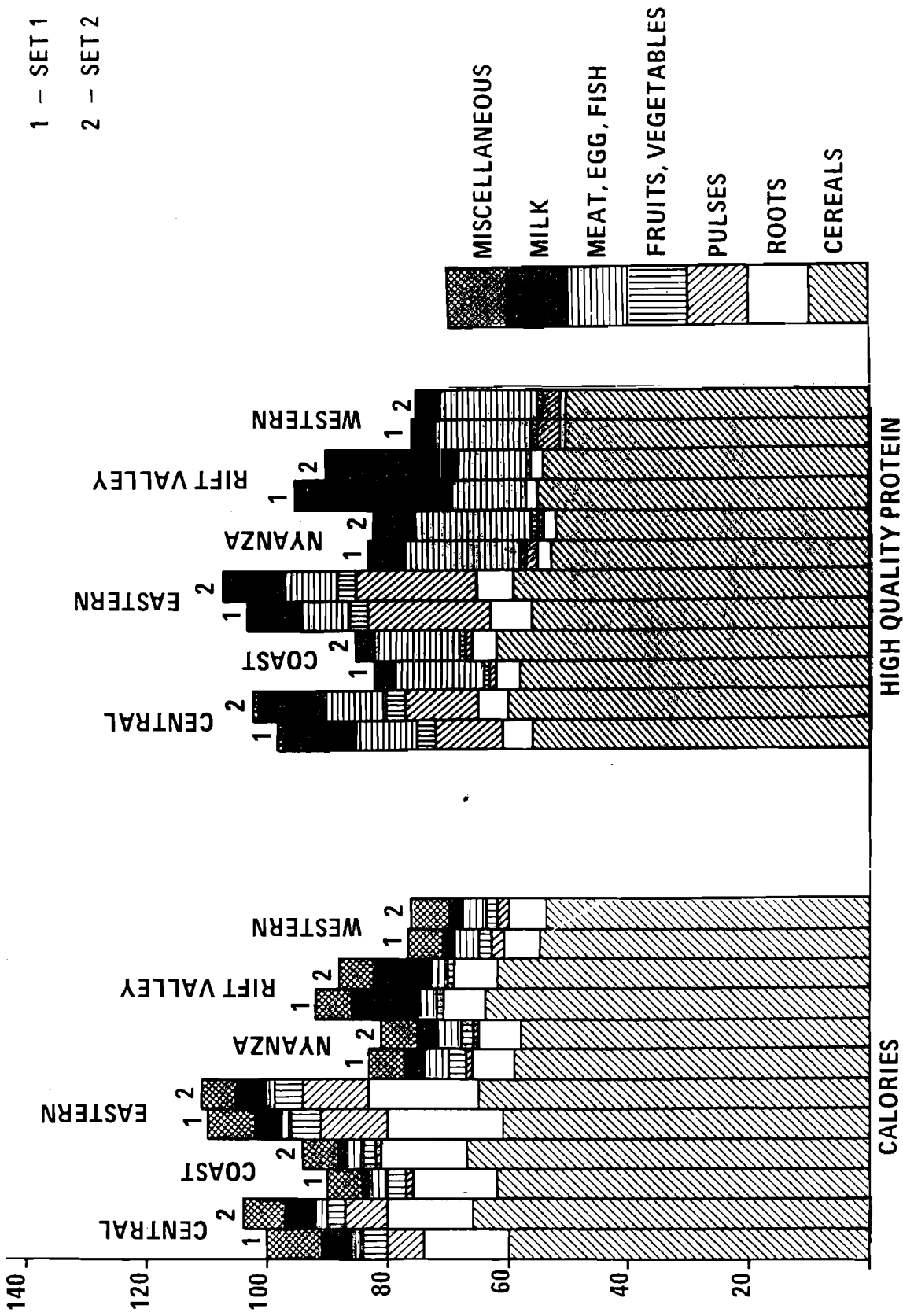
Figure 5a   CONTRIBUTION OF THE DIET TO VARIOUS REQUIRED NUTRIENTS IN SEVERAL PROVINCES
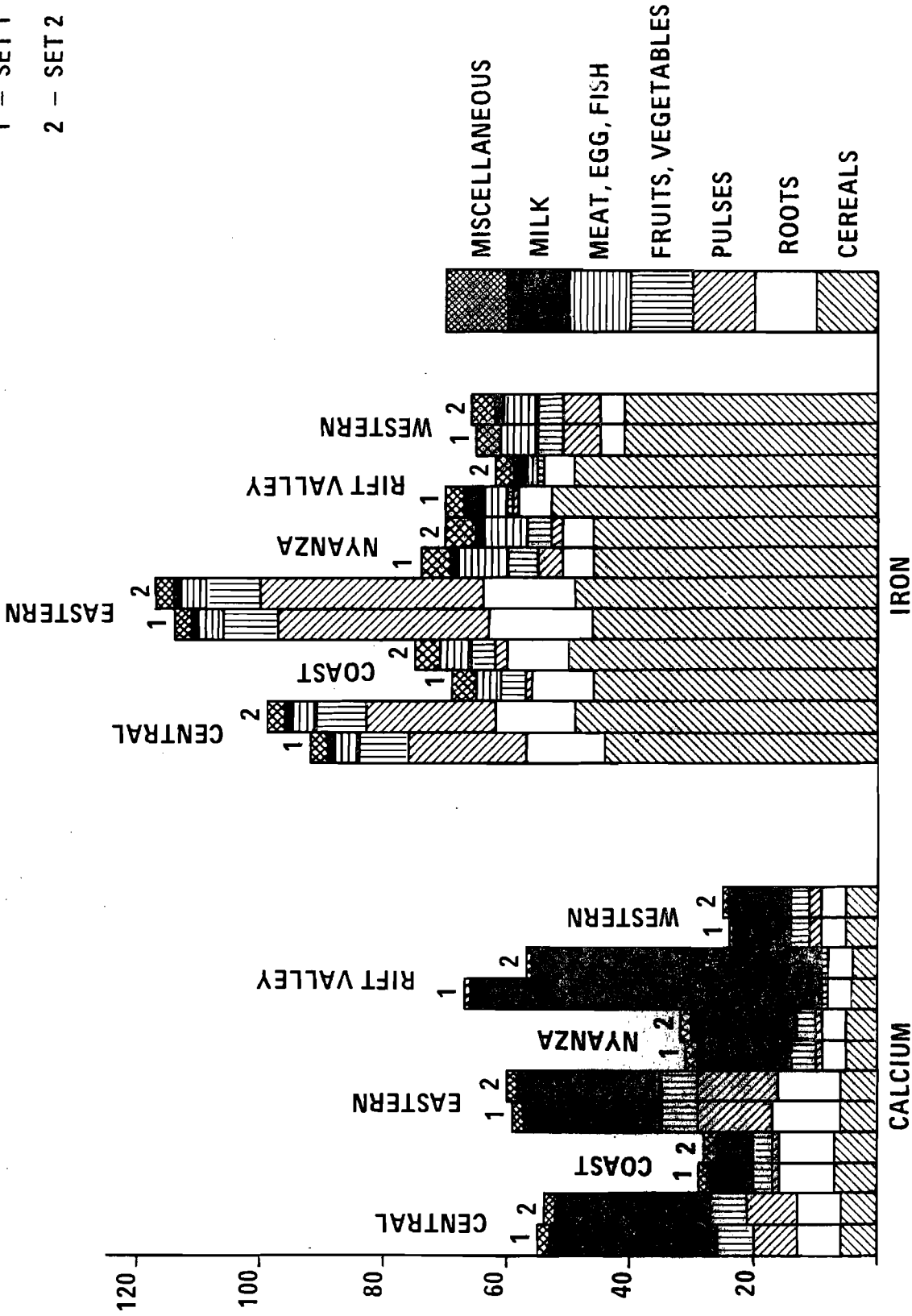
(moderate activity level)

Figure 5b

Figure 5c

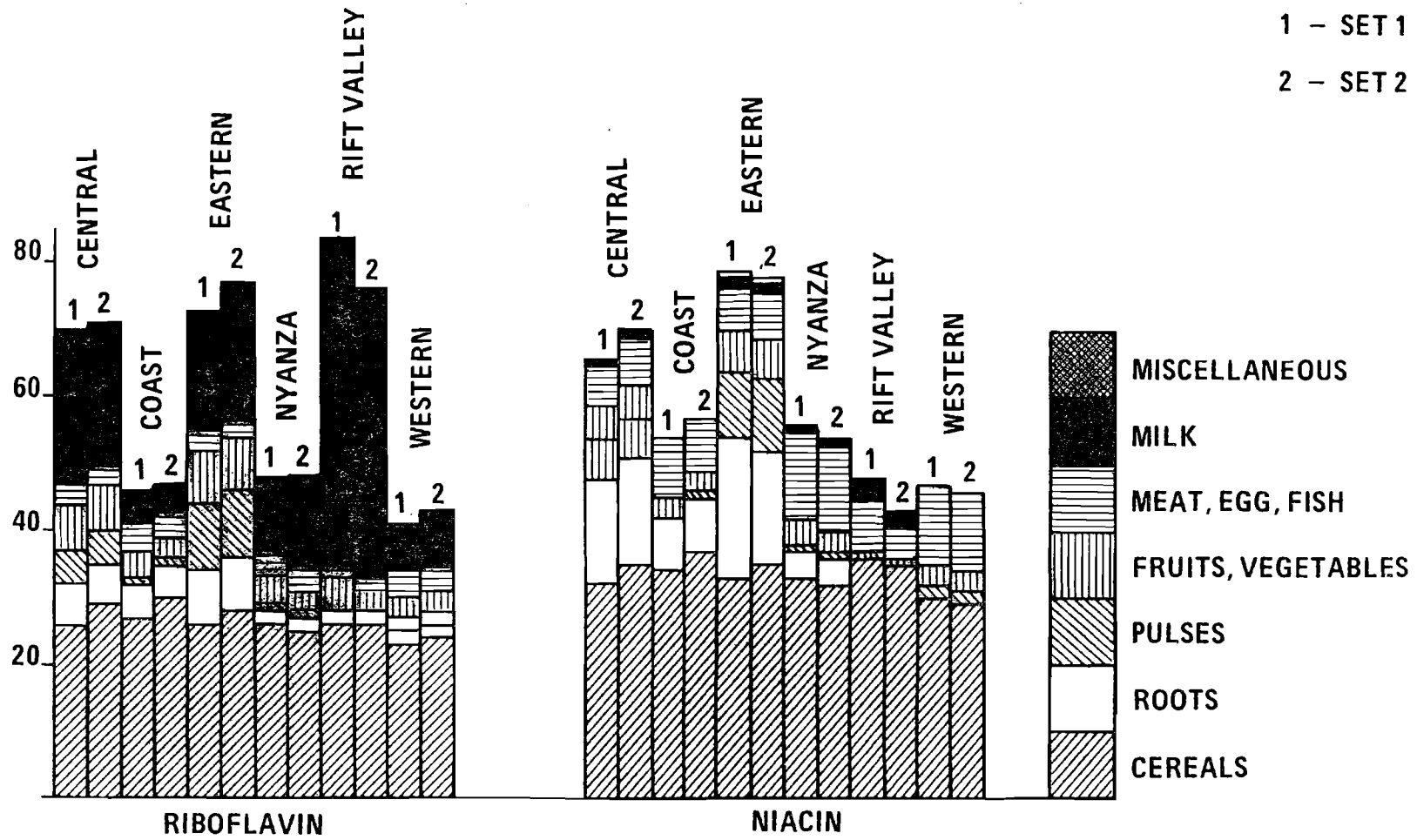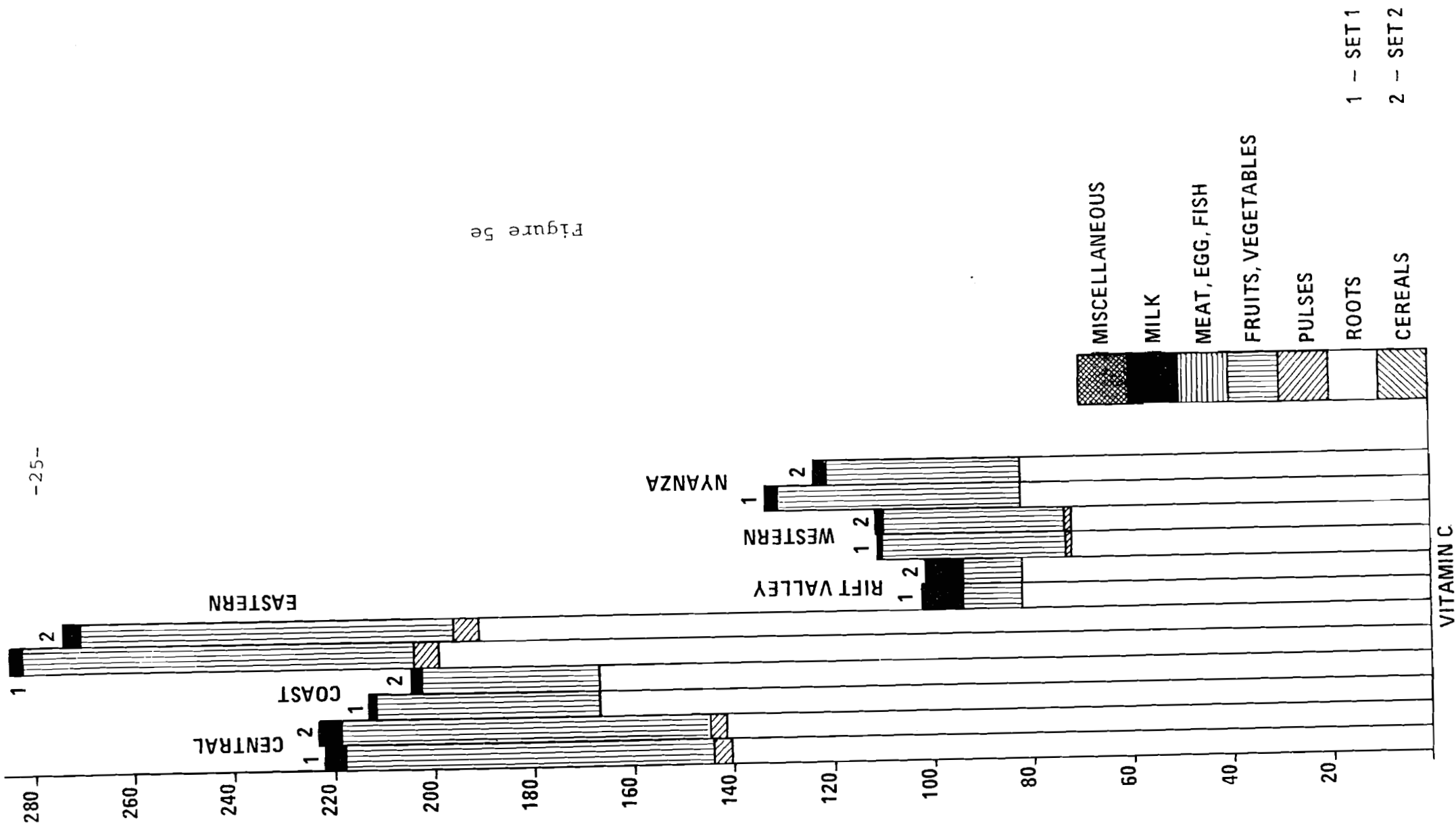Figure 5d

Figure 5e

VITAMIN C

- 25 -

Legend:
- MISCELLANEOUS
- MILK
- MEAT, EGG, FISH
- FRUITS, VEGETABLES
- PULSES
- ROOTS
- CEREALS

1 — SET 1
2 — SET 2

Regions: CENTRAL, COAST, EASTERN, RIFT VALLEY, WESTERN, NYANZA

Axis values: 20, 40, 60, 80, 100, 120, 140, 160, 180, 200, 220, 240, 260, 280

reasoning is true for the low intake of iron, calcium and riboflavin. It is of interest to note that no cassava is eaten, the whole starchy root consumption consists solely of potatoes, therefore, the vitamin C level and the niacin level is relatively low.

