NUTRIENT INTAKE AND NUTRITIONAL STATUS OF PRIMARY SCHOOL CHILDREN IN A SCHOOL WITH AND WITHOUT A FEEDING PROGRAMME IN NYAMBENE DISTRICT, KENYA
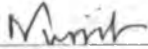
BY

MEME MARTIN MURIITHI

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DECLARATION

I, **MEME MARTIN MURIITHI** hereby declare that this thesis is my original work and has not been presented in any other university.

MEME MARTIN MURIITHI

Date 14.11.96

This thesis has been submitted for examination with our approval as university supervisors.

Dr. WAMBUI KOGI-MAKAU

Lecturer,

Unit of Applied Human Nutrition,

Department of Food Technology and Nutrition.

Date 14.11.96

Dr. NELSON M. MUROKI

Senior Lecturer,

Unit of Applied Human Nutrition,

Department of Food Technology and Nutrition.

Date 14.11.96

DEDICATION

To my parents,

Mr. Solomon M. Meme and Mrs. Salesia E. Solomon

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ACKNOWLEDGEMENT

ABBREVIATIONS

ACCN/SCN...Administrative Committee on Coordination-Subcommittee on Nutrition

ANP........Applied Nutrition Programme

ASAL.......Arid and Semi-arid Areas

CARE.......American Relief Everywhere

CBS........Central Bureau of Statistics

CRSP.......Collaborative Research Support Programme

CTA........Technical Centre for Agricultural and Rural Cooperation

DEO........District Education Officer

DMOH.......District Medical Officer of Health

ECSA.......East, Central and Southern Africa (Food and Nutrition Cooperation)

FAO........Food and Agriculture Organization

GoK........Government of Kenya

HAZ........Height-for-age Z-Score

HFA........Height-for-Age

MALM.......Ministry of Agriculture and Livestock Marketing

MoED.......Ministry of Education

NCPB.......National Cereals and Produce Board

NGO........Non-Governmental Organization

NSFCK......National School Feeding Council of Kenya

OXFAM......Oxford Famine

PEM........Protein-Energy Malnutrition

SD.........Standard deviation

SFP........School Feeding Programme

UN.........United Nations

UNESCO......United Nations Education Scientific and Cultural
           Organization

UNICEF......United Nations International Childrens Emergency Fund

URI........Upper respiratory infection

WFA........Weight-for-Age

WAZ........Weight-for-Age Z-Score

WFH........Weight-for-Height

WFP........World Food Programme

WHO........World Health Organization

WHZ........Weight-for-Height Z-Score

DEFINITIONS

Dependency Ratio...The proportion of dependants who are below fifteen and above sixty five years of age to those between fifteen and sixty five years in the study households.

Feeding Programme...The provision of meals (in this study during lunch time) to primary school children.

Household...All the people who have lived together for at least three months and operate as a unit, including such members as unrelated servants, labourers and relatives who took meals together.

Miraa...A herb also known as 'khat' predominantly grown in Nyambene district and consumed for its light intoxicating effect on the user.

Standard deviation or Z-score...The deviation of the value for an individual from the median value of the reference population, divided by the standard deviation for the reference population, i.e.

$$\text{Z-score} = \frac{\text{(Observed value)} - \text{(Median reference value)}}{\text{Standard deviation of reference population.}}$$

ABSTRACT

The assessment of nutritional status in Kenya revolves around pre-school children, hence, not much is known about the nutritional status of school age children. Going by the premise that about 30% pre-schoolers in Kenya suffer protein-energy malnutrition, there is need for clarifying the likely situation of children once they get older. This study, therefore, targets the "older children", i.e. the school age children, as a group which may be at risk of malnutrition.

A cross sectional survey of descriptive and analytical nature was carried out in Nyambene District of Kenya during the months of January, February and March 1995. The principal objective of the study was to determine and compare the dietary intake and nutritional status of two groups of school children aged 5-10 years: i.e. those in a school with a World Food Programme (WFP)-sponsored lunch-time meal programme (Group A) and the other without the programme (Group B). For the purposes of this study, it was also necessary to determine and compare socio-demographic and socio-economic characteristics of the children's households as well as other factors with the potential to influence child growth such as household nutrient availability. A total of 325 school children and their respective households were covered; 162 from Group A and 163 from Group B.

A structured questionnaire was used to collect data during school

and home visits. Anthropometric, school attendance and nutrient intake by children participating in the feeding programme data were collected during school visits. Household nutrient availability, the children's dietary intakes at home, child morbidity, household socio-demographic and socio-economic data were collected during home visits. The 24-hour recall was used for dietary assessment.

The results showed that household per capita caloric and protein availability at home were almost equal for both groups. No significant difference was found with regard to the per capita weekly expenditure on food between the two groups of households.

Children in the lunch programme were found to have a significantly higher caloric intake (86%) of the recommended daily allowance (RDA) compared to non-programme children's 76% of RDA (p<0.05). The protein intake was found to be higher in both cases than the RDA. Though not significantly, children in Group B had a higher protein intake (238%) of RDA than those in Group A whose adequacy was 216% of the RDA. This was because the children outside the feeding programme received significantly more protein (30.8g) from home lunch compared to those in the feeding programme whose lunch provided 24.0g at school (p<0.05), with intakes from breakfast and supper being practically similar in both groups.

The prevalence of acute malnutrition (wasting) for the programme children (8.6%) was significantly higher than that of non-programme

children which was 2.4% (p<0.05). The level of stunting was similar for both groups, that is, 23.5% for children in the programme school and 25.2% for those in the non-programme school. Prevalence of underweight for children in the programme school (22.2%) was slightly higher (but not significantly) than that of the non-programme children which was 18.4%. The overall results show a more favourable nutritional situation for girls than boys in both groups of children.

From this study, it is evident that children participating in a school feeding programme were not at a nutritional advantage when compared to non-participants. This was contrary to what was expected. Although it was outside the scope of this study to explain why this was so, it is the researcher's view that this could partly be accounted for by the fact that the children in the feeding programme obtained only about 60% of the nutrients that they should have had if the programme was continuous throughout the school term. It is therefore recommended that further investigations be carried out to identify the reasons behind this weakness in the WFP-school feeding programme to help improve the programme throughout the country. It is also noteworthy that the selection of schools to participate in the feeding programme was not based on information obtained from a nutritional survey. The results of this study are expected to be useful to education policy makers and other interested parties such as NGOs who are involved in school feeding programmes and other types of interventions.

CHAPTER ONE

INTRODUCTION

1.1 Statement of the Problem

Malnutrition poses a serious health problem in developing countries. Protein-energy malnutrition (PEM) is the main nutritional problem for young children in Kenya (UNICEF, 1990 and WHO, 1983). The Central Bureau of Statistics (CBS) in 1987 showed that 24% of children under five years in Kenya were stunted.

Population data on PEM among school children are scarce. As pointed out by Pollit (1990), this is because most epidemiological information available from governments and international bodies is on infants and pre-school children (0-5 years). The comparatively little information available on school children is derived from particular studies mainly from Asia, Latin America and to a smaller extent, Africa.

PEM is the major form of malnutrition in school age children in Kenya mainly due to insufficient dietary intakes (GoK/UNICEF, 1992). When accompanied by infections as is usually the case, it results in frequent absenteeism from school and therefore slowed learning pace for the child, in addition to permanent physical and mental growth deficits. The negative impact of malnutrition on learning has been well documented by studies carried out in many parts of the world. Sigman et al (1989) found out that well

nourished Kenyan school children in Embu District performed better academically than those who were malnourished. The study showed that 25% of the children were stunted and that their daily caloric intake were below the recommended levels. In Samburu District in Kenya, Kielmann et al (1988) found out that there was a decline in nutritional status of children with increasing age.

This study refocusses attention to the "older children", the school-age children who seem to have been neglected for long yet they most likely could bare all the "cumulative" nutritional stress. The very intensive nature of the 8-4-4 education system demands a lot of time and energy from the child to travel long distances for mid-day meals or snacks. Unless these children are provided with regular nutritious meals while in school, their nutritional status may be expected to be inferior to that of children in a situation where such meals are provided.

School children participating in a school feeding programme under the National School Feeding Council of Kenya (NSFCK) were found to have a better nutritional status than those out of the programme (Pieters et al., 1977). No such study has been carried out on children participating in the World Food Programme (WFP)-sponsored school feeding programme introduced in 1981 in the arid and semi-arid (ASAL) areas of Kenya.

The CBS survey carried out in 1987 for children under five years

showed that the former giant Meru district (currently subdivided into Nyambene, Meru and Tharaka-Nithi districts) nationally ranked 5th with 3.9% of the children wasted. This was higher than the national figure of 2.5%. PEM is rampant in the new Nyambene district. According to the District Medical Officer of Health (DMOH), the prevalence of malnutrition in this new district was the highest compared to other areas of the former greater Meru district, from which it was carved off in 1993.

This study aspires to fill gaps in knowledge by making an assessment of the nutrient intake adequacy and nutritional status of primary school children within a school providing a WFP-sponsored lunch-time meal and one which does not. It will determine whether children in a school which provides lunch-time meal are at a nutritional advantage when compared to those in a school which does not provide children with such a meal in the Nyambene District of Kenya.

1.2 Research Objectives

The objectives of the study were:

1. To determine selected characteristics of (5-10 year old) study children's households in and out of a school feeding programme and establish whether the two groups are different or similar.

  (a) To describe selected demographic characteristics of households (male/female sex ratio, household size, dependency ratio and age of children and parents).

(b) To describe selected socio-economic characteristics of households (education levels, household per capita food expenditure and income sources).

(c) Using the characteristics listed in a and b, establish whether the two groups of households are different or similar.

(d) To identify the main sources of food in the two types of households and assess the household food consumption frequency and the per capita caloric and protein availability.

2. To establish the morbidity status of the children as reported by parents.

(a) To determine illness prevalence.

(b) To determine the main illnesses experienced by the children.

(c) To compare the morbidity status of the children in the two groups.

3. To establish whether there is a difference between the dietary intake and adequacy of children participating in a school feeding programme and that of children not in such a programme.

(a) To determine the children's dietary intake of calories and proteins.

(b) To determine the adequacy level (calories and protein) in meeting recommended daily allowances (RDA).

(c) To determine the contribution of the school lunch-time meal to RDA.

(d) To compare the dietary intakes and adequacy of the two groups of children.

4. To establish the difference, if any, between the nutritional status of children participating in the school feeding programme and non-participating children.

(a) To determine nutritional status of the children using anthropometric indicators.

(b) To compare the nutritional status of the children in the two groups.

1.3 Hypotheses

The following hypotheses will be tested;

1. There is no significant difference in wasting (current nutritional status) between school children participating in a feeding programme and those not in the programme.

2. The caloric adequacy level is not significantly different in the two groups of children.

3. The protein adequacy level is not significantly different in the two groups of children.

1.4 Potential Benefits of the Study

The findings of this research are expected to be of use to;

a. The Ministry of Education and education planners to base their policies which potentially influence children's nutrition.

b. The community concerned as it will highlight the factors that influence the nutritional status and ultimately the academic performance of their children in school.

c. Other researchers as it will provide baseline data for future

studies on school children in Kenya.

d.   Interested groups such as Non-Governmental Organizations
       (NGOs) who are involved in nutritional intervention
       programmes.

CHAPTER TWO

BACKGROUND RESEARCH

2.1 Introduction

It is important to assess the nutritional status of school children as a way of identifying nutritional problems and means of alleviating those that might come to light as a result of such investigations. Past experience has shown that many intervention strategies such as school feeding programmes are not usually based on policies founded on information derived from research findings. It has been noted that this has often resulted in disappointing results in terms of cost, effectiveness and magnitude of intervention impact (Payne, 1986).

Furthermore, studies having established a relationship between the nutritional status and learning ability of school children, the next step should be to assess the nutritional status of the children. Since the ultimate aim of research work is the alleviation of problems facing the community, this study has identified school meals as a way of alleviating nutritional problems of school children. But before embarking on such an intervention on a large scale, the nutritional importance of school meals must be assessed in order to justify the intervention.

2.2 School Feeding Programmes in Kenya

There are a number of school feeding programmes (SFP) in Kenya and their nature depends mainly on the type of school and to a lesser extent the geographical location of the school in the country.

2.2.1 The World Food Programme-Sponsored School Feeding Programme

The Government of Kenya/World Food Programme (GoK/WFP) school feeding programme was introduced in 1981. It covers the districts in arid and semi-arid areas (ASAL) as well as divisions of the less arid and low potential areas in which food production is low. These areas have food deficits, are economically poor and have school enrolment levels that are below the national average of 87%. During the first school term of 1995, the programme covered 19 districts in Rift Valley, Coast, North Eastern and Eastern (which included Nyambene district) provinces with a total enrolment of 360,000 children.

The feeding programme diet consists of maize, beans and vegetable oil. These are used for preparing mid-day meals in pre-primary and primary schools. The programme is meant to provide each child with a mid-day meal consisting of maize (in Nyambene district yellow maize), beans and vegetable oil in the following quantities; 150g of maize, 40g of beans and 15g of oil (see Section 4.3.3 for nutrient content). The parents and the school community are encouraged to provide vegetables or any other foods available in

the community to supplement lacking nutrients, for example fruits and vegetables to supply vitamins and minerals.

The programme is viewed as a practical and positive means of achieving realistic and measurable education objectives. As a support service, it is used as a means of promoting education in the disadvantaged districts by addressing one of the most important needs in life which is food.

As this programme relies heavily on transportation of food to schools in the disadvantaged areas of the country, transport problems due to the extremely rough terrains, difficult roads and long delays in vehicle repairs continue to be bottlenecks to the smooth operation of the programme. According to the WFP Country Director, 70% of WFP's development assistance to Kenya goes to the school feeding scheme, but only 60% reaches the beneficiary institutions due to poor transportation (Daily Nation, 22nd September 1995).

Budgetary constraints have also affected the project. Monitoring and evaluation of programme performance has not been carried out smoothly due to inadequacy of funds to run vehicles both at the Ministry of Education (MoED) and district headquarters. According to the WFP country director (Daily Nation, 22nd September 1995), the MoED has found it impossible to meet 50% of the internal transport, handling and storage costs as should be the case.

Since 1990, the National Cereals and Produce Board (NCPB) which supplies maize and beans has found it difficult to supply enough grains to the project due to incapacitation by drought conditions and the recent liberalization of the grain market. In fact, the future role of NCPB in the SFP is uncertain.

The SFP is presently in its second phase which will see the phasing out from the programme of the less arid districts in order to accommodate the new financial policies guiding WFP inputs all over the world. This re-targeting will put into consideration areas where enrolment, especially for girls are 70% or below. Other criteria for inclusion will be excess drop-out and repetition rates. The current programme phase terminated in July 1995, after which it has been running under an extension period up to July 1996. Its future depends on whether the donor will grant a new phase 3 which is hoped to go up to the year 2001.

A monitoring and evaluation mission for the project in 1986 after visiting 15 schools in three beneficiary districts (Turkana, Isiolo and Meru) observed that the nutritional objective of the WFP-sponsored SFP was not quantified and therefore difficult to evaluate. It pointed out that the current estimated levels of undernutrition should be stated along with the targeted reduction. This mission also found out that the project document did not explain the link between the government's goals in the education sector and the objectives of WFP's assistance through the project.

Lack of quantification and, in general, poor specification of project objectives as well as lack of a time frame within which the intended effects of food aid should be realized was another weakness of the programme (Rabeneck, 1986).

The focus of this study was on school children in a school with a lunch-time feeding programme under WFP and those in a school without a feeding programme in the same environment.

2.2.2 The National School Feeding Council of Kenya (NSFCK) school feeding programme

The NSFCK, established in 1967, was originally initiated by Oxford Famine (OXFAM) and later supported by the American Relief Everywhere (CARE). In 1986 the programme reached its maximum beneficiary level of 60,000 pre-primary and primary school children in 15 districts in Central, Eastern, Rift Valley, Western, Nyanza and Coast provinces.

Presently, the NSFCK programme operates only in four districts (Thika, Nyeri, Nyandarua and Kisumu) and the number of children being fed has dropped to about 13,000. The reasons for reduction in beneficiaries are attributed to inflation and reduced purchasing power of parents, withdrawal of donor support and the reduction in the annual grant contribution from the MoED. The administration of NSFCK programme now relies on school committees headed by school headmasters and other members of the teaching staff. The

commodities used are bought from local markets. Private and public boarding schools also have feeding programmes. In some public boarding schools, they operate with assistance from NGOs.

2.3 Malnutrition

Malnutrition has been cited as both a cause and effect of underdevelopment. Berg (1981) defined it as the pathological condition brought about by inadequacy of one or more essential nutrients that the body cannot make which are necessary for survival, growth and reproduction and for the capacity to work, learn and function in society.

PEM is ranked as the major form of malnutrition in school age children in Kenya (UNICEF, 1990; UNICEF/GoK, 1991). In Jamaica, a developing country, PEM is also ranked first among the four major deficiencies affecting school children, followed by iron deficiency anaemia, vitamin A deficiency and iodine deficiency (Van Der Vynckt, 1986). PEM predisposes children to many incidences of preventable morbidity with possible subsequent mortality (Berg, 1981).

Following a series of meetings sponsored by the United States National Academy of Sciences, it was agreed that the most common form of malnutrition is due to an overall insufficient intake of food, expressed in aggregate as insufficient intake of energy (Sigman et al, 1989). Waterlow (1992) asserts that all correct

calculations of protein requirements and intake relate to a situation in which energy requirements are met. If not, the requirement for protein, as protein, become meaningless because part of it is oxidized to provide the deficient energy, which is the body's primary requirement from food.

Evidence from animal experiments and from studies in children show that satisfactory nitrogen balance cannot be achieved if energy intakes are inadequate. Infact, nitrogen balance can be used as a measure of the fulfilment of energy needs (Waterlow, 1992). Even though proteins can serve as alternative source of energy, they are an expensive source economically, ecologically and metabolically. It follows, therefore, that even if the protein intake appears adequate for a child, it cannot be fully utilized for growth unless the energy intake also meets requirements.

Growing children need more protein of better quality than do adults. In developing countries, mainly plant proteins are consumed by the population. Generally, plant proteins (approximate biological value 40-50) are of an inferior quality to animal proteins (biological value 60-85) based on chemical scoring and net protein utilization. Nevertheless, appropriate combinations of plant proteins can give amino acid profiles comparable to those of animal origin (Muroki, 1981).