The infant mortality rate[1] (Table 10 gives only a crude indicator for the nutritional situation of a group of people and should be used only with caution. The chances are relatively low for a child in this province to survive up to 3 years, which surely can be related to the low nutritional status of this age group among other factors.

Figure 5 stresses the importance of a mixed diet. This figure can be used to estimate the quality of the diet and to propose quite easily which commodity should be increased or decreased to obtain a balanced diet. The poor diet in the Western province has to be supplemented substantially in order to improve it qualitatively and quantitatively. If the missing calories are derived from an increase in milk consumption by approximately 200%, a vegetable and fruit consumption by about 400%, a pulse consumption of about 200% as well as an addition of 20-30 g nuts, an excellently balanced diet would be received.

1.4.2. Nyanza

The annual per capita income in Nyanza is slightly higher than in the Western province, and somewhat more money is spent on food (Table 4). For food relatively more money is spent in this province than in the whole country. However, since only 2/3 of the money is spent which actually would be needed for an adequate diet, an intake low in almost all nutrients must be expected. As in the Western province, the diet of the population in Nyanza is only adequate in thiamine and vitamin C, all the other nutrients are consumed in the average below the required amount for optimal health. As in the Western province, the consumption of pulses, fruits and vegetables as well as of milk products is far below the level which assures a balanced diet. These particular items need a substantial improvement in the general diet pattern. The meat and fish consumption is relatively high here in this province, when compared to the other provinces. It is the highest one in the whole country.

The infant mortality rates and the life expectancies are the lowest of the whole country (Table 10) which is surely related

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1) The infant mortality rates and the life expectancies of the Kenyan provinces are derived by Anker and Knowles (9) who tested the differences among the provinces statistically by various points of view. One of their variables was the amount of quality-adjusted agricultural land per capita which was positively related to life expectancy, but not statistically significant. However, the amount of quality-adjusted agricultural land cannot be used directly as a synonym for the nutritional status of the rural population, which was not evaluated as a variable. Therefore these data can be used for comparing them with the nutritional intake data, assuming that there may be a positive significant correlation.

Table 10. Infant Mortality levels and Life Expectancy at Birth (1969 census)

Province/Towns	Percent of births surviving to age of 2	percent of births surviving to age of 3	life expectancy at birth, years
Central	91.08	88.96	60.1
Nyanza	78.63	75.44	38.6
Western	82.76	79.50	43.5
Coast	81.46	80.24	43.4
Rift Valley	89.24	86.64	54.1
Eastern	86.16	84.36	49.8
Nairobi	90.39	88.95	56.8
Mambasa	85.69	83.94	49.2
Kisumu*	76.50	76.64	38.0
Nakuru**	86.99	83.46	51.2

* refers to the Kisumu district, and, actually, only 9% of the people are living in Kisumu Town. However, because of the close relationship between the urban and rural population, these figures may be also true for the urban population.

** refers to Nakuru District. Nakuru Town covers only 16% of the people in this district. Because of the strong migration of the urban and rural population, these figures may also hold for the town itself.

Source: R. Anker and J.C. Knowles (1977). An Empirical Analysis of Mortality Differentials in Kenya at the Macro and Micro levels. Population and Employment Working Paper No. 60. International Labour Office, Geneva.

to the nutritional status of this province.

It is not surprising that the diet patterns are similar in
the Western and the Nyanza province because they border each
other. The cultural, and consequently the nutritional, behaviour
between both states is quite interrelated. The relatively low
income and consequently the low nutritional value of their food
connected with a remarkable degree of malnutrition is partially
due to their poor agricultural development.

1.4.3. Rift Valley

The Rift Valley borders on the two provinces discussed before.
The per capita income is higher in this province and also more
money is spent on food. However, the food intake is still below
the amount needed for an adequately balanced diet (Table 7 - 9).
The improvement of the general pattern is only small and, as
expected from Figure 4, only the thiamine intake is adequate in
the average diet. Even vitamin C is in deficit due to the
extremely low vegetable consumption. The overall food pattern
in this province is even more out of balance than the ones in the
provinces discussed above. The diet is even poorer in respect to
the variety of items consumed (Figure 5). Besides the very low
fruit and vegetable consumption, the diet is missing almost all
pulses; the amount of meat available is also relatively low.
Therefore, in the intake of iron, vitamin A and niacin are below
the requirements. On the other hand, enough milk products are
consumed in this province to contribute to a calcium and riboflavin
intake which is the biggest one of all the provinces, and to a
protein content of the diet which is relatively improved (which
is, however, still below the requirements).

The relatively low infant mortality rates and high life ex-
pectancies are not quite related to the overall food pattern.
They may be partially due to the high milk consumption which
especially improves the weaning food and, therefore, is very
effective just in this age group. If this is the only explanation
it would show very clearly the importance of having enough milk
in the diet.

As already mentioned, the diet in this province is almost
completely lacking in any fruits, vegetables, and pulses. To
substantiate their diet, approximately 60 g of pulses and 400 g
of fruits and vegetables should be consumed per day per capita.
This high discrepancy between the amount actually eaten and the
amount required for a good diet does not have to exist necessarily;
there is also the possibility, that these commodities were not
evaluated extensively in the survey. However, this observation
needs further investigation.

1.4.4 Central Province

The Central Province is the richest one in Kenya. The per capita income is the highest of all the provinces, however, less of it is spent on food than on average by the rural population (Table 4). The supply of energy is almost sufficient, depending upon whether the population is considered as moderately active or very active, whether set 1 or 2 is used, and how much of the food is lost while preparing (Table 7 - 9). The protein intake is slighty lower than the caloric supplies which is due to the relatively high consumption of starchy roots and the low consumption of meat products. In this province, the intake of thiamine and vitamin C is also adequate. The intake of iron is about that of the one required which is due to a sufficient consumption of pulses. The vitamin A intake,almost the highest one in the whole county, is still below the requirements,pointing to the general problem of the rural Kenyian diet, the too low consumption of fruits and vegetables. The intake of riboflavin being below the requirements as in all the other provinces needs improvement by a higher milk consumption.

As can be expected from the nutritional analysis, the chances are the highest for a child in this province to survive to the age of 3, and, consequently, the life expectancy is the highest one in this province (Table 10).

1.4.5 Eastern Province

The per capita income in the Eastern Province is lower than in the Central Province, however more of it is spent on food (Table 4). As can be expected, the diet is slightly improved in respect to all nutrients, making it adequate in calories, protein, iron,thiamine and vitamin C (Table 7 -9). However, since the diet is not a balanced one, deficiencies arise in vitamin A, riboflavin, and niacin. The overall starchy root consumption is too high, whereas too little fruit and vegetables as well as milk products are consumed. Again, as in the other provinces, it is not known whether some nuts are consumed which would improve the niacin intake. In order to improve the diet in the Eastern Province and to make it as balanced as possible the amount of starchy roots should be cut to half the amount whereas twice as much fruits, vegetables and milk products should be eaten.

The infant mortality rates (Table 10) are much higher than expected for the relatively good diet. The reason for this discrepancy can be found in the different structure of the income distribution - the very poor (especially sensitive to infant mortality) may be outbalanced by the rich - as well as in a high incidence of diseases due to infections and contaminations by parasites.

1.4.6 The Coast Province

In comparison to the Central and the Eastern Province, the per capital income in the Coast Province is quite low (Table 4). Even if more of the money is spent on food than on average, the expected diet cannot be upgraded very much. The highest share of the income is used for food in the Coast Province, and this is influenced by the household size. The highest number of persons belonging to one household is found in this province (Table 2).

The diet in the Coast Province is deficient in all nutrients except thiamine and vitamin C (Table 7-9). The requirements of thiamine are met at the retail level but may become low at the consumption level after the food is prepared. The relatively low thiamine intake is due to the extremely low consumption of pulses (Figure 5, Table 9). The high vitamin C content of the food is derived from cassava which is the only starchy root eaten in this province. The very low content of pulses in the diet further on influences negatively the intake of riboflavin, niacin and iron.

The amount of milk contributing to the diet is also very low and, therefore, is responsible for the low riboflavin content of the diet as well as for the low calcium intake. The vitamin A intake is the lowest one of all provinces which is partially due to the low vegetable and fruit consumption. In order to improve the overall diet the same recommendations have to be given as for the other provinces - a slight decrease in the starchy root consumption followed by a substantial increase in pulses, fruits, vegetables and especially in milk products.

The infant mortality rate (Table 10) is very high, and consequently the life expectancy very low, which is due in part to the low nutritional level in this province. However, part of it is also contributed to it by the high incidence of maleria in this region.

1.5 The comparison of the nutritional status of the rural population with previous surveys

Nutritional surveys in Kenya were earlier carried out by Bohdal, Gibbs and Simmons (10) in May 1965 - July 1966 and by Cremer et al. (11) in 1966. These surveys have several shortcomings in respect to the nutritional states of the whole country. Only small, very specific (not necessarily representative) areas were surveyed which makes it hard or almost impossible to generalize the data for the whole province or even for the whole country. Further on, the time of the survey was quite often only very short (7 days). It was carried out very often only during one season, which does not allow the extrapolation of the data in order to obtain a consumption pattern for a whole year. In spite of these technical differences with the present survey, it will be assumed that the earlier surveys are representative

for the province, they were conducted only to get an idea whether the results of the present survey are in approximately the same magnitude.

The nutritional standards used in the surveys to calculate the value of the diet differ slightly which is due to continuous research in this field. Therefore, it appears to be advisable to compare the results in absolute numbers in order to avoid these difficulties. Further differences among the surveys are caused by using different food composition tables to calculate the nutritional value of the food eaten. Major variations seem to exist in the content of crude protein, iron and vitamin A. The differences in the vitamin A content are due to the fact that it was assumed in the present survey that yellow maize is eaten, whereas the others assumed green maize; furtheron, the vitamin A content of vegetables was assumed to be higher in the present study.

It looks like that relatively more animal products and much more sugar are consumed in the Central Province nowadays than 10 years ago. However, the bean consumption decreased considerably in the last 10 years (it also could be just due to the present survey as pointed out in Shah and Frohberg [5]. The calorie consumption of the whole province may be higher nowadays; however due to the decreased intake of pulses less protein is consumed. All the other nutrients are proportionally higher with the amount of food eaten nowadays.

Relatively more sugar and less legumes are consumed also in the Nyanza Province; in addition, more vegetables are eaten here nowadays than 10 years ago. The amount of food available may be still the same as previously; it does not look like that considerably more food is consumed nowadays. Consequently, the intake of all major nutrients is approximately the same as before.

More of the calories are derived from starchy roots, animal products and sugar, and less from cereals in the Eastern Province nowadays. However, inspite of these changes, the diet is still approximately the same in quantitative and qualitative terms.

It can be concluded that the diet of the rural population in Kenya did not change considerably during the last 10 years. The major problem is still that too less food is available to feed everyone properly and that the diet largely depends upon the food availability in an area. The diet is still an unbalanced one, which means that it was and that it is more deficient in vitamin A, niacin and riboflavin than in other nutrients.

1.6   Future Outlook

Estimating the average amount of food available to the rural population in the year 2000, it looks like enough food is on the market (Table 11). [A detailed description of this estimation is given in Shah (12). However, it has to be kept in mind that this assumes equal distribution among all persons. But, as shown before, huge discrepancies exist between the poor and the rich income class. Therefore, it can be supposed that the poor class, at least in part, still will be suffering from under-nutrition. The nutritional problem will not be solved completely, it may just be eased somewhat.

[The method of estimation is described in part A of this presentation]

Nutrient	Supply in percent of requirements*				
	in 1975	in 2000			
		1	2	3	4
energy	93	111	114	114	101
protein	93	116	124	130	101
fat**	11	15	17	18	12
calcium	44	55	63	68	46
iron	84	104	110	114	95
vitamin A	58	72	75	77	65
thiamine	146	175	181	175	162
riboflavin	62	75	83	88	66
niacin	61	78	83	86	69
vitamin C	177	180	182	179	178
income (KSh)	495	875	1328	1919	585

*requirements in the year 2000 different from Table 1:

energy	2190	kcal
protein	27.4	g
thiamine	1.10	mg
riboflavin	1.31	mg
niacin	14.45	mg

**in percent of required energy

1 Medium population projection and likely growth (7%) of total PCE assuming in the income distribution
2 Medium population projection and likely growth (7%) of total PCE assuming a moderate change in the income distribution
3 Medium population projection and likely growth (7%) of total PCE assuming a drastic change
4 Low population projection and low growth (4.5%) of total PCE

Source: M.M. Shah (12).

The quality of the diet will not change at all, and will correspond further on to the one predicted in Figure 4. This diet will be deficient in vitamin A, riboflavin, and niacin; all the other essential nutrients will be consumed at or above the required amount. The price of this diet can be estimated to be approximately 500 KSh per caput and year, if constant prices are assumed. As a safety factor, 50 KSh have to be added to compensate for the higher meat and fat consumption, two very expensive items. If it is further assumed that 75% of the income is spent for food as in 1975 (Table 4), the income should be approximately 750 KSh. According to this estimation, only the projection 1 (with a medium increase in population and income and with no change in the income distribution) (Table 11) can be considered as the one which is likely to represent the behavior of the rural population. Projection 2 and 3 (medium increase in population and income with a moderate or drastic increase in the income distribution, respectively), are not very likely, because 41% and 29%, respectively, of the income would be spent for food. However, they do not correlate with the behavior of the rural population (they also do not fit Figure 3) and they would assume a similar behavior as observed among the urban population which will be shown later.