The staple diet of many communities in developing countries is

cereals and legumes. Legumes have a well-recognised deficiency of the essential sulphur-bearing amino acids, methionine and cysteine but are comparatively rich in lysine and tryptophan which are deficient in cereals. On the other hand, cereals are rich in methionine and cysteine. In a legume/cereal mixture, therefore, supplementation occurs which comes close to providing an ideal source of dietary proteins for human beings at a legume/cereal ratio of 30:70. The comparatively low levels of methionine and cysteine in legumes is in a large part offset by the higher proportions of these amino acids present in most cereals (Davidson and Passmore, 1987).

Other forms of malnutrition common in developing countries include iron deficiency anaemia and vitamin A deficiency. Deficiencies of other micronutrients, iodine, vitamin C, folate and other B-vitamins are also prevalent in some areas, but to a smaller extent than the former three.

In addition to heightened morbidity, undernutrition may adversely affect the central nervous system and may impair intellectual, psychological and neuromuscular capacity (Coursin, 1965). Impairment of the above may lead to inadequate realization of the individual's inherent potential (Dobbing, 1985). This may in turn result in slow development of the community.

2.3.1 Etiology of malnutrition

According to UNICEF (1990), the etiology of malnutrition is multifaceted. A combination of individual characteristics, family factors and macro level variables contribute to poor nutritional status. Malnutrition is directly linked to inadequate dietary intake and disease, which in turn result from interaction of many underlying factors. Inadequate maternal and child care, insufficient household food security and unhealthy environment are cited as the underlying causes of malnutrition. While inadequate food intake may be one cause, it is not necessarily the only cause, nor, in some cases even the most critical determinant of malnutrition (GoK/UNICEF, 1992).

Morbidity pattern, past nutritional status, food intake and food practices and beliefs all affect a person's current nutritional situation. Environmental factors at the community or country level can act either as barriers or as facilitators in affecting nutritional status. An unfavourable health environment caused by inadequate water, sanitation services and health care can increase the probability of infectious diseases and indirectly precipitate certain forms of malnutrition.

The nutritional status of an individual is also affected by the amount and kinds of food available in the market or on the farm, the ability of the individual's household to obtain food, the desire of the leading members of the household to obtain food which

they have access to and the use of the obtained food by the family or individual to meet nutritional needs (Kennedy and Pinstrup-Anderson, 1983).

2.4 Anthropometry as an Indicator of Nutritional Status

The nutritional status of a population can (among others) be assessed using the indicators Height-for-age (HFA), Weight-for-age (WFA), and Weight-for-height (WFH) according to the National Centre for Health Statistics (NCHS) reference values taking minus 2 standard deviations (-2SD) as the cut-off point. For comparability of information from different studies, it is advisable to report nutritional status data as Z-scores rather than percentage of reference median or percentiles (Beaton, 1993; WHO, 1995).

Generally, a Z-score above -2SD is considered to indicate a state of adequate nutrition while below -2SD indicates an inadequate nutritional state. Below -3SD Z-score is categorised as severe protein-energy malnutrition. For the purposes of this study, the children who fell below -2SD of the study indicators were considered malnourished and above -2SD as well nourished as recommended by WHO. The Z- scores have an additional advantage of having the same meaning across different ages and indicators. The three indicators HFA, WFA and WFH reflect different but interrelational aspects of nutritional status (Waterlow, 1977).

Height-for-Age is the relationship of observed height to expected

height for a specific age and sex. HFA reflects deficits in linear growth, thus the nutritional history of an individual and is also referred to as stunting. It is, therefore, interpreted as an indicator of past nutritional adequacy. A low HFA indicates chronic malnutrition which might have resulted from chronic illness and/or inadequate dietary intake, relative to body needs over a long duration, i.e. a possible chronicity of malnutrition.

Measurable growth retardation does not occur during a short period of stress or nutritional deprivation. Rather, frequent periods of acute deprivation or infection or a prolonged period of inadequate food intake may cause a child to be short in terms of his/her age, which occurs especially during the first two years of life when growth is most rapid. Although improved diet may result in an increase in height, some permanent growth retardation may occur, particularly if the period of stress or nutritional deprivation is prolonged. It is generally agreed that the prevalence of nutritional stunting is a sensitive indicator of the overall well-being of a society over time since it is not influenced by seasonality.

Weight-for-Age is the relationship of observed weight to expected weight for a specific age and sex, but does not distinguish between present and long-term malnutrition. As such, it gives a mixed reflection of both stunting and wasting (it generally measures the degree of underweight and is thus a useful measure of nutritional

progress in a community of mixed child age composition).

Weight-for-Height relates body mass to stature and is the relationship of observed weight to expected weight for a specific height and sex. Acute undernutrition, generally characterized by low WFH, is termed "wasting". Conversely, overnutrition or "obesity" is characterized by high WFH. WFH indicates the degree of wasting and is thus used to estimate acute malnutrition and the need for immediate action (WHO,1986).

2.5 Prevalence of Malnutrition among School Children

A study carried out in Papua New Guinea to assess the nutritional status of 1453 primary school children revealed that 5% of the children were wasted (Maose et al, 1988).

A comparative study on the nutritional status of urban and rural children of Kawara state, Nigeria concluded that school children in the rural areas were more at risk of protein-energy malnutrition (Ebomoyi, 1986).

Another study done in the health district of Cusco-Peru on children under the age of 10 years described a significant decline in nutritional status with age (Wolf, 1985).

A Tanzanian survey of primary school children aged 8-18 years in eight regions in the mainland found out that boys were more

malnourished than girls. This might probably be because the African culture dictates that the place for women (and by extension young girls) is the kitchen which places the girls at a nutritional advantage compared to boys in terms of food intake. Stunting was found to progressively increase with age (Kimati and Scrimshaw, 1985).

A nutritional survey among 8 million primary school children in the Philippines showed that 3% were severely underweight, 21% moderately underweight, and 35% mildly underweight (Florencial, 1991).

A study done in Embu, Kenya on school children aged 7-9 years by Sigman et al (1989) showed that 25% were stunted. The males and females in the sample were not different in terms of stunting or underweight. The same study found out that the primary school children consumed less calories on the average than those recommended by FAO/WHO/UNU committee of 1985. Sixty-five per cent of the boys and 73% of the girls had daily caloric intakes below the recommended levels. Over 90% of the protein came from plant sources.

A CBS survey carried out by teachers on school children aged 7-9 years in Kitui and Kwale districts of Kenya in 1991 found out that malnutrition was consistently higher in boys than in girls. In Kitui, 6% of the surveyed children were severely stunted and 18%

moderately stunted. In Kwale, 7% of the children were severely stunted and a further 19% moderately stunted (CBS, 1991).

Another study done in Samburu by Kielmann et al (1988) showed a high prevalence of wasting among school age children (5-15 years) which was 30% below 80% of the standard. The data showed a decline in nutritional status with increasing age. Whereas 7% of the pre-school age children were below 80% of the median reference population, this increased to 35% for school age children.

2.6 Morbidity Prevalence in Kenyan School Children

It was found out in Embu District that upper respiratory infection (URI) was the main illness in primary school children, which was found to affect 30.5% of the boys and 26.2% of the girls (Neumann and Bwibo, 1987). Infectious diseases have a synergistic relationship with nutrition whereby the presence of one predisposes the other, the combination of the two with a more profound effect than the sum of the two. Infections may adversely affect growth by reducing appetite and thus food intake, decreasing nutrient absorption, increasing metabolic requirements, or causing direct nutrient loss (WHO, 1995). Infections have been reported to be an important cause of school absenteeism (GoK/UNESCO, 1991).

Parasitic infections are causes of significant levels of morbidity among school-age populations. Intestinal parasites contribute to the causation of protein-energy malnutrition and iron deficiency

anaemia; conditions which are known to have adverse effects on learning. The chronicity of parasitic worm infections, for example, and the insidious nature of their health and developmental effects, especially during the school period when children are undergoing rapid physical, mental and intellectual development, has led to gross underestimation of their importance in both health and education. (GoK/UNESCO, 1991).

Experimental studies on iron deficiency anaemia and school performance have consistently reported poor performance (in a wide range of achievement tests) among iron deficient anaemic children. Vitamin A deficiency can impair the visual system resulting in "night blindness" and if severe, in blindness. It also diminishes the body's capabilities to cope with infections and may retard growth and lower productivity (GoK/UNESCO, 1991).

Other common health problems which may affect school children, attendance and classroom behaviour include skin and eye infections such as scabies, ringworm and conjunctivitis which are easily transmitted in crowded classrooms (GoK/UNESCO, 1991).

2.7 School Feeding Programmes and Nutritional Status of Children

A research conducted in Mafraq area, Jordan to assess the impact of school feeding programmes on the nutritional status of primary school children aged 7-15 years showed that weight and mid-upper-arm circumference values were significantly and generally higher

for children participating in the programme than out of programme children. This was so especially among females and younger age groups, who are more sensitive to nutritional changes. Height retardation was common in the programme area and could indicate the presence of past or chronic malnutrition. But the programme, being less than one year, was difficult to draw precise and definite conclusions from the data collected (Hijazi and Abdulatif, 1986).

Studies carried out in Baroda-India, have shown that a good school lunch designed to remove deficiencies in the home diet and based on locally available foods can result in a significant improvement in the nutritional status of school children as judged by weight gain and biochemical status (Rajalakshmi, 1967). Several other researches carried out in South India have reported that a well balanced diet supplement provided at school resulted in statistically significant increase in weight and height, in school attendance, and in classroom performance.

An investigator in Madhaya Pradesh State of Central India indicated that supplementary food eaten on a regular basis had a positive impact on the nutritional status of school children (Rewal and CARE, 1983).

A study carried out in Kirinyaga district of Kenya to evaluate the effect of a school feeding programme under the National School Feeding Council of Kenya (ten years after its inception) on the

growth of school children aged 7-11 years showed that children in the school lunch group were heavier and taller than in the control group (Pieters et al, 1977).

2.8 School Attendance, Enrolment, Performance and Wastage

Effects of nutrition and health during early years of life are potentially capable of having long-term consequences on a child's formal education. Poor nutrition and health conditions during the school period add to the developmental consequences of earlier malnutrition. Better nutritional history and better present nutritional status are consistently associated with higher cognitive scores or better school performance (Pollit, 1990). Good nutrition brings about enjoyment and mental energy, which are important prerequisites to school achievement (Akinadewo, 1981).

In the Philippines, children with good nutritional status were found better able to concentrate in school and scored significantly higher on mental achievement tests. A significant positive correlation was found between academic achievement and nutritional status even after controlling for effects relevant to school, teachers, household and pupil-related variables. In the developing world, undernutrition resulting from protein energy malnutrition is the foremost nutritional deficiency often resulting from deficient diets which can be exacerbated by parasitic infection, micronutrient deficiencies and, most always, poverty. The evidence is unequivocal in demonstrating that short stature in school

children, a product largely resulting from growth retardation in early childhood combined with environmental factors related to poverty is an indicator of risk of poor school performance. Consistency in findings from numerous studies suggests that growth retardation and present poor nutritional status of school children can be indicators of school participation (Levinger, 1986).

A study done in Tamil Nadu, a South Indian village suggests that increased nutrition, as a result of school feeding programmes helps retain the children in the schools (Babu and Hallam, 1989). Evaluation of the school lunch programme by Roy and Rath (1970) in Orisa, India and Cotten (1982) in Haiti suggest a positive relationship between SFP, attendance and enrolment. Both studies found that school attendance and enrolment was higher in schools with a feeding programme than those without.

A Sri-lankan study, however, showed that attendance rates in non-SFP schools was higher than for SFP schools. It was suggested that many of the non-SFP schools had been deliberately excluded because their students had a relatively high level of nutritional well being (Miller, 1982). A study on school feeding in Karnataka, India by CARE (1977) found that schools not participating in the feeding programme had higher recorded enrolments. This was attributed to poor supply of food commodities which did not attract children into the SFP schools. The study suggested that efficiency of delivery must be at least 80% for gains to be achieved.

Adequate nutrition and health increase the ability of children to learn. Analysis of four Guatemalan villages indicates that protein-enriched food supplements delivered in childhood significantly improved scores on educational achievement tests administered ten years later (World bank, 1995).

A study carried out in Mexico showed that sub-optimal nutrition and unfavourable home environment were both important factors in low school achievement (Noriega et al, 1990).

A study done in Embu, Kenya showed that school children (7-9 years) who were better nourished scored higher in verbal comprehension and matching tests (Sigman et al, 1989).

The WFP school feeding programme has been reported to have led to increased and stabilized school enrolment and maintained attendance in some beneficiary districts in Kenya (UN/WFP, 1992).

From the foregoing, educational policy-making must protect children's nutritional status by among other things making provisions for nutritious foods at school, especially in arid and semi-arid areas with food deficits. Mobilization of parents and the school community to support such an intervention would be very necessary together with the setting up of school gardens to grow crops for use in the feeding programmes to ensure sustainability. (Van Der Vynckt, 1986).

2.9   Gaps in Knowledge

School feeding programmes have two objectives to the beneficiary children: nutritional and educational. A number of studies have shown school feeding programmes to have a positive effect on scholastic performance and/or cognitive development. In addition they have been shown to improve school enrolment and increased school performance (Levinger, 1986; Pollit, 1990).

Studies on the WFP-sponsored SFP in Kenya have been undertaken as an evaluation of the management and operations of the food distribution and have merely included impressions on the nutritional impact of the programme on the beneficiaries. Accordingly, the programme's nutritional impact has not yet been evaluated (WHO/FAO, 1992).

CHAPTER THREE

STUDY SITE AND METHODOLOGY

3.1 The Study Site

The study was conducted in Antuambui location (Appendix 10) of Laare division in Nyambene district, Kenya, which lies to the north-eastern region of the former giant Meru district, from which it was carved off in 1993. Nyambene district is one of the eleven districts in the Eastern Province of Kenya. With an area of 12,000 square km, it boarders Meru district to the west, Tharaka-Nithi district to the south, and Isiolo district to the north and east. Antuambui location covers 181 square km of the Laare division's 1112 square km, has a population of 18,864 people and a population density of 104 persons per square kilometre. The location has 3,542 households (CBS, 1989).

3.1.1 Topography, Geology and Climate

The most striking physical feature in the district is the Nyambene ranges which rise sharply above the surrounding plateau. The summit is to the south where the peak - Itiene, reaches 2,514 metres above sea level. The slopes of the Nyambene are steep with low crests which flow onto the basement complex, with their profile gradually flattening and lateral erosion becoming predominant. This greatly compromises soil conservation efforts in the district. The plains that dominate the district are composed of volcanic Nyambene lava. High rainfall on the eastern slopes provides plenty of surface

water but in the north (where the study area is located) and north-east, a porous bedrock allows much of the water to flow beneath the surface which leads to water shortage. The Catholic Diocese of Meru has provided water in market centres and in the rural areas, people buy the water at a cost of 2 shillings per 20-litre jerrycan at piped water points. During the dry seasons, many people have to walk long distances of up to 15 km in search of water. The rainfall pattern is bi-modal. The long rains are in mid-March to May and short rains in October to December. The wettest months are from October to December and the driest January, February and August. A big part of the district (which includes the study area), is semi-arid with unreliable rainfall. The reduced rainfall coupled with its unreliability together with low altitude and high temperatures renders these marginal or semi-arid parts of the district difficult for agriculture (GoK, 1994).

3.1.2 Agriculture

Nyambene's paradoxical wealth is derived from the sale of *khat or miraa*, as it is known locally. Statistics from 1992 indicate that *miraa* is the most important cash crop in this district. *Miraa* covers 5,200 hectares around Maua Hills which includes Tigania, Ntonyiri, Laare and Antubetwe divisions. In Laare division, *miraa* covers approximately 1000 hectares (Ministry of Agriculture and Livestock Marketing (MALM) - Laare Divisional Office, 1995.)

The main food crops grown are maize, bananas, potatoes, sorghum,

millet and beans. With the emergence of horticulture, the growing of french beans, cabbages and tomatoes is slowly picking up. Such crops, however, are principally grown for sale and their farming is hampered by insufficient supply of water in the region. The district is not self-sufficient in food and, consequently, has to rely heavily on supplies from outside. Livestock farming is mainly practised for sale (MALM-District Office, 1995).

Despite high earnings from *miraa*, there is a consensus from many quarters that the money obtained is of limited benefit women and children and, therefore, does not contribute, as would be expected, to household food security, and consequently to the well being of women and children. *Miraa* is strictly a man's business most men make merry with the proceeds from it in towns and shopping centres. A community welfare programme involving men, e.g. family life training could help divert some of this money for use in the households.

3.1.3 Education

At the time of conducting the study, the district had 293 pre-primary, 304 primary and 36 secondary schools. Eleven schools had WFP-sponsored school feeding programmes in three feeding zones namely, Igembe South (5 schools), Igembe North (4 schools) and Central Laare (3 schools). There were five primary schools and one secondary school in Antuambui location, the study area.

The district has an illiteracy rate exceeding 60% (the National female illiteracy rate is 60% and that of males 31% according to GoK/UNESCO, 1991). The 1987 CBS survey also reveals that males in Kenya have a higher literacy rate than females. Examination performance in the district is poor and many young children drop out of school between classes five and eight. Boys mainly do so to engage in full time harvesting, sorting and packing of *miraa*, which earns them up to Ksh.200/day. According to the District Education Officer (DEO), *miraa* accounts for over 40% school drop out rate. Circumcision of girls, early pregnancies and marriage are the major factors that affect girls' education.

Inability of parents to meet the cost-sharing obligations, poor health and nutrition as well as lack of health education opportunities due to inadequate health education staff and facilities are also related to school wastage in Nyambene district (GoK/UNESCO, 1991). The National school drop out rate is estimated at 45% for boys and 65% for girls.

The World Food Programme is involved in feeding programmes in three primary schools in Antuambui location. The three primary schools (Linjoka, Lukununu and Mea) that are next to the northern grazing area (which borders Isiolo district) were selected in Laare division by the District Development Committee in collaboration with Ministry of Education officials to participate in the WFP feeding programme.