1.7   Conclusions

Generally speaking, the diet of the rural population in Kenya is too low in energy and high quality protein, as well as in all major nutrients. The diet as a whole cannot be considered as a balanced one because some nutrients are more deficient than others. It does not help to improve the diet just in quantity, also the quality has to be improved. The low value of the food is also reflected in the high infant mortality rate, and consequently, in the low life expectancy.

Figure 5 can be used in order to estimate the content of a balanced diet which is based on the average diet consumed in Kenya by the rural population. As already mentioned very often throughout this report, the major problem of the Kenyian diet can be found in the low consumption of pulses, vegetables, fruits, milk and nuts; therefore, the intake of these items has to be increased substantially. Taking these observations into consideration, the proposed content of the food consumed in one day per person should be composed as listed in Table 12. This theoretical diet consists mainly of maize as staple food too, but it is substantiated in addition with all the other food items in order to deliver all the required nutrients. It has to be kept in mind that this diet would be appropriate for a moderately active population. If the people are more active as assumed, the diet has to be supplemented which can be done by a higher consumption of cereals and starchy roots. Some additional food of the same quality as the proposed one should be obtained in order to compensate for the losses during preparation. This diet would cost about 450 KSh per year and person. Adding to

it an increase of about 10% for food losses, it amounts to
500 KSh per year and person. This simple calculation shows that
this balanced diet would not be more expensive that the tradit-
ional one. It would just need a different distribution of the
money between the food commodities. However, this may be the main
problem and can be achieved only very slowly by teaching the people
the importance of a good balanced diet and giving them the
insentive to grow more of these items by themselves than they
have done up to now.

   According to this survey, the most urgent help will be
needed in the Western Province. The food available there is the
lowest one in quantity and quality of all the provinces. And
more specifically, it will be the poor income class suffering
the most from malnutrition. However, these findings have to be
substantiated by further research especially at the medical level.

Table 12.

A . Estimation of a Balanced Diet for the Rural Population Per Day and Caput

	amount[a] (g)	energy[b] (kcal)	b) high quality protein (g)	fat[b]	calcium[b] (mg)	iron[b] (mg)	vitamin A[b] (mg)	thiamine[b] (mg)	b) ribo-flavin (mg)	b) nia-cin (mg)	b) Vitamin C (mg)
cereals[c]	350	1,200	14	6	40	7	700	0.8	0.3	5.2	-
starchy roots[d]	100	100	1	-	30	1	150	0.1	-	0.7	22
pulses	70	240	6	1	70	3	70	0.4	0.2	1.6	3
vegetables & fruits[e]	280	130[g]	1	1	70	2	2430[g]	0.1	0.2	1.2	53
meat, fish & eggs	50	90	5	6	10	1	40	-	0.1	1.3	-
milk	260	170	6	10	340	-	420	0.1	0.5	0.4	3
miscellaneous f)	66	190	-	5	10	1	210	-	-	-	-
nuts	35	60	1	5	30	1	-	-	-	0.8	2
TOTAL		2,180	34	34	600	16	4,020	1.5	1.3	11.2	83

B. Estimation of the Price of the Balanced Diet (assuring constant prices).

item	amount (g)	estimate price/kg[h] (KSh)	price / amount (KSh)
cereals	150	0.80	0.28
starchy roots	100	0.40	0.04
pulses	70	2.10	0.15
vegetables and fruits	280	0.50	0.14
meat, fish and eggs	50	3.50	0.18
milk	260	0.93	0.24
miscellaneous f)	66	1.40/10.00	0.12
nuts	35	3.50	0.12
TOTAL			1.27 x 365 days = 463 Ksh/day and caput

a) amount estimated from Figure 5

b) average of the whole commodity group as consumed in the country.

c) maize and millet

d) cassava

e) 1/2 fruit and 1/2 vegetables

f) sugar and fat [60 g of sugar (1/2 refined + 1/2 as cane) and 6 g of fat]

g) less energy and more vitamin A would be consumed if more vegetables would be eaten than fruits

h) estimated price is the average price of the whole commodity group in 1975

2. Nutritional Situation of Urban Population

Only the first phase of the Urban Food Purchasing Survey,
April - June 1977, could be considered in this analysis. The
results of this investigation have to be treated carefully
because only a part of the spectrum of urban consumers (about
2% of the urban households) is covered and the residential
areas of the towns may not be represented adequately. The
study of the food expenditure pattern was performed by repeated
visits on alternate days to a household throughout one month
(= 15 visits). The survey was based on expenditure recalls
for 48 hours. These consumption data were extrapolated to the
consumption level of the whole year and do not consider any
seasonal changes in the food pattern. Even if the data of the
survey were not weighed to a total urban population figure
and even of the mentioned uncertainties, these data can be used
to estimate the nutritional status of the urban population.

The analysis of the food balance sheets was performed as the
one of the rural population which was described earlier. The
requirements of the urban population calculated from the age
structure of the population are listed in Table 1. The urban
population is physically not working as hard as the rural popul-
ation and, therefore, their requirements should be considered as
somewhere between lightly active and moderately active. However,
the urban population should be considered as moderately active
in respect to their protein requirements because the amount of
protein needed does not depend upon the physical activity.

2.1. The Total Urban Population

The most characteristic feature of the nutritional situation
in Kenya is the same one whether the urban or the rural part
of the population is considered (Tables 3 and 13). Both these
groups do not in general have enough food available to meet the
energy and protein requirements. Therefore, it can be supposed

Table 13 : The Relative Daily Supply of Nutrients to the Urban Population in 1975.

1. The urban population is considered as lightly active.
2. The urban population is considered as moderately active.

	energy %		protein crude %		protein high quality %		fat* %		cal-cium %	iron %	vita-min A %	thiamine %		ribo-flavin %		niacin %		vita-min C %
	1	2	1	2	1	2	1	2	1+2	1+2	1+2	1	2	1	2	1	2	1+2
Urban																		
Total	96	91	221	208	102	96	17	16	43	93	99	148	140	62	58	69	65	162
Poor	84	79	192	181	86	81	13	12	33	84	82	135	127	50	47	57	54	136
Medium	99	94	231	218	107	100	19	18	45	97	106	151	142	64	60	79	74	173
Rich	115	108	270	255	126	119	23	22	61	111	119	166	157	80	76	89	84	207
Nairobi																		
Total	101	95	230	216	103	97	18	17	46	98	111	156	147	68	64	75	70	188
Poor	92	87	206	194	91	86	15	14	38	92	95	149	141	58	54	63	59	167
Medium	105	99	241	227	112	106	20	19	46	100	116	158	149	68	64	80	75	183
Rich	117	111	273	257	126	119	22	21	61	112	124	169	159	81	76	94	89	216
Mombasa																		
Total	101	95	240	226	108	102	16	15	42	101	79	157	148	63	59	74	70	138
Poor	85	80	201	189	88	83	11	10	27	85	56	141	133	44	41	58	55	92
Medium	107	100	257	243	116	109	18	17	42	105	84	167	158	64	60	81	76	141
Rich	133	125	319	301	149	140	28	26	76	129	129	188	177	100	94	104	98	238
Nakuru																		
Total	81	76	172	162	80	75	15	14	35	72	84	120	113	55	52	55	52	163
Poor	72	68	148	140	69	65	11	11	29	64	76	109	103	45	42	47	44	166
Medium	101	95	218	205	102	96	18	17	45	93	102	152	143	66	62	70	66	171
Rich	85	80	190	179	92	87	19	18	41	75	91	116	110	58	54	62	59	155
Kisumu																		
Total	83	78	197	185	95	90	15	14	38	85	102	127	119	54	51	61	58	168
Poor	79	75	189	178	89	83	13	13	34	81	101	124	117	52	49	57	54	152
Medium	75	70	181	170	88	83	14	13	36	79	96	114	108	50	47	48	45	152
Rich	101	95	228	215	109	103	20	19	41	97	104	146	137	63	60	75	70	177

* percent of total energy requirement

Absolute figures are given in Tables 14 - 18.
Source: M.M. Shah and H. Frohberg [5].

that a high percentage of the urban population will also be
undernourished, partially even to a high degree. However,
some qualitative improvements are noticeable in the diet of
the urban population, even if it is quantitatively as low as
the one of the rural populace. The overall content of minerals
and vitamins is elevated in the diet of the urban people, and,
therefore, their food consumption pattern has to be con-
sidered as a more balanced one (but not as a perfect one).
Furthermore, the gap between the nutritional situation of the
poor and the rich income class is not as wide any more; the
poor people are a little bit better off than the ones in the
countryside whereas the rich do not consume so much of the
whole food basket which is available for all of them. However,
analogous to the rural population, only the rich income class
can buy enough food to compensate the energy requirements and
the food losses during preparation.

In comparison to the rural population, the people in the
towns eat less starchy roots but more fruits and vegetables,
meat, fish and eggs as well as fats and oils (Figure 6, Table 68).
The shift in the dietary preferences influences positively
the content of iron and vitamin A in the diet which are consumed
in an almost sufficient amount. However, no improvement is
observed in the riboflavin [1] and niacin [1] intake, which is as
insufficient as the one of the rural population, because an
increase in the consumption of milk products and nuts is not
detected. The thiamine and the vitamin C intake is also as
substantive as the one of the rural population. The main
staple food is still maize flour, however, more rice and
wheat products are consumed by the urban population, which
brings slightly more variations to the diet. Because of these
variations in the food, the diet cannot be considered in general
as poor as the one of the rural population.

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1) The amount of riboflavin supplied in the diet is still suffi-
cient for all income groups to prevent clinical symptoms (the mi-
nimum dietary level is around 0.6 mg/day for the lightly active
urban population). However, the intake of niacin (without the
contribution from tryptophan, but which may be low anyhow) is
below the dietary level (9.37 mg), that will prevent clinical
symptoms, for the poor income group in all the cities. There-
fore, a high incidence of dermatitis and perhaps mental depres-
ions should be expected among the urban poor population provided
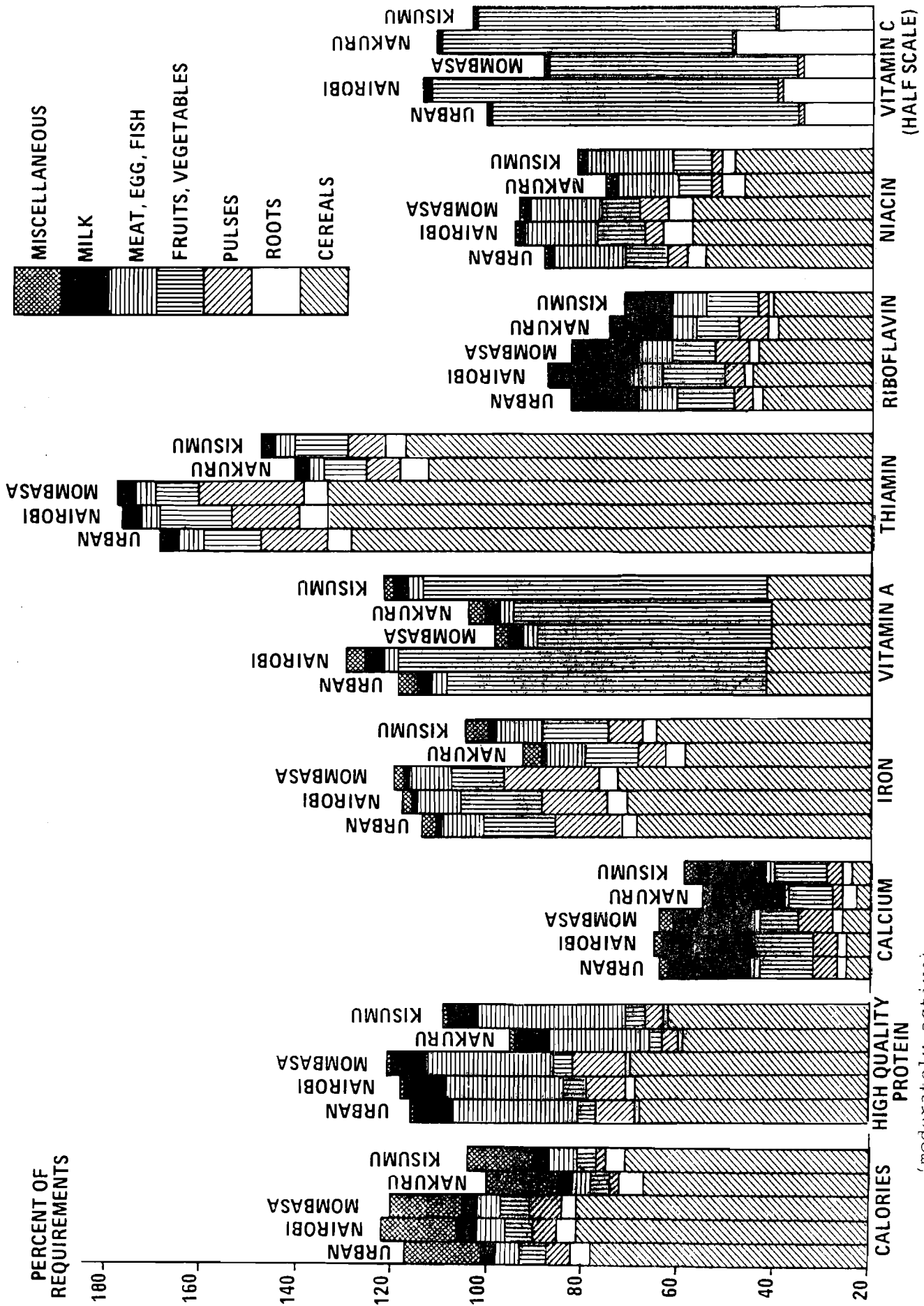no other items rich in niacin are consumed than the ones elabo-
rated in the survey.