The Catholic Mission has set up a number of boarding schools in the district in which children are provided with meals. Many parents, however, cannot afford to take their children to these mission schools due to the high costs. Some Catholic Mission schools are half-day for lower classes and full-boarding for upper classes, while others are full-boarding. Plan International works in partnership with the community to achieve community development in the sector of education, among others. It has constructed a number of primary schools and funds are generated through foster parents to sponsor the education of children from poor families up to the age of 12 years.

3.1.4 Health Facilities

Nyambene district has a total of 40 health facilities. Of these, one is a Catholic Mission hospital, 2 are health centres, 36 are dispensaries and one is a nursing home.

In Laare division there is one Government health centre with maternity, and one Catholic Mission dispensary and five private dispensaries. There are 10 market centres in the division.

3.1.5 Roads

The roads in the district are very poor. Apart from the main road from Meru town to Maua town, all the others are earth roads which become impassable during the rainy season. Some areas, including the study area, become inaccessible during the rainy season.

3.2 The Study Design

A cross-sectional survey of descriptive and analytical nature was carried out. Methods of data collection included home and school visits. Home visits were made to collect households' and children's characteristics data which included demography, food sources and expenditure, income sources, child morbidity, food frequencies, and dietary caloric and protein availability and intakes for households and children, respectively. Visits were made to the schools to collect children's data on anthropometry, school attendance and the dietary intake from lunch (for children in the feeding programme school).

3.2.1 The Study Population and Sample Size

The study population consisted of Nyambene people of the Meru ethnic group living in the Laare area of the district. The sampling frame was all the children aged 5-10 years (and their respective households) in two public day-primary schools: one with a WFP-sponsored lunch time meal and another one without a lunch programme. Hereafter, these study groups are identified as Group A which comprised children participating in the school feeding programme and Group B comprising of children not participating in a school feeding programme.

The sample size was calculated using a formula appropriate for comparative studies (Fisher et al., 1991):

$$n = 2Z^2 pq \ / \ d^2$$

where:

n = sample size to be selected from each population (or school).

z = 1.96 (standard normal deviate; usually set at 1.96 which corresponds to the 95% confidence level at required alpha level of 0.05).

p = 0.3 (22.3 % was the proportion of stunted children under five years in Meru District - (CBS, 1987). That of the "older children" was assumed higher (30%) because stunting increases with age. This had the additional advantage of increasing the study sample size.

q = 1-p =0.7 (proportion of children expected to be well-nourished in Meru District).

d = 0.1 (the difference P1 and P2 expected between the two populations to cause a significant difference i.e. the approximate test difference in malnutrition between the two samples which is significant at an alpha level of 0.05).

Inserting these values in the formula,

$$n1 = n2 = \frac{2(1.96)^2 \times 0.3 \times 0.7}{(0.1)^2}$$

= 161 children per school.

Allowing for 5% attrition rate = 169 children per school.

3.2.2 Sampling Method

The sampling procedure was as follows:

i)   Random selection of 1 district out of 19 with WFP school feeding programmes in Kenya.

The selected district was Nyambene.

ii) Random selection of 1 out of 3 feeding zones (Igembe South, Igembe North and Central Laare) in the district.

The selected zone was Central Laare.

iii) Random selection of 1 school out of the 3 (Mea, Lukununu and Linjoka) with a WFP-sponsored feeding programme in the zone. The selected school was Lukununu.

iv) Purposive selection of the nearest non-programme school with all other characteristics similar to the programme school. This was to facilitate data collection considering limitation of funds and time.

The selected school was Mwerongundu.

v)   Registration of all children aged 5-10 years in each school (children in the feeding programme school must have undergone pre-primary education in the same school).

vi) Random selection of 169 children between ages 5-10 years from each school. Selection of a child into the study population automatically selected the households to be visited.

vii) Systematic random selection of a subsample of 62 children from each school for dietary intake assessment. From a list of 169 children per group a sampling interval of 3 was used after randomly selecting the starting point. This number represented

one third of children from each group and was more than the minimum sample (50 subjects) that is recommended for comparative statistical analysis (Fisher et al., 1991). Selection of a child into the subsample automatically selected households to participate in dietary assessment.

Lukununu primary school had a feeding programme sponsored by the World Food programme where all the children were provided with a lunch time meal. Children in Mwerongundu primary school did not take any meal in school, therefore, had to go to their respective homes for lunch. Respondents to the structured questionnaire were mothers of the school children in the sample as well as the cook in the programme school. Teachers in both schools assisted to organise the pupils for anthropometric measurements and also provided information on school attendance by the pupils at the end of the term.

In order to zero in on the school children aged 5-10 years in the two schools, the children were issued with forms bearing their names (from the school registers) to take home and fill in their fathers' names, villages and their dates of birth (Appendix 6). The forms were collected by class teachers and handed over to the chief investigator who calculated their ages. All the children aged 5-10 years were listed down to come up with the sampling frame from which the study children were randomly picked. The dates of birth were verified by asking the mothers to show clinic attendance cards

during home visits. For the few who could not produce the cards, the school enrolment register was used for verification. The selected children's age distribution is shown in Table 3.

3.3 Field Study Instruments

3.3.1 Questionnaire

A structured questionnaire (Appendix 9) consisting of questions on demography, parental education, income sources, food sources and expenditure, child morbidity experience, food frequency, dietary intake, anthropometry and school attendance (as per the daily attendance registers at the end of the term) for the school children was used. The questionnaire was administered to mothers of the children because according to the Meru custom, men do not participate in meal preparation and could not accurately answer questions on dietary intakes.

Teachers responded to questions on children's school attendance. Pupils were respondents to anthropometric data. The dietary part of the questionnaire was administered to a sub-sample of 62 households and school children from each of the two groups. For the children in the school with a feeding programme, dietary intake assessment was also carried out in the school to determine caloric and protein intakes during lunch.

3.3.2 Anthropometric Measurements

The researcher carried out all the anthropometric measurements with the help of one assistant. The procedures followed are as described by WHO (1995) in measuring weight and height.

A 100kg capacity bathroom scale with increments of 100g, which was calibrated every morning at Laare Market with a one-kilogramme stone, was used to measure weight. Before weighing each child, the scale was set at zero on a flat surface. Then the lightly dressed child was made to stand on the scale and weight was recorded to the nearest 0.1kg. Two such readings were taken for each child to arrive at an average weight for the child.

A vertical measuring rod reading a maximum of 175 centimetres and capable of measuring to an accuracy of 0.1cm was used to take the children's stature or height. The children were made to stand barefooted on the flat board with their hands hanging loosely at the sides with feet parallel and with heels, buttocks, shoulders and back of the head touching the upright scale. Then the child's head was held comfortably erect, with the lower border of the orbit of the eye in the same horizontal plane as the external canal of the ear. The headpiece of the measuring device was then lowered gently, crushing the hair and making contact with the top of the head. The child's height was then read to the nearest 0.1cm. Two readings for each child were made to obtain the average height of the child.

3.3.3 Food Intake Measurement

Measuring cylinders graduated in millilitres of capacities 1000 ml, 500 ml and 100 ml were used in obtaining food volumes in the 24-hour dietary recall for households and study children. The volume of food prepared for the whole household and that consumed by the index child were measured. The proportion of the household meal consumed by the child was obtained by dividing the volume of food consumed by the child by that of the whole household. The respondents were asked to show the amounts of each ingredient used to prepare the meal using household measures and food models. A kitchen food scale was used to weigh foods in the area to facilitate the conversion of household food measures to grams. The amount of each ingredient consumed by the child was calculated by multiplying the proportion of the household meal consumed by the child by the amount of ingredient contained in the household meal. Then WHO (1987) food composition tables were used to calculate the amount of calories and protein derived from all the ingredients ingested by the index child.

3.4 Training Interviewers

The chief investigator was assisted by two enumerators; both successful form four school leavers who were waiting to join the university. Both were from the study area and were therefore, familiar with the respondents. They were intensively trained on interpretation of the questionnaire into the local language, methods of interaction with the respondents, interviewing

techniques and in assisting the researcher to collect data on anthropometry. This training continued during pre-testing of the study tools. The assistants throughout the data collection period were closely supervised by the researcher. When the actual survey began and they were proved conversant with the interviewing procedure, they were allowed to carry out on their own.

3.5 Data Collection

3.5.1 Interviewing Procedure

The chief investigator first visited the offices of the district commissioner and education officer, both of whom gave the greenlight for the study to be carried out. In the company of the local chief, assistant chief and the headmaster, a meeting was held in each school during which the parents were informed of the research and requested to assist the interviewers by volunteering the required information. Children were then sent home with identification forms (Appendix 6). The forms were later collected by class teachers and handed over to the chief investigator who calculated their ages. Subsequently, a sampling frame, from which to select the children and households to participate in the study, was developed.

3.5.2 Dietary Assessment

Household food frequency (an estimate of how often various types of food and drinks are ingested) in a week was carried out by asking the respondents the types of food they ate and how often they ate

them. Dietary assessment was conducted at two levels: at home and at school (for the group of children in the programme school). The dietary caloric and protein availability to the whole household and the actual intake by children at home was assessed using the 24-hour recall method. Household per capita nutrient availability excluded any food taken outside the home by any member. An interview was used to find out the nutrient availability to household members and the actual nutrient intake at the individual level for index children during the preceding 24 hours with food quantities being assessed using household measures and food models as described by Cameron and Van Staveren (1988).

The 24-hour recall method is suitable for assessing the average usual intakes of a large population, provided that the sample is truly representative and that the days of the week are adequately represented. The method is inexpensive, easy and quick with low respondent burden so that compliance is high. It was the most suitable method since most of the respondents were illiterate. The element of surprise (as suggested by Simko et al, 1984), made it less likely for respondents to modify their eating patterns during the interview.

The 24-hour recall method has been reported as a valid method for conducting dietary recalls in some studies while others have reported the opposite. Amanda et al., (1995) found out in an Australian Aborigin community that the method tended to produce

higher mean values for intake of most nutrients and there was evidence of selective recall of certain foods in comparison with other methods (weighed dietary intake, food frequency, diet history and the 'store-turnover').

In this study, thorough training and close supervision of field assistants during pre-testing, early stages of the actual survey and daily checking of consistency and completeness of questionnaires by the chief investigator helped to ensure validity of the 24-hour dietary recall. A single 24-hour recall is recommended as adequate in a group of people sharing many characteristics such as ethnicity sex, household roles and when the same enumerators are involved in the assessment. In this study, only mothers of the index children were interviewed. According to Beaton et al., (1979), it is preferable in some cases to use a single interview if the sample size is big enough and truly representative of the population and when repeated interviews may bring about respondent burden. In the study area, the use of repeated 24-hour recalls would have been unsuitable due to time and financial limitations because dietary assessment was carried out only during the school days when the school feeding programme was operational. Moreover, the use of water to measure food volumes limited the use of repeated recalls because the area is an ASAL where people fetch water from far and have to pay for it as already mentioned in Section 3.1.1.

Dietary assessment for children taking lunch at school was made by visiting the school. Observed weighed record technique was used to assess the caloric and protein intake of the programme group of children in school immediately before consumption (Cameron and Van Staveren, 1988). The volumes of the food portions served and consumed by the children were measured. Then the proportion of the ingredients consumed were obtained by dividing the volume of food consumed by the child by the total volume of food prepared for all the children. These proportions were multiplied by the amount of ingredients contained in the school meal to arrive at the amount of ingredient ingested by the child. Subsequently, household caloric and protein availability and the actual nutrient intake by the children was calculated using the WHO (1987) food composition tables (Appendix 7).

3.5.3 Child Age Determination

More than 95% of the parents were able to produce clinic attendance cards which were used to ascertain the age of the study children during home visits since they showed birth dates of the children. For those who could not produce the cards, the dates they gave were counter checked with the ones in the school enrolment registers to verify their validity. It was, therefore, possible to determine the ages of the children accurately.

3.5.4 Research Activities

In December 1994, the principal investigator obtained a research permit and the study objectives and methodology were communicated through the local authorities to the community in early January 1995. The pilot study followed shortly and the actual data collection started late the same month.

Pre-testing of the study tools was carried out in Ntunene location which neighbours the study location, Antuambui. A total of 32 school children from Murungene primary school and théir respective households were pre-tested on. The two locations were similar in all respects. The results of the pilot study were then used to adjust the original questionnaire with consultation with my University advisors, after which necessary modification was made. Major changes were made in demography and income sections.

General information about the study area was collected from the MOH, DEO, MALM, NSFCK, MoED, Plan International District Office, and Diocese of Meru Office.

3.6 Data Entry, Cleaning, Processing and Analysis

Over the duration of the field study, the questionnaires completed each day were checked by the chief investigator for completeness of data, clarity of entry and consistency of answers. The data were entered and analyzed at the Applied Human Nutrition Unit (ANP) computer room, Upper Kabete campus, University of Nairobi, using

the programmes named below;

a. The data was entered and cleaned in the Dbase III+ software.

b. The anthro programme was used to convert raw anthropometric data (weight and height) into nutritional indicators and compare them with the National Centre for Health Statistics (NCHS) reference figures as designed by WHO (1983) and Hamil (1979).

c. The Statistical Package for Social Scientists (SPSS) was used for data analysis.

3.6.1 General Characteristics of Study Population

Frequencies, t-tests and chi-squares were used to give percentages, means and standard deviations in the descriptive analysis and presentation of general household and child characteristics.

3.6.2 Nutritional Status

Anthropometric indicators were used to assess the nutritional status of the study children. Height-for-age (HFA) expressed the height of the child as a percentage of the expected height for a standard child of that age. Weight-for-age (WFA) expressed the weight of the child as a percentage of the expected weight for a standard child of that age. Weight-for-height expressed the weight of the child as a percentage of the expected weight for a standard child of that height as given by the NCHS.

By use of the anthro package, Z scores were generated, and the

anthropometric indicators (HFA, WFA and WFH) were used to classify the school children into categories of nutritional status. Comparison of the nutritional status of the children in the two groups, i.e. feeding programme and non-feeding programme was done using chi-square and t-test.

In order to investigate the association of age and sex to the anthropometric results, cross-tabulation and chi-square testing were done by study group and for the two groups of children pooled together.

3.6.3 Food Sources and Food Frequency

The respondents were asked to state the main source of six major foods in their households during the 6 month period prior to the survey. The responses, which were either 1 (for own production) or 2 (for purchase) were scored on a scale of 0-1. From this, the number and the proportion of households who either relied more on own production or market as the main source of the six foods was established. Then chi-square test was used to compare the households in which the children were in the programme with those whose children were out of programme.

The respondents were asked to state the number of times various types of food were consumed in their households in a period of seven days. This was then used to get weekly food frequency. T-test was then administered to compare the two groups of households.

3.6.4 Dietary Intakes

The 24-hour dietary recall method was used for dietary assessment for a subsample of 124 households and school children (62 from each study group). The number of household members who took each meal was used to calculate the per capita caloric and protein availability for the households during each meal. T-test was then used to compare the two groups of households.

The school children's dietary intakes were also conducted using the same method, with intake in the presence of the lunch programme in school. The caloric and protein intakes during each meal were then compared for the programme and non-programme children. The children's caloric and protein intakes were used to calculate the dietary adequacy of the children based on their RDA from the WHO (1987) food composition tables (Appendix 8) using t-test. Comparisons of the contribution of different meals to caloric and protein adequacy for the children in the same study group was carried out using paired t-tests.

The percentage contribution of different types of food (cereals, legumes, roots and tubers, fruits and vegetables, livestock products and fats and oils) to the children's caloric and protein intakes was computed. Then comparisons were made in the two groups using t-test.

3.6.5 Child Morbidity

The number of children who were reported by their mothers to have been sick and suffering from various types of illness in each area of study was used to compare morbidity experience using the chi-square test. T-test was administered to compare school attendance which was based on the number of days a child was absent from school as per the daily school attendance registers at the end of the term in the two schools.

3.6.6 Correlation Analysis

The pearson correlation of independent variables with specific nutrition indicators as the dependent variables was done to identify factors which potentially influence the nutritional status of school children in the two areas of study (significant correlation coefficients, however, do not automatically imply causal relationships).

CHAPTER FOUR

RESULTS

4.1 Introduction

This chapter depicts both the descriptive and analytical results of this study in which nutritional status and dietary adequacy of two groups of children were compared. The first (Group A) comprised primary school children in a school with a feeding programme and the second (Group B) of children without a programme. For the purposes of this study, it was necessary to compare demographic, socio-economic as well as factors that have the potential to influence child growth between the two groups. Hereafter, the term Group A (or programme group) will be used to refer to the group participating in the school feeding programme and Group B (or non-programme or out of programme group) to non-participants.

4.2 General Characteristics of the Study Households and Children

The general characteristics of the population are shown in Table 1. The total population in the 325 sampled households was 2,694. The population of the sampled 162 households whose children participated in the feeding programme was 1,335 while that of the 163 households whose children did not participate in the feeding programme was 1,359. The male/female sex ratio in both areas was 1:1. Out of the selected general characteristics, the study groups were similar in terms of household size, dependency ratio and per capita household food expenditure.

slightly more than half of the population (57.4% in the programme group and 55.8% in the non-programme group) of households was below 15 years and above 65 years of age. Hence, the dependency ratio in the programme group, i.e. 1.2:1 was slightly higher than in non-programme group which was 1.0:1. The mean age of fathers of children in Group A (44.3 ±9.4 years) was significantly higher than that of fathers of children in Group B (p<0.01) which was 41.6 ±8.1 years. Similarly, the mean age of mothers of Group A children (35.3 ±7.2 years) was significantly higher than that of mothers of Group B children which was 32.7 ±6.4 years (p<0.005).

The education level of parents of the study children (as measured by number of years they spent in school) was generally low and the results show that male parents had on the average spent more years in school than female parents in the two groups. Fathers of children in Group B had spent significantly more (p<0.005) years in school (4.0 ±4.3) than the fathers of children in Group A who had spent 2.7 ±3.5 years (i.e. 2/3 the period). Likewise, mothers of Group B children had spent significantly more (2.3 ±3.4 years) in school while the mothers of Group A children had spent 1.7 ±2.8 years in school (p<0.05).