Figure 6   SOURCE OF NUTRIENTS OF THE URBAN POPULATION

(light activity)

(moderately active)

TABLE 14 : CONSUMPTION PATTERN OF THE URBAN POPULATION IN 1975

	Energy (kcal)	protein crude (g)	protein high quality (g)	fat (g)	calcium (mg)	iron (mg)	vita-min A (I.U.)	thiamin (mg)	ribo-flavin (mg)	niacin (mg)	vita-min C (mg)
Total											
cereals	1235	33.0	13.2	11.4	39	6.9	988	1.16	0.30	4.97	-
starchy roots	78	1.0	0.4	-	14	0.4	-	0.05	0.02	0.50	13.2
pulses	98	6.3	2.2	0.5	39	1.9	9	0.15	0.05	0.60	0.9
fruits & veg.	121	3.0	1.2	0.5	84	2.1	3027	0.13	0.15	1.26	57.9
meat,egg,fish	117	10.2	7.1	8.2	12	1.2	139	0.05	0.09	2.12	-
milk	71	3.6	2.2	3.9	136	0.1	153	0.04	0.18	0.14	1.1
miscellaneous*	331	0.6	0.2	15.9	19	0.4	161	-	-	0.12	-
	2051	57.7	26.5	40.4	343	13.0	4477	1.58	0.79	9.75	73.1
Poor											
cereals	1173	31.3	12.6	11.6	33	6.7	1066	1.13	0.29	4.49	-
starchy roots	78	0.8	0.3	0.1	15	0.4	-	0.04	0.02	0.49	17.3
pulses	85	5.5	1.9	0.4	34	1.7	7	0.13	0.04	0.52	1.0
fruits & veg.	71	2.2	0.9	0.3	64	1.5	2361	0.09	0.10	0.87	42.3
meat,egg,fish	79	7.3	5.1	5.4	8	0.9	85	0.03	0.06	1.48	-
milk	50	2.5	1.5	2.7	92	0.1	103	0.02	0.13	0.08	0.7
miscellaneous*	251	0.5	0.2	10.2	16	0.4	88	-	-	0.09	-
	1787	50.1	22.5	30.7	262	11.7	3710	1.44	0.64	8.02	61.3
Medium											
cereals	1255	33.8	13.3	11.5	41	7.2	974	1.17	0.30	5.09	-
starchy roots	75	1.0	0.3	0.1	13	0.5	-	0.06	0.02	0.70	14.1
pulses	94	6.1	2.1	0.5	38	1.8	8	0.15	0.05	0.58	0.8
fruits & veg.	123	3.3	1.3	0.5	90	2.3	3266	0.14	0.16	1.80	61.7
meat,egg,fish	138	11.8	8.3	9.7	14	1.4	164	0.05	0.10	2.54	-
milk	72	3.6	2.2	3.9	135	0.1	152	0.04	0.18	0.14	1.1
miscellaneous*	359	0.8	0.3	18.1	26	0.3	190	-	0.01	0.19	-
	2116	60.4	27.8	44.3	357	13.6	4754	1.61	0.82	11.04	77.7
Rich											
cereals	1278	34.2	13.4	10.3	47	7.1	802	1.16	0.28	5.53	-
starchy roots	63	1.1	0.4	0.1	8	0.5	-	0.06	0.02	0.86	9.2
pulses	151	9.8	3.3	0.8	61	3.0	13	0.24	0.08	0.93	1.3
fruits & veg.	225	4.4	1.9	0.7	108	2.8	3777	0.19	0.22	1.91	80.8
meat,egg,fish	168	14.1	9.9	12.0	16	1.8	202	0.06	0.12	2.90	-
milk	116	5.9	3.6	6.3	221	0.2	248	0.06	0.30	0.23	1.8
miscellaneous*	449	1.1	0.4	24.7	25	0.1	309	-	0.01	0.21	-
	2450	70.6	32.9	54.9	486	15.5	5351	1.77	1.03	12.57	93.1

* miscellaneous = sugar, fat, nuts, spices, stimulants, alcoholic beverages

Source: M.M. Shah and H. Frohberg [5].

As discussed above, the rural population just purchases more food of about the same quality when the income of a household increases; no big general changes in the preference of different commodity groups are noticed. An opposite behavior is observed among the people in the cities. The total amount of cereals consumed by the poor and the rich income class does not differ very much; however, the poor people eat more maize flour and only a small amount of rice and wheat products, whereas the latter items are consumed in a much higher quantity by the rich class. The same shift is noticed for the starchy root consumption – the poor eat slightly more of this commodity and they especially stress the cheaper cassava meal, whereas potatoes are preferably eaten by the rich class. An even stronger dependency upon the income was observed for all the other items . Much more vegetables, fruits, meat, fish, eggs, and milk products are consumed by the rich income class than by the poorer people (Table 14 , Figure 7). The fat and sugar consumption is also depending upon the income, because both items are considered as luxury foods. Due to these additions, the intake of energy and protein is sufficient for the rich income class to meet the requirements and the food losses during preparation. The medium class is approaching this stage, but it has not reached it quite yet. The improvement of the diet pattern is pointed out in Figure 7. The shift in the preferences of the different commodity groups influences especially positively the content of protein, calcium, vitamins A and C, riboflavin and niacin in the food.

The eating habits of the urban population are influenced by the portion of the income people are willing to spend on food. Therefore, it can be supposed that the diet of the poor class becomes more or less sufficient in all major nutrients when enough money is available. It also can be concluded already at this stage that the diet of the urban population would become a very balanced one when slightly more milk products and a few more nuts would be consumed in addition. This diet, then, should be quite desirable for the whole country. This observation implies further on that the major nutritional problem in the
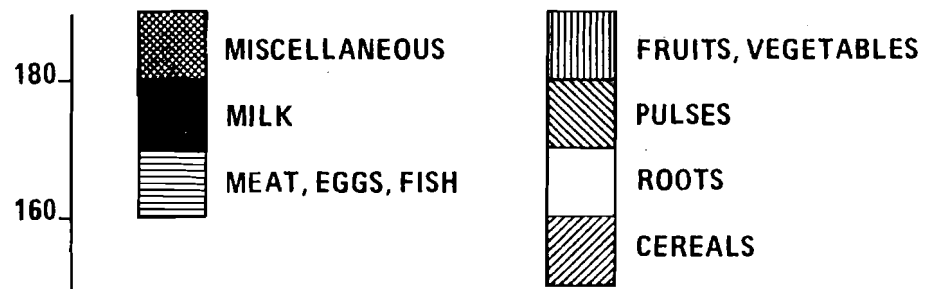
Figure 7a

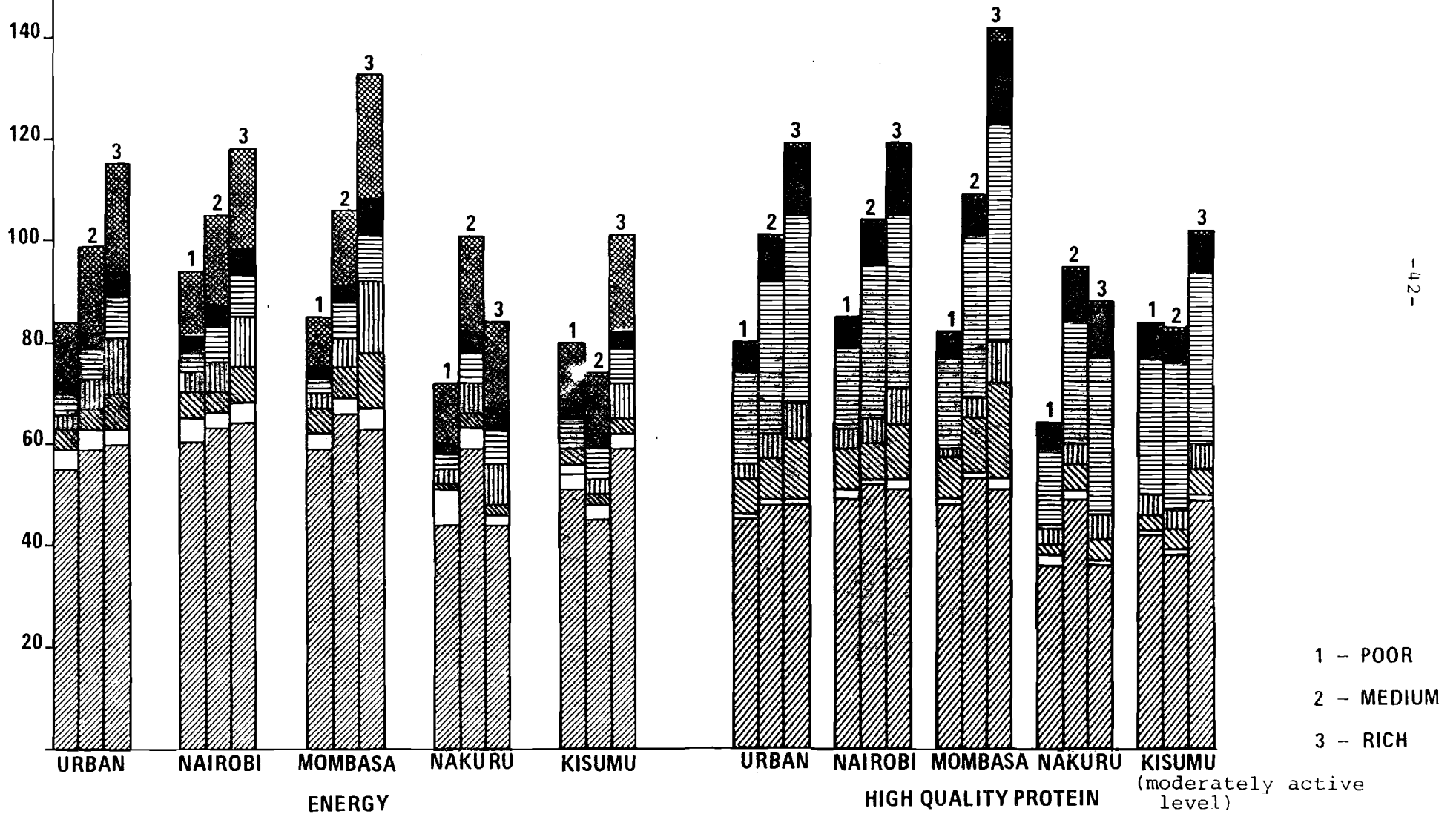Contribution of the Diet to various required nutrients for the urban population (light activity)

ENERGY
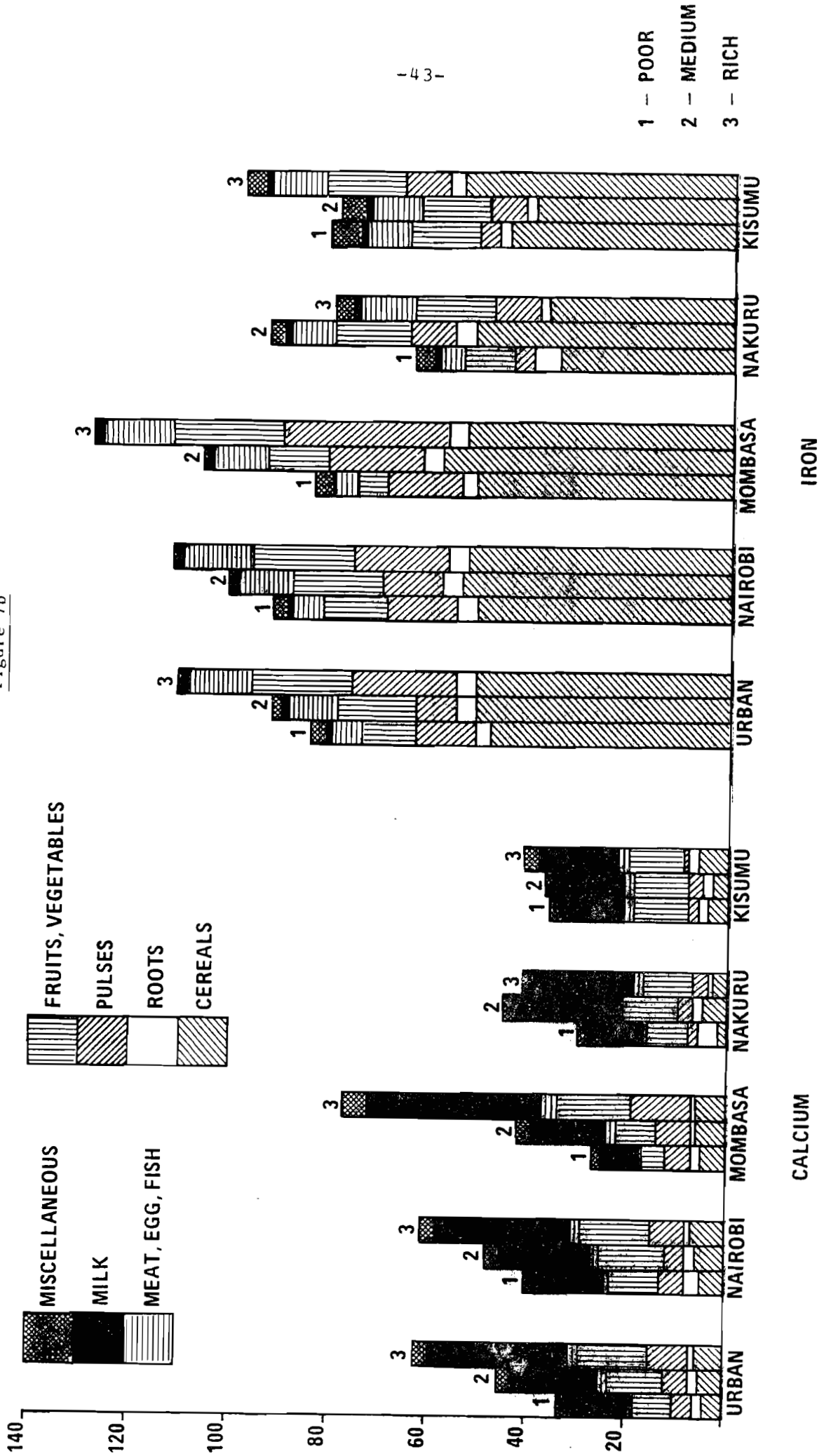
HIGH QUALITY PROTEIN

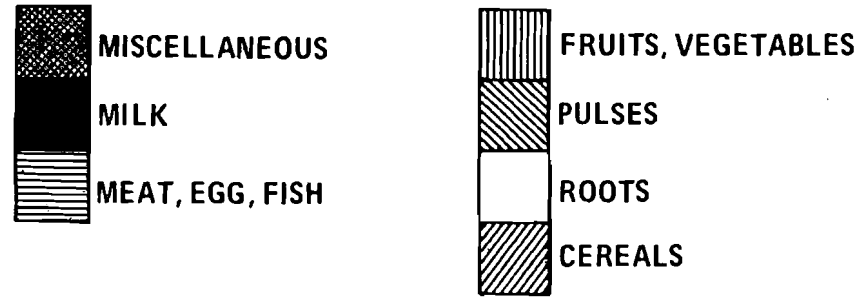(moderately active level)