Table 1:   Demographic Characteristics of the Study Population

Characteristic	In programme N=162		Out of programme N=163		T Value
Av. h/hold size	8.2	±2.6	8.3	±2.5	-0.3
Av. dependency ratio	1.2:1	±0.7	1.0:1	±0.6	1.6
Av. fathers' age in yrs	44.3	±9.4*	41.6	±8.1	2.7
Av. mothers' age in yrs	35.5	±7.2*	32.7	±6.4	3.4
Av. fathers' educ in yrs	2.7	±3.5	4.0	±4.3*	-3.1
Av. mothers' educ in yrs	1.7	±2.8	2.3	±3.4*	-1.8

Av = Average.

h/hold = household.

± standard deviation.

* t-test significance at $p < 0.05$

As is evident from Appendix 1, more fathers and mothers of children in Group B attended school and to higher levels than the fathers and mothers of children in Group A. Despite being similar in terms of household size and dependency ratio, the households of Group B children had on the average more children in primary, secondary and tertiary levels of education than those of Group A. The mean number of children in secondary schools in the non-programme group of households (0.3 ±0.7) was significantly higher ($p < 0.005$) than that of those in the programme (which was 0.1 ±0.4 children) (i.e. about three times).

Table 2 shows the distribution of households according to various sources of income ranked in order of importance in both programme and non-programme households. The main source of income was *Miraa*

which was reported by practically the same proportion of households in both groups (i.e. 59.9 and 60.7% in the programme and non-programme groups, respectively). The second most important source of income was business which was also reported by almost equal numbers in both groups (i.e. 23.5 and 21.5% of the households in the programme and non-programme groups, respectively). Casual employment was the third most important source of income and was slightly higher for the parents of programme children (6.8%) than those of non-programme children which was 4.9%. Permanent employment and sale of animals and their products were fourth and last (fifth) and were practised by very small numbers i.e. 2.5 and 6.7%, and 3.1 and 0.6% for the programme and non-programme parents, respectively.

Table 2:   Distribution of Households by Income Source and Food
           Expenditure

Income source/food expenditure	In prog. N=162	Out of prog. N=163	Total N=325
Miraa	97 (59.9)+	99 (60.7)	196 (60.3)
Business	38 (23.4)	35 (21.5)	73 (22.5)
Casual employment	11 (6.8)	8 (4.9)	19 (5.8)
Sale of food crops	7 (4.3)	9 (5.5)	16 (4.9)
Permanent employment	4 (2.5)	11 (6.7)	15 (4.6)
Sale of animals/products	5 (3.1)	1 (0.6)	6 (1.8)
Av.PC h/h food exp.(shs)	45.6 ±37.2	52.2 ±42.6	t = -1.5

+ Figures in parenthesis percentages.
PC h/h food exp. = per capita household food expenditure.
t = t-test value.

The distribution of the children by sex and age by study group was as shown in Table 3. The mean age of the children was practically the same for both groups, i.e. 8.2 ±1.2 years for programme children and 8.3 ±1.2 years for non-programme children.

Absenteeism of children in the programme school (8.6 ±7.5 days per term) was significantly higher (p<0.001) than that of children in the non-programme school which was 3.1 ± 3.9 days.

Table 3: Distribution of Study Children by Age and School Absenteeism

| Age group | Number of children | | | | | |
| | In programme | | | Out of programme | | |
	Males	Females	%	Males	Females	%
5-6 years	17	19	22.2	14	15	17.8
7-8 years	31	43	45.7	32	42	45.4
9-10 years	22	30	32.1	28	32	36.8
Total	70	92	100.0	74	89	100.0
Av.age (yrs)	8.2 ±1.2			8.3 ±1.2		
Av.sc.abs.	8.6 ±7.5			3.1 ±3.9		

Av.sc.abs. = Average days school absent

The proportion of children who were reported to have been ill within the seven days prior to the survey (Table 4) was practically the same (i.e. 52.5% in Group A and 52.8% in Group B). The three

main illnesses in both groups were upper respiratory infections (URI), gastrointestinal problems and skin infections. Gastrointestinal problems included diarrhoea, vomiting, stomach discomfort and pain.

Significantly more (p<0.05) children in the programme group (29%) than those in the non-programme group (17.8%) i.e. about 1.5 times suffered URI. On the other hand, significantly more (p<0.05) children out of the programme (8.6%) suffered from fever and headache compared with those in the programme group (2.5%), about 3.4 times.

Table 4: Distribution of Children by Type of Reported Illness

| Illness | Group | | X² |
	In prog. N=162	Out of prog. N=163	
URI	47 (29.0)**	29 (17.8)+	5.7
GI problems	22 (13.6)	24 (14.7)	0.1
Skin infections	10 (6.2)	13 (8.0)	0.4
Fever & headache	4 (2.5)	14 (8.6)**	5.8
Others	2 (1.2)	6 (3.7)	2.0
Total	85 (52.5)	86 (52.8)	

+ Figures in parenthesis percentages.

** x² significance at p < 0.05

others.... Ear/tooth ache and eye infections.

In the programme group, more girls (57.7%) than boys (45.6%) were reported sick. The reverse was the case for the non-programme group where more boys (54.0%) than girls (50.6%) of the girls were reported sick (Table 5). The difference, however, according to chi-square testing was not significant.

Table 5:   Distribution of Child Morbidity by Sex

Illness	In Programme		Out of Programme	
	Males N=70	Females N=92	Males N=74	Females N=89
URI	16 (22.8)+	31 (33.7)	12 (16.2)	17 (19.1)
GI problems	11 (15.7)	11 (12.0)	13 (17.6)	11 (12.4)
Skin infection	3 (4.3)	1 (1.1)	8 (10.8)	6 (6.7)
Fever&Headache	2 (2.8)	8 (8.7)	3 (4.0)	10 (11.2)
Others....	0 (0.0)	2 (2.2)	4 (5.4)	2 (2.2)
Total	32 (45.6)	53 (57.7)	40 (54.0)	46 (50.6)

Others . Ear/tooth ache, eye infections
+ figures in parenthesis percentages

4.3   Food Sources in the Study Area

The major foodstuffs, categorised as own production or purchased shows that overall, households in both groups depended more on purchased food produced outside the study area than on own production (Table 6). There were significantly more (33.1%)

(p<0.05) non-programme households that grew cereals than there were (17.9%) in the programme households. Similarly, there were significantly more non-programme households that grew vegetables and fruits, i.e. 27.6 and 18.4% respectively (p<0.001) than there were in the programme households which were respectively 5.6 and 6.2%. The non-programme households coincidentally bought less of these products. Production of legumes and livestock products was higher (though not significantly) in the programme households than in the non-programme households.

Table 6: Distribution of Households by Source of Foodstuffs

Foodstuff	Source	Households		X^2
		In prog. N=162	Out of prog. N=163	
Cereals	bought produced	133 (82.1)+ 29 (17.9)	109 (66.9) 54 (33.1)**	9.9
Roots and tubers	bought produced	137 (84.6) 25 (15.4)	126 (77.3) 37 (22.7)	2.8
Vegetables	bought Produced	153 (94.4) 9 (5.6)	118 (72.4) 45 (27.6)**	28.5
Fruits	bought produced	152 (93.8) 10 (6.2)	133 (81.6) 30 (18.4)**	11.3
Legumes	bought produced	83 (51.2) 79 (48.8)	89 (54.6) 74 (45.4)	0.4
Livestock products	bought produced	82 (50.6) 80 (49.4)	85 (52.1) 78 (47.8)	0.1

+ figures in parenthesis percentages

** x^2 significance at p < 0.05

4.3.1 Household Food Consumption Frequency

The weekly food frequency for households is presented in Table 7. Cereals were the most frequently consumed foods while roots and tubers were most infrequent. The frequency of consumption of cereals, legumes, tea with milk; fats and oils, meats and roots and tubers was practically the same for households in both groups. The consumption of vegetables in the programme group (4.8 times/week) was significantly more (p<0.001) than that of the households in the non-programme group (2.1 times/week). Likewise, the mean weekly consumption of fruits in the programme households (1.5 times/week) was significantly higher (p<0.005) than that of non-programme households (0.2 times/week).

Table 7:   Mean Weekly Household Food Consumption Frequency

Food	In programme N=162	Out of programme N=163	T value
Cereals	18.6	18.1	0.4
Legumes	14.0	14.2	0.2
Tea with milk	13.8	14.1	0.6
Fats and oils	4.1	4.0	0.2
Vegetables	4.8*	2.1	3.8
Meats	1.5	1.2	1.0
Fruits	1.5*	0.2	3.0
Roots and tubers	0.8	0.6	0.5

* t-test significance at p < 0.05

4.3.2 Household Per Capita Dietary Caloric and Protein
Availability

The 24-hour recall household per capita dietary caloric and protein availability are shown in Table 8. Nutrient availability does not of necessity indicate ingestion of the amounts shown by each family member, but rather what each household member would have received in an ideal household nutrient distribution situation.

For both groups, breakfast, lunch and supper contributed calories and proteins at practically similar levels to the daily per capita availability. Lunch and supper together contributed about the same proportion (i.e. close to 90%) of the daily per capita of both calorie and protein availability in the two groups. Although there was no significant difference in caloric and protein availability between the two groups, the non-programme households' was slightly higher in both cases. This means that the non-programme households had a slightly higher potential of providing their children with more nutrients than programme households.

Table 8:   Household Per Capita Caloric and Protein Availability.