1 — POOR

2 — MEDIUM

3 — RICH

MISCELLANEOUS

MILK

MEAT, EGGS, FISH

FRUITS, VEGETABLES

PULSES

ROOTS

CEREALS

- 42 -

Figure 7b

Figure 7c

Legend:
- MISCELLANEOUS
- MILK
- MEAT, EGG, FISH
- FRUITS, VEGETABLES
- PULSES
- ROOTS
- CEREALS

RIBOFLAVIN — URBAN, NAIROBI, MOMBASA, NAKURU, KISUMU

NIACIN — URBAN, NAIROBI, MOMBASA, NAKURU, KISUMU

1 – POOR
2 – MEDIUM
3 – RICH

- 44 -

Figure 7d

Figure 7e

VITAMIN C

-46-

Legend:
1 — POOR
2 — MEDIUM
3 — RICH

MISCELLANEOUS
MILK
MEAT, EGG, FISH
FRUITS, VEGETABLES
PULSES
ROOTS
CEREALS

Cities: URBAN, NAIROBI, MOMBASA, NAKURU, KISUMU
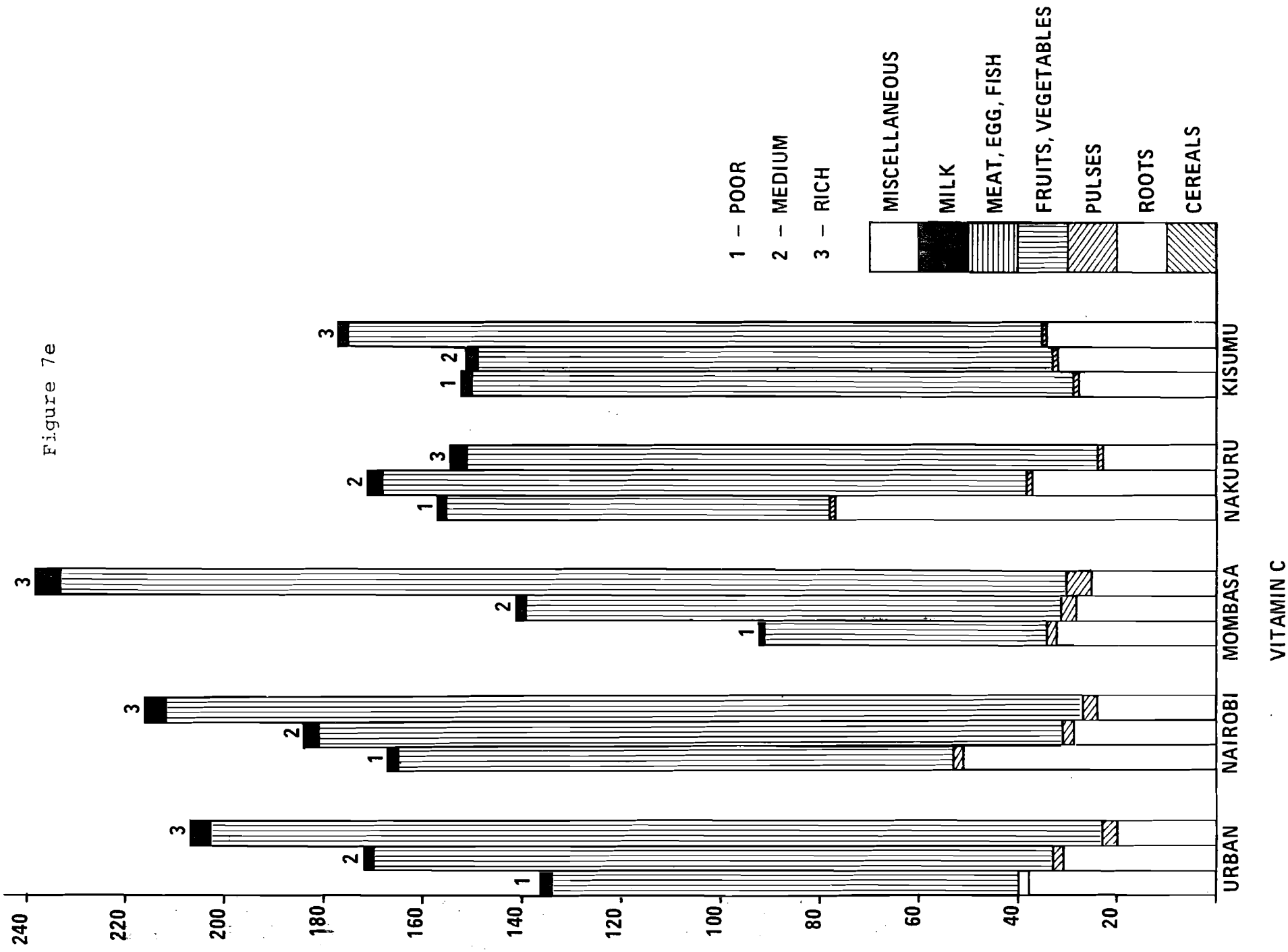
cities is a quantitative and not a qualitative one.

2. 2. Nairobi

The nutritional situation in Nairobi is above the average
of the total urban population (Table 13). Slightly more
food can be purchased in this city and consequently the intake
of energy, protein and all other essential nutrients is elevated.
It is also worth noticing that the differences are much smaller
in the food pattern of the poor and the rich income class than in the other
cities of this survey. . The nutritional situation of the poor class is here the
best one of all cities, but it is still far below the acceptable level.

The diet pattern of the people in Nairobi differs slightly
from the average one of the urban population (Table 15, Figure 7).
Somewhat more cereals are consumed here than in the average and,
what is remarkable and what will be different to the other
cities, higher quantities of this food commodity group are purchased with
increasing income. This augmentation in total cereal consumption is due to
a steep raising of wheat flour products and rice. In addition, slightly
more starchy roots are consumed by all the income classes -
especially by the poor class - than in the other cities.
However, its total consumption decreases with increasing income,
and, as noticed throughout the whole country; also the proportions shift
between the purchased amount of cassava and potatoes depending on the income,
with more cassava eaten if less money is available for food and more
potatoes consumed if more money is available. In Nairobi,
the bean consumption - a relatively expensive item - is also
much stronger depending upon the income than in the other
cities; the poor people purchase only about half of that which
the rich people buy. The consumption pattern of all the
other items corresponds to the level in the other cities.

Not only the quantity but also the quality of the food
is above average in Nairobi. The average diet of these citizens is
sufficient in thiamine, vitamins A and C, and almost in iron,
implying that the diet is supplemented with enough fruits
and vegetables. As expected, the content of all essential

TABLE 15 : CONSUMPTION PATTERN IN NAIROBI IN 1975

| | Energy (kcal) | protein | | fat (g) | calcium (mg) | iron (mg) | Vita-min A (I.U.) | thiamin (mg) | ribo-flavin (mg) | niacin (mg) | Vita-min C (mg) |
		crude (g)	high quality (g)								
Total											
cereals	1298	34.7	13.7	11.7	42	7.2	1006	1.21	0.32	5.29	-
starchy roots	89	1.2	0.5	0.1	16	0.5	-	0.06	0.03	0.80	17.0
pulses	96	6.3	2.1	0.5	39	1.9	8	0.15	0.05	0.59	0.8
fruits & veg.	129	3.5	1.4	0.5	97	2.4	3476	0.16	0.16	1.41	65.4
meat,fish,eggs	119	9.7	6.8	8.6	11	1.3	156	0.04	0.09	2.14	-
milk	78	3.9	2.3	4.2	147	0.1	165	0.04	0.21	0.15	1.2
miscellaneous *	348	0.6	0.2	17.8	17	0.3	180	-	0.01	0.10	-
	2157	59.9	27.0	43.4	369	13.7	4991	1.66	0.87	10.48	84.4
Poor											
cereals	1270	33.9	13.7	12.5	36	7.2	1130	1.22	0.31	4.88	-
starchy roots	106	1.2	0.5	0.1	21	0.6	-	0.06	0.03	0.68	23.0
pulses	100	6.5	2.2	0.5	40	2.0	9	0.16	0.05	0.61	0.9
fruits & veg.	83	2.6	1.1	0.4	78	1.8	2833	0.10	0.13	1.04	50.3
meat,fish,eggs	78	6.4	4.5	5.5	6	0.8	95	0.02	0.06	1.45	-
milk	59	2.9	1.7	3.3	110	0.1	123	0.03	0.16	0.11	1.0
miscellaneous *	272	0.3	0.1	12.9	9	0.4	68	-	-	0.03	-
	1968	53.8	23.8	35.2	300	12.9	4258	1.59	0.74	8.80	75.2
Medium											
cereals	1349	36.2	14.4	11.8	46	7.5	985	1.25	0.32	5.57	-
starchy roots	74	1.1	0.4	0.1	12	0.5	-	0.05	0.03	0.78	12.9
pulses	88	5.7	1.9	0.4	35	1.7	8	0.14	0.05	0.54	0.8
fruits & veg.	123	3.6	1.5	0.5	100	2.5	3656	0.15	0.17	1.44	67.4
meat,fish,eggs	143	11.8	8.4	10.2	14	1.5	183	0.05	0.09	2.60	-
milk	76	3.9	2.3	4.2	144	0.1	162	0.04	0.20	0.15	1.2
miscellaneous *	375	0.7	0.4	20.5	20	0.2	212	-	0.01	0.13	-
	2228	63.0	29.3	47.7	371	14.0	5206	1.68	0.87	11.21	82.3
Rich											
cereals	1357	36.1	14.1	10.4	52	7.4	803	1.21	0.30	6.04	-
starchy roots	77	1.4	0.5	0.1	10	0.6	-	0.08	0.03	1.08	10.9
pulses	140	9.1	3.1	0.7	56	2.7	12	0.22	0.07	0.86	1.2
fruits & veg.	211	4.5	1.9	0.7	114	2.8	4046	0.18	0.21	1.89	83.3
meat,fish,eggs	166	13.4	9.5	12.3	16	1.9	221	0.05	0.12	2.96	-
milk	115	5.8	3.5	6.2	218	0.2	243	0.06	0.30	0.24	1.9
miscellaneous*	435	0.9	0.4	22.8	22	0.1	264	-	0.01	0.17	-
	2501	71.2	33.0	53.2	488	15.7	5589	1.80	1.04	13.24	97.3

* miscellaneous = sugar, fat, nuts, spices, stimulants, alcoholic beverages

Source: M.M. Shah and H. Frohberg [5].

nutrients is below the average in the diet of the poor
people. Their diet - as the diet of all other poor
Keny.ans - is especially lacking riboflavin and niacin; the
intake of iron and vitamin A is still in the acceptable range,
while thiamine and vitamin C are supplied adequately. On the
other hand, the diet of the rich income class is very close to
an excellent one, in respect to the balance between energy,
protein and all the other nutrients. This diet just would
need a supplementation in riboflavin and niacin which are,
however, still far above the minimum level that will prevent
clinical symptoms. If more emphasis can be put on food rich
in these two vitamins as, i.e.,milk products and nuts, the
diet of the rich class in Nairobi can be used as an example
of a balanced diet which also has the taste of the native
population.

Nairobi has the highest average income level in Kenya (Table 18),
and, therefore, it is expected to have the highest nutritional
level, too. However, the preferences for food are much lower
in this city than in the others because a relatively smaller
portion of the income is spent for food. Thus, it is one of
the tasks to educate people about the importance of more and better food with
the hope that they change their eating habits towards the desired direction.

The lowest infant mortality rates and highest life
expectancies of all four cities under investigation are observed
in Nairobi (Table 10). This is due among other facts to the
high medical care and high educational level which are products
of the high development as well as the high income level in
this city, but also, at least in parts, due to the relatively
high nutritional level.

2. 3. Mombasa

The average nutritional situation in Mombasa is comparable with the one
in Nairobi. The people in both cities can obtain the same amount of energy
on a per capita basis; only slightly more protein is consumed in
Mombasa. The intake of vitamins and minerals is also the

same in both cities except that the amount of vitamin A is
much lower in Mombasa (Tables 13,14, and 16, Figures 6 and 7).
However, the nutritional gap between the poor and the rich
income class is much wider in Mombasa. The diet of the poor
class is not better than the average diet of this income
class in all cities together. On the other hand, the rich class
consumes a much bigger part of the total food basket than observed
for the rich income class in the other cities.

The poor income class eats an exceptionally small amount
of fruits and vegetables and drinks not much milk. Further on,
the consumption of starchy roots and meat is below the average
of this income class. Fortunately, many more beans are eaten in this town than
on average, which upgrades the whole diet to some extent. These deviations
in the food pattern make the diet of the poor income class
exceptionally low in calcium, vitamins A and C; all the other
vitamins and minerals are as low as already observed for the
poor income group of all other cities.

The medium income class is able to spend much more money
on food and, therefore, it should be expected that their whole diet
pattern improves. These people eat slightly less maize than
the poor group; instead of it, they consume more wheat flour,
rice, and almost twice as much bread. Their behavior towards
starchy roots is the same one as already observed for all groups
in the whole country - the cassava consumption decreases and
the potato consumption increases with having available
more money for food. However, the energy obtained from this
commodity group is still the same. Also, more desirable food such as fruits,
vegetables, milk products, meat, eggs, fish, fats and sugar can be purchased
with a higher per capita income.
Therefore, the diet of the medium income class is adequate
in energy, protein, iron, thiamine, and vitamin C; however,
all the other essential nutrients are still insufficiently
supplied. This behavior indicates that the diet desired
by the people in Mombasa is not a very balanced one because
it is low in vitamin A, riboflavin and niacin. The reason

TABLE 16: CONSUMPTION PATTERN IN MOMBASA IN 1975

	Energy (kcal)	crude (g)	protein high quality (g)	fat (g)	calcium (mg)	iron (mg)	Vita-min A (I.U.)	thiamin (mg)	ribo-flavin (mg)	niacin (mg)	Vita-min C (mg)
Total											
cereals	1291	34.8	13.8	11.5	45	7.4	950	1.21	0.31	5.31	-
starchy roots	71	1.0	0.3	0.1	12	0.5	-	0.05	0.02	0.70	13.0
pulses	142	9.2	3.1	0.7	57	2.8	12	0.23	0.08	0.87	1.2
fruits & veg.	136	2.6	1.1	0.4	63	1.6	2186	0.10	0.12	1.13	47.0
meat,eggs,fish	117	11.0	7.6	7.8	13	1.2	118	0.04	0.09	2.12	-
milk	66	3.3	2.0	3.6	124	0.1	139	0.04	0.17	0.13	1.0
miscellaneous*	321	0.8	0.3	14.1	23	0.6	151	-	0.01	0.16	0.1
	2144	62.7	28.2	38.2	337	14.2	3556	1.67	0.80	10.42	62.3
Poor											
cereals	1256	33.8	13.3	12.0	40	7.2	1043	1.20	0.30	4.94	-
starchy roots	69	0.8	0.3	0.1	13	0.4	-	0.04	0.02	0.51	14.5
pulses	105	6.8	2.3	0.5	42	2.1	9	0.17	0.06	0.64	0.9
fruits & veg.	58	1.4	0.6	0.2	37	0.9	1318	0.06	0.06	0.59	25.6
meat,eggs,fish	71	7.4	5.1	4.4	8	0.7	58	0.02	0.04	1.34	-
milk	33	1.7	1.0	1.8	62	-	70	0.01	0.08	0.06	0.5
miscellaneous*	211	0.5	0.3	6.5	13	0.6	32	-	-	0.07	0.1
	1803	52.4	22.9	25.5	215	11.9	2530	1.50	0.56	8.15	41.6
Medium											
cereals	1405	37.9	14.7	12.7	48	8.1	1016	1.32	0.33	5.75	-
starchy roots	69	1.0	0.3	0.1	11	0.5	-	0.05	0.02	0.70	12.5
pulses	136	8.8	3.0	0.7	55	2.7	12	0.22	0.07	0.84	1.2
fruits & veg.	133	2.7	1.1	0.4	64	1.7	2318	0.11	0.13	1.17	48.7
meat,eggs,fish	143	12.9	8.9	9.7	14	1.5	142	0.04	0.10	2.66	-
milk	64	3.2	2.0	3.5	120	0.1	135	0.04	0.16	0.13	1.0
miscellaneous*	320	0.7	0.3	14.8	20	0.1	144	-	0.01	0.15	0.1
	2270	67.2	30.3	41.9	332	14.7	3767	1.78	0.82	11.40	63.5
Rich											
cereals	1345	35.8	14.0	10.5	50	7.4	809	1.19	0.30	5.94	-
starchy roots	79	1.5	0.5	0.1	10	0.6	-	0.08	0.03	1.11	11.1
pulses	234	15.2	5.2	1.2	94	4.6	21	0.37	0.12	1.44	2.1
fruits & veg.	300	5.1	2.1	0.9	116	3.1	3944	0.23	0.29	2.27	91.4
meat,eggs,fish	186	16.7	11.8	12.8	20	2.0	246	0.05	0.14	3.27	-
milk	146	7.5	4.5	8.0	278	0.2	312	0.08	0.38	0.30	2.3
miscellaneous*	541	1.5	0.7	31.7	42	0.2	466	-	0.02	0.36	0.1
	2831	83.3	38.8	65.2	610	18.1	5798	2.00	1.28	14.69	107.0

*miscellaneous = sugar, fats, nuts, spices, stimulants, alcoholic beverages.

Source: M.M. Shah and H. Frohberg (15).

for that is a very general one in Kenya - the desire for
fruits, vegetables, milk products and nuts is too low.

The rich income class in Mombasa reflects nicely the
shift in the diet pattern which occurs when more money is
available for food. The amount of total cereals eaten decreases
while especially the consumption of pulses , fruits, vegetables,
meat, milk products, fats and sugar increases. The lower
cereal consumption is due to a decrease in maize flour indicating
that this is the main staple food if the money is limited.
On the other hand, as also already pointed out for the medium
income class, the intake of rice and wheat flour - two relatively
expensive items - increases. This diet of the rich income class
is adequate in all essential nutrients but it is too high in
energy and, therefore, cannot be considered as a balanced diet. It has to be
pointed out, that this is the only income group in all four cities under
investigation who receive the required amount of all essential
nutrients - these are 4% of the total urban population (Table 19)!

It is not surprising that the nutritional level is the
highest in Mombasa because it is also the highest one in the
whole Eastern province, where Mombasa is located. The portion of the income
spent on food is also the highest in this city pointing out that the preference
of being well nourished is higher than that of the average
Kenyian. Further on, the relatively low infant mortality rate
and the relatively high life expectancies (Table 10) are in
accordance with the results of this survey.

2. 4 Nakuru

The poorest among the cities is Nakuru in respect to its
nutritional situation (Tables 13, 17, Figures 6 and 7), which may
may be due to an overall shortage of food on the market as well as of money for
purchase of the available food. Remarkably low is the cereal
consumption, which is almost exclusively derived from maize
flour. Almost no other cereals as wheat products, rice and
millet are eaten in Nakuru. On the other hand, the starchy
root consumption, especially of the poor income class, is
quite high. The intake of all the other commodity groups

TABLE 17 : CONSUMPTION PATTERN IN NAKURU IN 1975

	Energy (kcal)	protein crude (g)	protein high quality (g)	fat (g)	calcium (mg)	iron (mg)	Vita-min A (I.U.)	thiamin (mg)	ribo-flavin (mg)	niacin (mg)	Vita-min C (mg)
Total											
cereals	997	26.6	10.8	10.2	24	5.4	955	0.99	0.25	3.80	-
starchy roots	115	1.2	0.4	0.1	24	0.6	-	0.06	0.03	0.72	25.9
pulses	42	2.7	0.9	0.2	17	0.8	4	0.07	0.08	0.26	0.4
fruits & veg.	93	2.5	0.9	0.4	69	1.6	2441	0.10	0.12	1.01	46.0
meat,eggs,fish	95	8.3	5.7	6.7	10	1.1	118	0.03	0.06	1.77	-
milk	64	3.2	1.9	3.5	120	0.1	135	0.03	0.17	0.12	1.0
miscellaneous*	309	0.4	0.2	13.3	16	0.5	117	-	-	0.08	-
	1715	44.9	20.8	34.4	280	10.1	3770	1.28	0.71	7.76	73.3
Poor											
cereals	929	24.7	10.0	9.8	19	4.9	964	0.91	0.23	3.48	-
starchy roots	147	1.3	0.6	0.2	32	0.7	-	0.07	0.04	0.76	34.7
pulses	29	1.9	0.6	0.1	12	0.6	3	0.05	0.02	0.18	0.3
fruits & veg.	59	2.0	0.8	0.3	61	1.4	2244	0.09	0.10	0.78	39.2
meat,eggs,fish	67	6.3	4.4	4.5	7	0.7	75	0.02	0.05	1.25	-
milk	47	2.3	1.4	2.6	87	0.1	98	0.02	0.13	0.08	0.7
miscellaneous*	249	0.2	0.1	9.5	12	0.6	52	-	-	0.03	-
	1527	38.7	17.9	27.0	230	9.0	3436	1.16	0.57	6.56	74.9
Medium											
cereals	1261	33.6	13.6	12.2	39	7.3	1068	1.22	0.30	4.87	-
starchy roots	85	1.2	0.5	0.1	15	0.5	-	0.06	0.03	0.81	16.8
pulses	67	4.4	1.5	0.3	27	1.3	6	0.11	0.04	0.42	0.6
fruits & veg.	126	3.1	1.2	0.5	84	2.1	3011	0.14	0.15	1.30	58.3
meat	118	9.6	6.7	8.4	11	1.2	149	0.04	0.08	2.15	-
milk	86	4.4	2.7	4.7	164	0.1	184	0.05	0.23	0.17	1.4
miscellaneous *	399	0.6	0.3	16.7	18	0.4	179	-	0.01	0.15	-
	2142	56.9	26.5	42.9	358	13.0	4597	1.62	0.84	9.87	77.1
Rich											
cereals	936	25.1	10.0	9.5	25	5.2	860	0.90	0.22	3.64	-
starchy roots	53	0.8	0.3	0.1	9	0.3	-	0.03	0.02	0.50	10.5
pulses	52	3.4	1.1	0.3	21	1.0	5	0.08	0.03	0.32	0.5
fruits & veg.	162	3.2	1.3	0.5	76	1.9	2674	0.14	0.15	1.41	57.1
meat	145	12.0	8.5	10.4	14	1.6	187	0.04	0.09	2.67	-
milk	90	4.6	2.7	4.9	171	0.1	191	0.05	0.23	0.18	1.5
miscellaneous*	370	0.4	0.2	19.1	11	0.4	193	-	-	0.05	-
	1808	49.5	24.1	44.8	327	10.5	4110	1.24	0.74	8.77	69.6

* miscellaneous = sugar, fats, nuts, spices, stimulants, alcoholic beverages
Source: M.M. Shah and H. Frohberg [5].

is also below the average consumption level of all the cities .
Therefore, the diet in Nakuru is in general deficient in all
essential nutrients; only thamine and vitamin C are supplied
in an acceptable range at the retail level.

The nutritional level in no other city in Kenya is as
low as the one of the poor income class in Nakuru. The diet
of these people is extremely deficient in energy, protein and all
other essential nutrients. Therefore, a high incidence of disease
has to be expected being related to malnutrition, i.e.,
kwashiorkor, marasmus, goitre, avitaminosis, and many others.

As soon as the per capita income is slightly above the
minimum, people buy more food, especially more cereals. Only the
total amount of purchased energy decreases due to a sharp decrease
in the cassava consumption. The consumption of pulses, fruits,
vegetables, meat, eggs, fish, and milk products was almost double
for the medium class income when their diet was compared with
the one of the poor income group. This additional food
substantiates the intake of energy, protein, and all other
essential nutrients. However, just thiamine, vitamins A and C
are obtained close to an adequate level by this diet - all the
nutrients received are still below their required level.

The nutritional status of the rich class is not the highest
one of the whole city as would have been expected from the
results discussed up to now in this report. Several reasons can
be given for this phenomenon:

(i) The per capita income of the rich income class is only
    slightly higher than the one of the medium class because
    the number of dependencies on one salary is higher for
    the rich class in Nakuru than for the other income
    groups (Table 19).

(ii) The percentage of the money spent for food is smaller
     for the rich income group than for the medium class
     (Table 19).

(iii) The same behavior is observed here as already in
Mombasa - the rich income class eats relatively less
of the cheap maize flour but more of the expensive items
as fruits, vegetables, meat, fish, eggs, and milk products.

Therefore, the diet of the medium income class has nutritionally
a higher value and is more sunstantive than the one of the rich
income class.

The general attitude of the rural population in Rift Valley -
the province where Nakuru is located - towards food is better,
because they spend more money of their money on food in order to
receive a qualitatively and quantitavely better diet. The phenomenon
that the diet in rural areas is better than in cities is charact-
eristic of some developing countries (7). Very often the quality
of the diets deteriorate when people move into towns, since they
then have to buy most of their food and they cannot grow it them-
selves anymore. In addition, the number of dependencies upon one
income becomes larger, and the temptation to buy other foods rather
than quality food also increases.

In spite of the very low nutritional level in Nakuru, the
infant mortality rate is relatively low. Reasons for that may
be good medical care and good infant feeding habits.

2. 5. Kisumu

The per capita income in Kisumu is lower than the one in
Nakuru and, thus, the lowest one of all four cities under
investigation (Table 18). In spite of that, the overall nutritional
status is slightly higher than in Nakuru which is due to the
fact that more of the income is spent for food (Tables 13 and 18 ,
Figures 6 and 7) . The characteristics of the average diet
in this town are that the cereal consumption is below the average,
because only a very small amount of wheat products and rice is
eaten. Further on, the average amount of beans, fruits, and milk
products available is below that in the other cities. However, much
more fish is consumed than anywhere else and relatively many
vegetables are eaten in this city.

TABLE 18: CONSUMPTION PATTERN IN KISUMU IN 1975

	Energy (kcal)	protein crude (g)	protein high quality (g)	fat (g)	calcium (mg)	iron (mg)	Vitamin A (I.U.)	thiamin (mg)	ribo-flavin (mg)	niacin (mg)	Vitamin C (mg)
Total											
cereals	1076	28.7	1.6	10.8	31	6.3	972	1.04	0.27	4.05	–
starchy roots	78	0.7	0.3	0.1	17	0.4	–	0.04	0.01	0.43	18.1
pulses	49	3.2	1.1	0.2	20	1.0	4	0.08	0.03	0.30	0.4
fruits & veg.	83	2.9	1.2	0.4	88	2.0	3230	0.12	0.14	1.12	56.4
meat,eggs,fish	135	12.4	8.7	9.1	15	1.4	148	0.04	0.09	2.51	–
milk	58	2.9	1.8	3.2	108	0.1	121	0.03	0.15	0.10	0.9
miscellaneous*	293	0.5	0.2	10.9	21	0.7	97	–	–	0.09	–
	1772	51.3	24.9	34.7	300	11.9	4572	1.35	0.69	8.60	75.8
Poor											
cereals	1085	28.9	11.7	11.2	30	6.3	1038	1.06	0.27	4.00	–
starchy roots	56	0.6	0.3	0.1	12	0.3	–	0.03	0.01	0.32	12.7
pulses	32	2.1	0.7	0.2	13	0.6	3	0.05	0.02	0.20	0.3
fruits & veg.	66	2.7	1.0	0.4	88	2.0	3225	0.12	0.13	1.04	54.6
meat,eggs,fish	127	11.9	7.6	8.3	13	1.2	122	0.04	0.09	2.35	–
milk	53	2.6	1.6	2.9	97	0.1	109	0.02	0.14	0.09	0.8
miscellaneous*	273	0.4	0.2	8.5	20	0.8	62	–	–	0.07	–
	1692	49.2	23.1	31.6	273	11.3	4559	1.32	0.66	8.07	68.4
Medium											
cereals	957	25.5	10.4	9.9	26	5.6	903	0.93	0.23	3.54	–
starchy roots	62	0.5	0.2	0.1	14	0.3	–	0.03	0.01	0.32	14.5
pulses	53	3.4	1.2	0.3	21	1.0	5	0.08	0.03	0.33	0.5
fruits & veg.	69	2.7	1.1	0.4	84	1.9	3057	0.11	0.13	1.02	52.3
meat,eggs,fish	128	11.7	8.1	8.7	13	1.4	136	0.04	0.08	1.40	–
milk	60	3.0	1.8	3.3	112	0.1	126	0.03	0.16	0.11	1.0
miscellaneous*	262	0.4	0.2	10.7	16	0.7	77	–	–	0.05	–
	1591	47.2	23.0	33.4	286	11.0	4304	1.22	0.64	6.77	68.3
Rich											
cereals	1247	33.3	13.6	11.2	46	7.6	890	1.16	0.30	4.96	–
starchy roots	70	0.8	0.3	0.1	14	0.4	–	0.04	0.02	0.54	15.1
pulses	68	4.4	1.5	0.3	5	1.3	6	0.11	0.04	0.42	0.6
fruits & veg.	141	3.5	1.3	0.5	91	2.3	3235	0.15	0.16	1.44	63.1
meat,eggs,fish	155	13.6	9.5	10.8	16	1.6	175	0.05	0.11	2.86	–
milk	66	3.3	2.0	3.6	125	0.1	140	0.04	0.17	0.13	1.0
miscellaneous*	411	0.7	0.3	21.6	27	0.6	247	–	0.01	0.15	–
	2158	59.6	28.5	48.1	324	13.6	4693	1.55	0.81	10.50	79.8

* miscellaneous = sugar, fats, nuts, spices, stimulants, alcoholic beverages

Source: M.M. Shah and H. Frohberg (5).

As already observed several times throughout this report, the diet of the poor income class is deficient in nearly all nutrients. Only thiamine, vitamins A and C are sufficiently supplied in the diet, at least at the retail level.

The diet of the medium income class even would need substantive improvement because it is quantitatively and qualitatively worse than the one of the poor income class. The reasons are the same as already mentioned for the rich income class in Nakuru.

On the other hand, the diet of the rich class improves tremendously as compared to the poor and medium classes. These people consume many more cereals, especially wheat products and rice, fruits, vegetables, and fats. The intake of the other commodity groups is only slightly elevated. Because of this additional food, the total diet becomes sufficient in protein, thiamine, vitamins A and C; the iron content almost meets its required level and no signs of dificiencies should occur. The diet just needs some substitution in energy, riboflavin and niacin, which should preferably be derived from milk products and nuts.

2. 6 Correlation of the Income with the Nutritional Status for the Urban Population

The per capita income of the urban population is much higher than the one of the rural population (Tables 4 and 19), however, food is also more expensive in the towns. Anyhow, the percentage of the income spent on food is on average much lower in the cities - the rural population spends on average 75% of their income for food, whereas the urban population only spends 39% in the average. However, spending practices are slightly different from town to town. The people in Nairobi have the highest per capita income, however they spend less of it for food than the people in Mombasa who's income is slightly lower. As these examples show, the preference for food which means the percentage of the income spent on eating is linked to the overall nutritional status.

TABLE 19: INCOME AND POPULATION DISTRIBUTION OF THE URBAN POPULATION IN 1975

	Income(Ksh)/ year & caput	Food expenditure (Ksh)/year & caput	percent of total urban population	percent of urban population within the city	percent of salary spent on food	household size
Urban						
Total	2160.00	844.29	100.0	100.0	39	5.60
Poor	1288.64	638.64	42.5	42.5	50	5.28
Medium	2360.89	915.95	24.7	24.7	39	5.83
Rich	3827.39	1190.45	17.7	17.7	31	6.28
Nairobi						
Total	2497.18	904.23	47.4	100.0	36	5.68
Poor	1503.27	693.82	18.3	39.1	46	5.50
Medium	2583.48	970.12	12.9	27.1	38	5.69
Rich	4437.62	1213.86	8.6	18.1	27	6.06
Mombasa						
Total	1909.77	854.71	20.9	100.0	45	5.63
Poor	1014.50	586.26	9.2	43.9	58	5.24
Medium	2185.51	921.74	4.8	22.8	42	6.21
Rich	3644.30	1389.26	4.0	19.0	38	5.96
Nakuru						
Total	1704.41	677.29	3.8	100.0	40	5.90
Poor	1119.69	534.61	1.8	48.4	48	5.23
Medium	2428.38	873.65	0.7	17.7	36	5.92
Rich	2483.04	851.21	0.7	19.4	34	8.67
Kisumu						
Total	1673.87	728.49	4.1	100.0	44	5.09
Poor	1320.26	678.04	2.1	52.2	51	4.69
Medium	1574.60	677.25	1.1	26.9	43	5.67
Rich	2789.08	921.50	0.6	13.4	33	5.86

of a group of people in a developing country. As more of the income is spent on food by these people, the relatively better the diet pattern will be.

The main features of the urban diet pattern are that the percentage of the energy derived from animal and vegetable protein as well as from refined sugar does not vary with increasing income (Figure 8). which is in contrast to the behavior of the rural population (Figure 2). The urban population also consumes more sugar than the rural population. On the other hand, a strong dependency of the fat consumption is observed upon the income for the urban population. The percentage of the energy derived from fat is also much higher for the urban population than for the rural one because oils and fats are very expensive and treated as luxury goods. The diets of the inhabitants of Kenya's cities contain on average 11% protein and 10% refined sugar. Furthermore, 16% and 21% of the energy in the diet of poor and rich people, respectively, is derived from fat. Therefore, 56% and 63%, respectively, of the energy is from carbohydrates in the rich man's and poor man's diet. The composition of these diet patterns is relatively good from the point of view of the distribution between protein, fat and carbohydrates.

In contrast to the rural population which shows a high demand for more food with increasing income (Figure 3), the urban population does not have such a pronounced dependency (Figure 9). A shift to better food with increasing income is more pronounced in the cities, which, however, can hardly be detected when only the amount of purchased energy is compared with the income. This described effect is most obvious in Nairobi, the city with the highest per capita income. In this city, the income-supplied energy curve levels off near to the required amount of energy leading to a very favorable tendency towards high quality food, with the result of a more balanced diet. The demand for higher quantity - not quality - prevails in Mombasa. This leads to the conclusion that food is a very highly ranged commodity in Mombasa causing the widest quantative gap in the food habits of the poor and the rich classes which
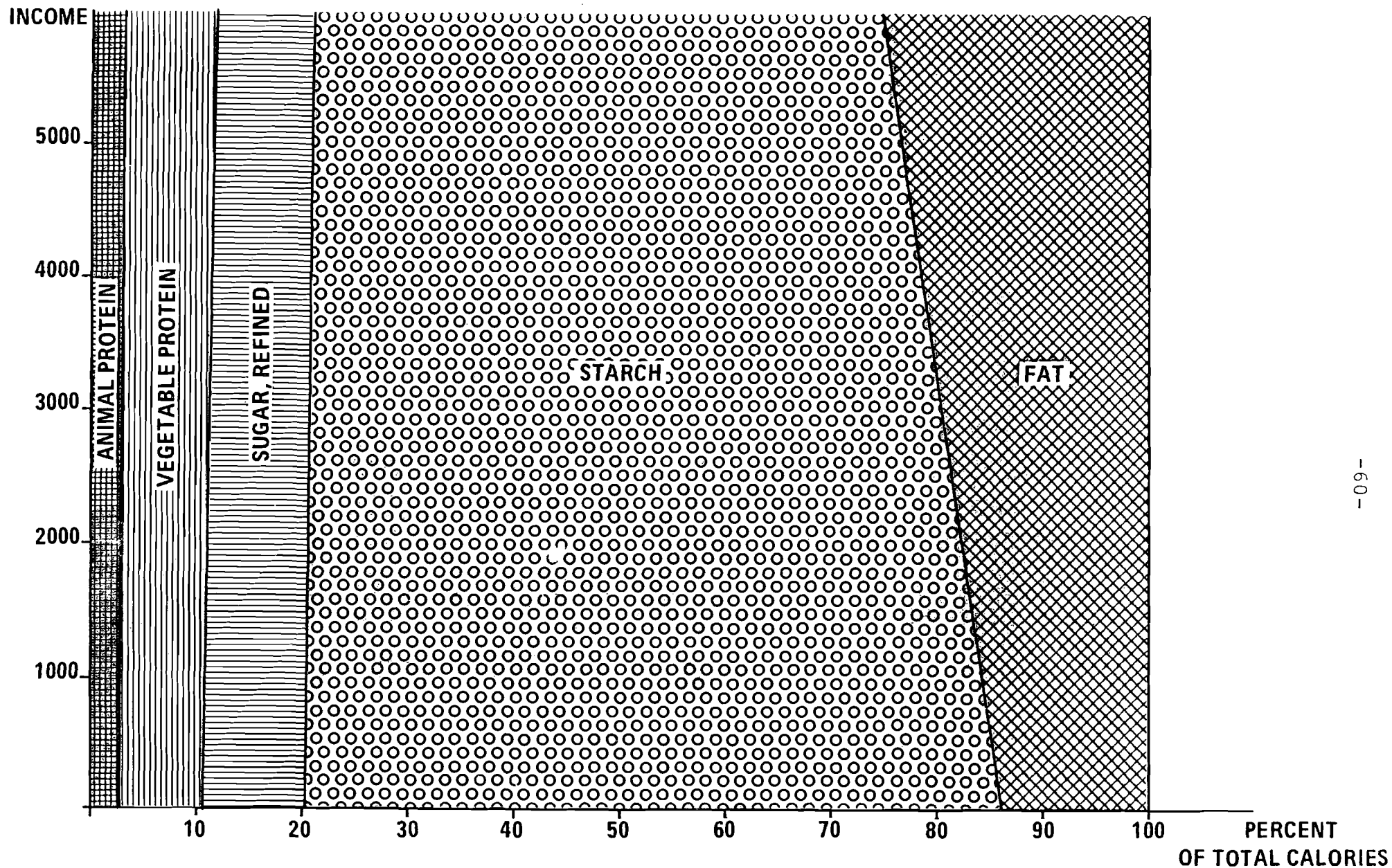
Figure 8 COMPOSITION OF THE DIET OF THE URBAN POPULATION (LIGHT ACTIVE)
DEPENDING ON THE INCOME

PERCENT OF
REQUIRED
ENERGY

140

120

100

80

60

40

20

1000 2000 3000 4000

INCOME/YEAR

URBAN
NAIROBI
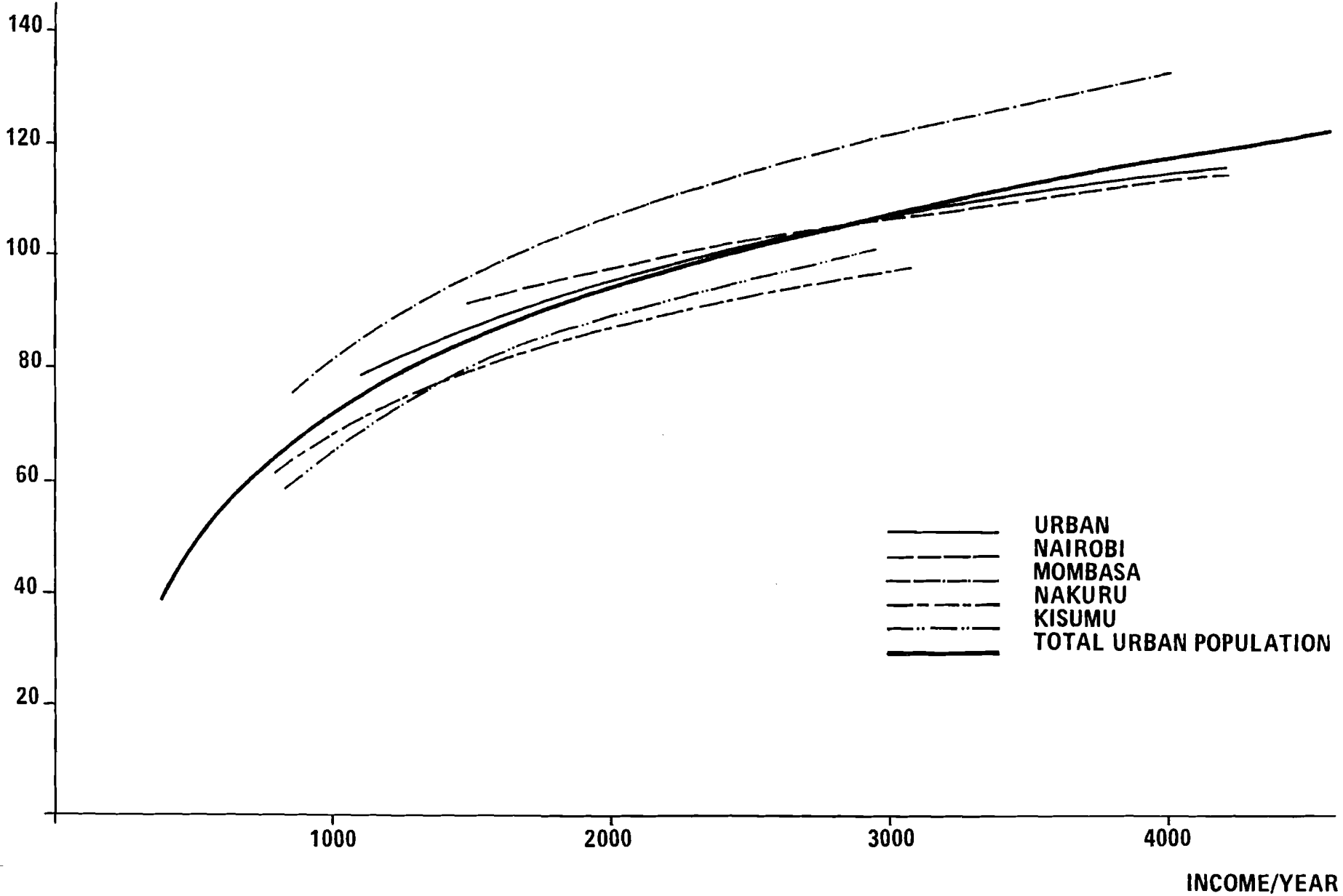MOMBASA
NAKURU
KISUMU
TOTAL URBAN POPULATION

Figure 9   SOURCE OF CALORIC REQUIREMENTS DEPENDING ON INCOME

was observed in all the cities under investigation. However, the income-supplied energy curve clearly shows a possible existence of overeating. The amount of energy consumed is lowest in in Kusumu and Nakuru, where the income is also the lowest, and, consequently, where least money is available for food. However, the demand for more food is also not very high and the preference for better food is not very pronounced in these cities. If the food pattern of all four cities under investigation is agglomerated and, if each income group is considered as a part of the whole urban population, the result is very close to the behavior of the total urban population. Therefore, this aggregation can be used further on as a rough approximation for the behavior of the total urban population in Kenya towards food.

The general conclusion about the behavior of the urban population towards food can be stated from the income-supplied energy curve as such that the demand for a better food quality and, consequently, for a more balanced diet is higher than the demand for more food with increasing income. If this behavior is extrapolated, a per capita income of 3200KSh is needed in any Kenyian city to be able to purchase a sufficient amount of calories (this assumption was derived from Figure 9), providing a light activity grade. However, if heavier work has to be done, more energy is needed which means that the income has to be higher too, if the same portion can be spent on food.

On the other hand, if the influence of food expenditures is considered upon the amount of energy obtained, a straight line dependency is observed in the range of the survey (Figure 10), which is analogous to the behavior of the rural population (Figure 4). As expected, the increase is the least in Nairobi, but much higher in Mombasa. The spending practices are similar in Nakuru and Kisumu.
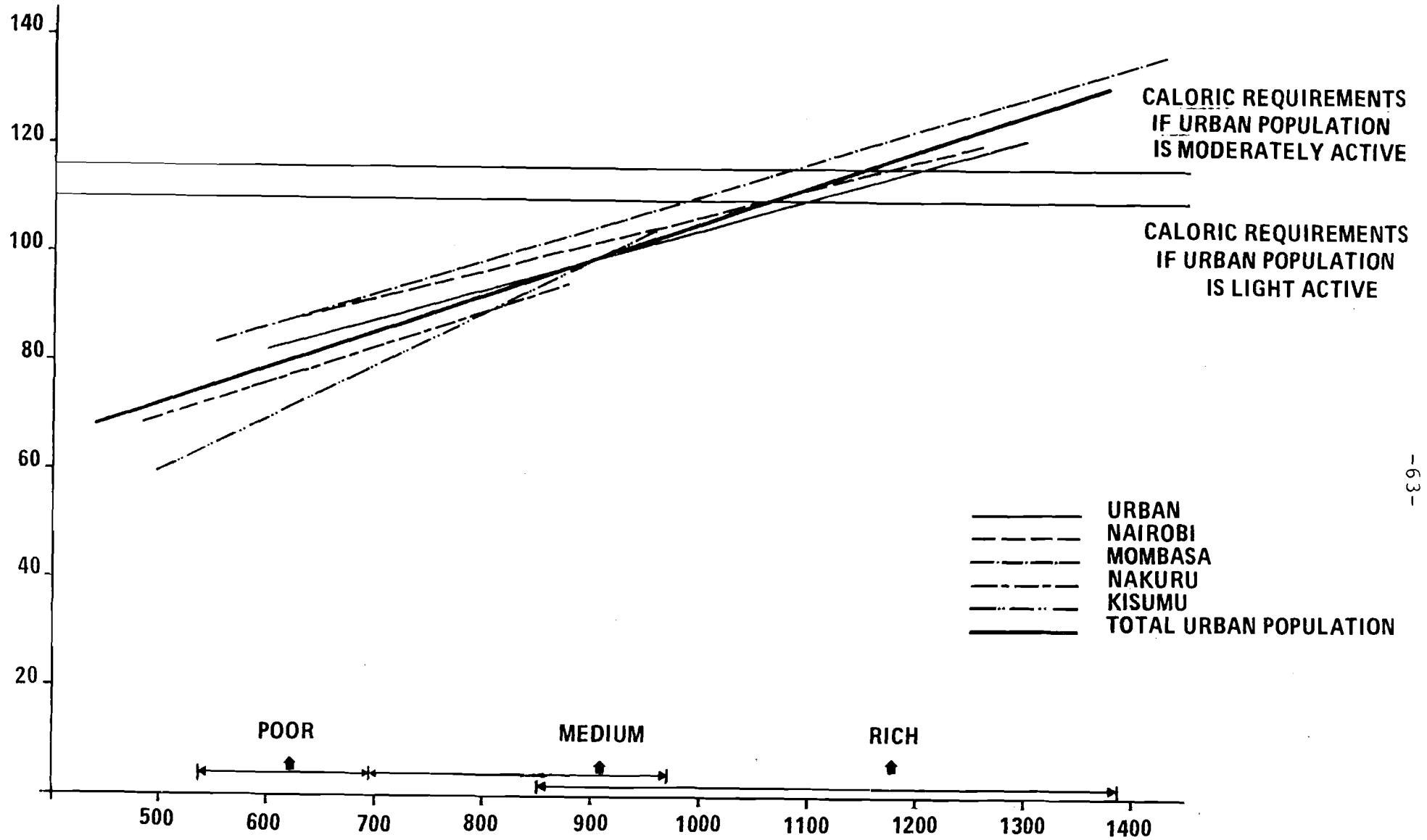
PERCENT OF
REQUIRED
ENERGY

CALORIC REQUIREMENTS
IF URBAN POPULATION
IS MODERATELY ACTIVE

CALORIC REQUIREMENTS
IF URBAN POPULATION
IS LIGHT ACTIVE

URBAN
NAIROBI
MOMBASA
NAKURU
KISUMU
TOTAL URBAN POPULATION

POOR   MEDIUM   RICH

Figure 10   SUPPLY OF CALORIC REQUIREMENTS DEPENDING ON EXPENDITURES FOR FOOD

-63-

Assuming that the behavior of the population stays the
same, approximately 1050 kSh would be needed per caput and
year to buy a calorically adequate diet for a group of people
at a light activity level. If they are more active, they
need more food, and consequently, the expenditures will be
higher. The costs of this diet would require about 33%
of that income which was estimated to be necessary for a
calorically adequate diet. The purchased diet will then be
deficient in niacin, riboflavin and low in calcium; all the
other nutrients will be adequately supplied. (Figure 11).
These deficiencies stress once more that the diet of the
urban population is not a completely balanced one and that
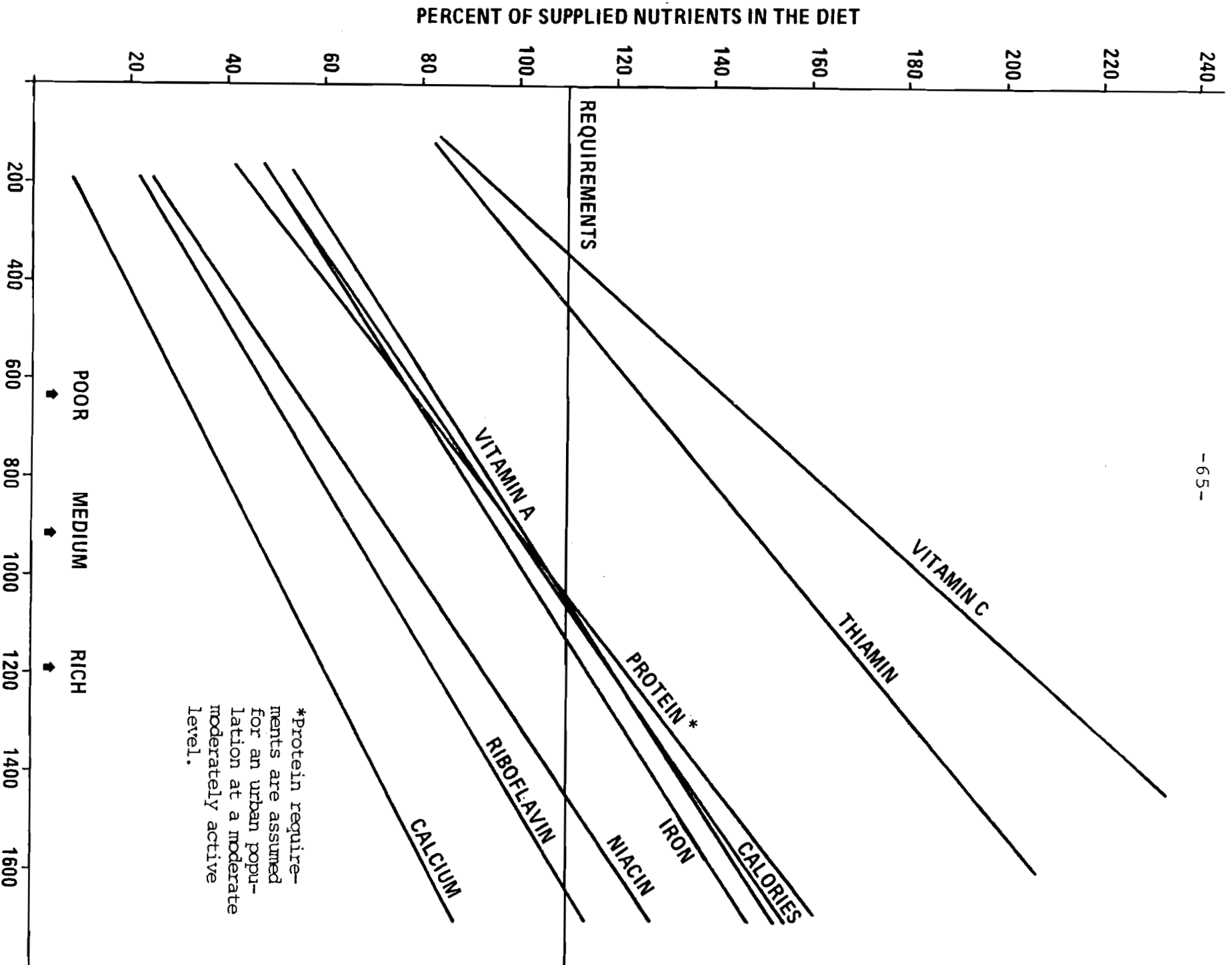substitution of the diet with milk products and nuts is needed.

2.7 The Comparison of the nutritional states of the urban population to a previous survey

A survey in an urban area of Kenya was carried out by
Munoz only in 1962. It was reevaluated by Bohdal et al [10].
The survey of the Bondeni Location of Nairobi will be considered
as being representative for the whole city in order to compare
it with the present survey. However, it should be kept in mind
that this is a gross oversimplification.

According to this survey, more calories are derived from
cereals and vegetables nowadays. However, proportionally less
legumes and starcht roots are consumed. It seems, that more food
is available nowadays but that it is of a lower quality than 15
years ago which may be due especially to the shift in cereal
and bean consumption.

2.8 Future Outlook

The nutritional situation was calculated for the urban
population in the year 2000 without taking into consideration
any changes in the eating habits, (Shah [12]. If a medium population
growth and a likely increase in income (7%) is assumed, enough
energy and protein would be available to meet everyone's

PERCENT OF SUPPLIED NUTRIENTS IN THE DIET

REQUIREMENTS

VITAMIN A

VITAMIN C

THIAMIN

PROTEIN *

IRON

CALORIES

NIACIN

RIBOFLAVIN

CALCIUM

POOR

MEDIUM

RICH

*Protein require-
ments are assumed
for an urban popu-
lation at a moderate
moderately active
level.

FOOD EXPENDITURE

Figure 11 DEPENDENCE OF THE QUALITY OF THE DIET UPON FOOD EXPENDITURE
FOR THE URBAN POPULATION (LIGHT ACTIVE)

requirements providing equal distribution of the food throughout
the country (Table 20, 1-3). Approximately 11-12% more energy
will be available to the urban population. The composition of
this diet in respect to nutrients is comparable with the one
predicted from Figure 11 for the given amount of energy - it is
sufficient in all nutrients except calcium, riboflavin and
niacin. Therefore, it can be assumed that this diet will cost
about 1050 kSh which will be about 27-28% of the total income.
These spending practices are comparable with the ones of the
rich class in Nairobi. However, the earnings of this group
are still slightly higher and, therefore, their diet is also
slightly better than the expected one of the total urban
population in the year 2000. The low content of riboflavin
and niacin strongly enforces the neccesity to educate the
urban population about the need to supplement their diet with
food which is rich in these nutrients, i.e., milk products and
nuts, in order to obtain a balanced diet.

If a low population growth and a low increase in income
(4.5%) is assumed, the diet of the urban population will
improve only slightly in energy and all other nutrients in
the future. The food available under these assumptions would not
be enough to meet everyone's requirements on the consumption level.
(Table 20, 4). It is also expected that more of the income (35%)
would have to be spent on this diet as compared with the spending
practice when medium growth in population and income is assumed.
In the case when low increase takes place, the spending practices
of the urban population are still the same as observed in 1975
and, therefore, the distribution of food among the urban popula-
tion may also be similar.

Table 74

Estimated Supplies of Nutrients in the Year 2000 for the
Urban Population (light activity)

Nutrient	Supply in percent of requirements *				
	in 1977	in 2000			
		1	2	3	4
energy	96	108	108	107	99
protein	96	110	110	109	99
fat **	17	21	21	21	18
calcium	43	52	52	51	46
iron	93	103	103	101	96
vitamin A	99	119	119	118	106
thiamine	140	157	157	156	152
riboflavin	58	72	72	72	65
niacin	65	82	82	81	73
vitamin C	162	202	202	200	178
income***(KSh)	2160	3818	3863	3723	2552

* requirements in the year 2000 different from Table 5: calculated
from the estimated age distribution of the population.

energy   2,160 kcal

protein   28.4 g (moderately active)

thiamine   1.08 mg

riboflavin   1.30 mg

niacin   14.26 mg

** in percent of required energy
*** Constant 1977 KSh

1 Medium population projection and likely growth (7%) of total
   PCE assuming no change in the income distribution

2 Medium population projection and likely growth (7%) of total
   PCE assuming a moderate change in the income distribution

3 Medium population projection and likely growth (7%) of total
   PCE assuming a drastic change in the income distribution

4 low population projection and low growth (4.5%) of total PCE
   Source: M.M. Shah, [12].

2 .9 Conclusion

The result of these two surveys in Kenya is that no difference exists between the amount of energy and protein available in the diet for the total urban and for the total rural population. The poorest rural income class (R11) also consumes about the same amount of food as the poor class in Nakuru, the city with the lowest nutritional level. However, the diet of the urban people is more balanced than the one of the rural population because they eat more fruits and vegetables which are lacking considerably in the diet of the people in the rural areas. In general, the diet of the people in a city is better than the one of the whole province where this city is in. A difference can also be noticed in the amount of food available to the urban and rural population. It can be estimated from the present surveys that 39%of the rural population and 51% of the urban population obtain less than 2000 kcal per caput. In addition 38% of the rural population and 29% of the urban population obtain between 2000 and 2500 kcal per caput. The remaining part consumes more than 2500 kcal. It indicates that, in the average, more of the rural people have more food available than the people in the cities.

These observations are in contrast to previous surveys in India, Sri Lanka and Brazil (7) in which the urban poor have lower caloric availabilities than the rural poor. However, studies in some African countries, i.e., Swaziland (13), Nigeria (14), Ghana (15), and Kenya(10) showed that the rural population is underfed whereas the urban people have more to eat. The present study can be ranged just in between these two extremes. The reasons for these differences may be of different nature.

   (i)   It is difficult to estimate the value of the food
         and the income of the rural population and, therefore,
         earnings and food expenditures of the rural popu-
         lation may be seriously underestimated.

(ii)   The survey may not be representative for the whole urban/rural population.

(iii) There are differences in the nutritional status among different areas and different cities of the same country. The evaluation is depending upon what is compared with.

(iv) There may be differences from country to country.

The problems with the present nutritional survey for the urban population are - as mentioned already earlier - that the survey was conducted only throughout one month and no changes in the food pattern (i.e., because of seasonal shortages) were considered. Further on, only 2% of the urban population were surveyed and it is not for sure that all residential areas were considered proportionally. These uncertainties are reason enough to regard these results only as preliminary ones which still need more support by further research, especially from medical field studies.

Anyhow, it can be generalized from this study that the average diet of the urban population is not too much out of balance. To obtain the optimal quality of a diet, some supplementations with riboflavin and niacin are needed. This can be achieved if food rich in these nutrients, i.e., milk products, nuts, fruits and vegetables would be more stressed in the average diet. According to the present survey, the main nutritional problem in the cities is related to poverty, and, as soon as people have enough money, they will buy more or less the right food (quantitatively and qualitatively) to fulfill their nutritional requirements. It has to be stressed once more, that an individual does not have to be undernourished just because he belongs to the poor class - the nutritional analysis refers only to the class as a whole and not to the individual in this class.

When the diet is taken which may be available to the urban population in 2000 (assuming medium population and income growth),

and when this diet is supplemented with about 15-20 g of nuts per day and caput, a diet is obtained which is a very balanced one and which is even to the taste of the native urban people. Therefore, this diet should be used as an example of a good one and this degree of the diet should be made available to each person in the cities.

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