Meal		In prog. N=162		Out of prog. N=163		T value
Breakfast	Kilocalories Protein (g)	363 12.7	(12.1)+ (9.1)	344 12.7	(10.4) (8.5)	-0.4 0.01
Lunch	Kilocalories Protein (g)	1408 66.6	(46.8) (47.7)	1554 64.4	(46.8) (43.4)	1.2 0.3
Supper	Kilocalories Protein (g)	1239 60.2	(41.1) (43.2)	1422 71.4	(42.8) (48.1)	0.7 -0.8
Total	Kilocalories Proteins (g)	3010 (100.0) 139.5(100.0)		3320 (100.0) 148.5(100.0)		1.5 -0.6

ꜛ Figures in parenthesis percentage contribution
to total daily availability.

4.3.3 Caloric and Protein Intakes for School Children

The school feeding programme is designed to provide the children with 150g of maize, 40g beans (a beans to maize ratio of about 1:4) and 15g vegetable oil. This should give 793 kilocalories (42.5% of recommended daily allowance - RDA) and 24g protein (92.3% of RDA). The school lunch programme was found to be operational for 38 out of 65 days of the school term due to the shortage of ingredients. This means that the children obtained only 58.5% of the nutrients that they should have had if the programme was operational throughout the term.

The programme children had a significantly higher caloric intake

during lunch time (Table 9) than non-programme children whose protein intake, however, was significantly higher from their home lunch. The total children's kilocalorie and protein intakes were not significantly different, although those in the programme had a slightly higher caloric intake than the non-programme group while the vice versa was true for protein intake.

The contribution of various meals to total daily intake suggest that lunch is a more important meal for children in both groups for its high contribution of calories. The total intake, however, was below the RDA for children in the two groups. The caloric content of school lunch (860 kilocalories) for the programme children was statistically higher (p<0.001) than that of lunch provided at home for children in the non-programme group which was 666 kilocalories. The caloric content of school lunch was 8% higher than what it is designed and provided 46% of the RDA for the programme group.

The vice versa, however, was true for protein intake, i.e. the intake by the non-programme children group during lunch (30.8g) was significantly higher (p<0.05) than that of those in the programme group (which was 24.0g).

A paired t-test administered on the kilocalorie intake for the programme children shows a significantly higher (p<0.001) caloric intake at lunch-time (860 ±1.0 kcal) than at supper time which was 557 ±326.1 kcal. No significant difference was found in protein

intake for the two meals. Paired t-test for home lunch and home supper for the non-programme children did not show any significant difference for both caloric and protein intakes.

Table 9: 24-hour Caloric and Protein Intake by the Children

Meal		Group				T value
		In prog. N=162		Out of prog. N=163		
B/fast	Kilocalories	173	(10.9)+	187	(12.8)	-0.5
	Proteins (g)	5.2	(9.3)	5.8	(9.4)	-0.8
Lunch	Kilocalories	860	(54.1)*	666	(45.7)	4.5
	Proteins (g)	24.0	(43.2)	30.8	(49.8)*	-2.6
Supper	Kilocalories	556	(35.0)	605	(41.5)	-1.8
	Proteins (g)	26.4	(43.2)	25.2	(40.8)	0.3
Total	Kilocalories	1590	(100.0)	1457	(100.0)	1.7
	Proteins (g)	55.6	(100.0)	61.8	(100.0)	-1.2

+ figures in brackets are percentage contribution to total daily intake.
* t-test significance at $p < 0.05$.

4.3.4 The Contribution of Various Foods to Children's Caloric and Protein Intake

Figures 1 and 2 show the contribution of various foods to caloric and protein intake by the two groups of children. In both study groups, the two major sources of calories and proteins were cereals and legumes.

The contribution of animal proteins to total protein intake for the children was very low in both study groups as shown in Figure 2. Only 5.6% of protein intake in the programme group and 6.7% for the non-programme children was of animal origin.

Cereals contributed significantly more calories and proteins in the programme than in the non-programme group (p<0.001). Likewise, fats and oils contributed significantly more calories in the programme than in the non-programme group (p<0.001). However, the contribution of legumes to both caloric and protein intakes were significantly higher in the non-programme than in the programme group (p<0.005). Likewise, the contribution of roots and tubers to caloric intake was significantly higher (p<0.001) in the non-programme than in the programme group. Roots/tubers and fruits/vegetables (others) contributed significantly more proteins in the non-programme than in the programme group (p<0.001).

Figure 1: Mean Contribution of various Foods to Caloric Intake of Programme and Non-Programme Children

Cereals*
53.8

Others
4.3

Fat/oil*
9.9

Legume
23.2

Roots/tubers
8.8

Programme Children

Cereals
38.2

Others
6.4

Legume*
34.7

Fat/oil
3.7

Roots/tubers*
17

Non-Programme Children
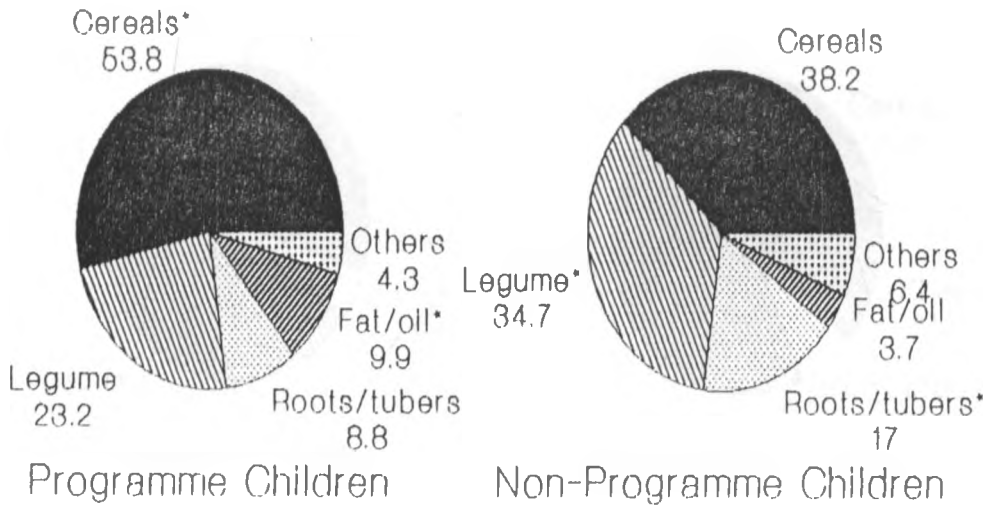
* = T-test significance at p<0.05.
Others= Fruits&vegetables and livestock products.

Figure 2: Mean Contribution of Various Foods to Protein Intake of Programme and Non-Programme Children

Programme Children

Non-programme childern
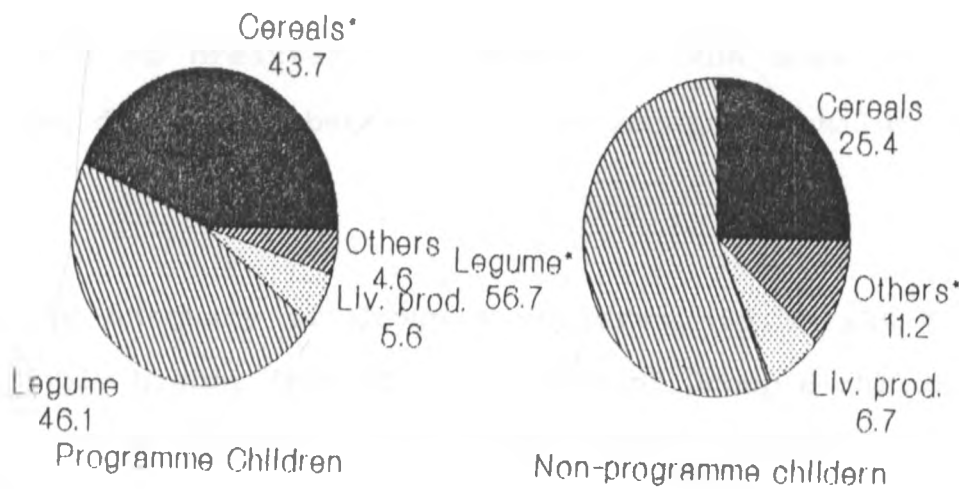
Liv. Prod.= Livestock products.
* = T-test significance at p<0.05.
Others= Root&tuber and fruit&vegetables.

4.3.5 Dietary Intake Adequacy for the Children

Children in both groups consumed less calories and more proteins than the RDA. In both groups of children, breakfast contributed less than 10% of the RDA for calories. The caloric and protein contribution of breakfast and supper to RDA does not show any significant difference between the two groups of children (Figures 3 and 4).

The caloric adequacy of Group A children (85.7% ±20.7 RDA) was significantly higher (p<0.05) than that of Group B children (which was 76.0% ±26.8 of RDA). This was accounted for by the fact that the lunch meal for the programme children contributed significantly more calories (46.3% ±2.9 of RDA, p<0.001) than for the non-programme children (whose lunch contributed 34.6% ±17.3 of RDA).

The mean total protein consumption for the non-programme children (238.4 % ±128.5 of RDA) though higher than that of the programme children's (216.3 ±109.0 % of RDA), was not significantly different (Figure 4). The lunch time contribution to RDA for protein for the non-programme children (118.7% ±88.9 of RDA) was, however, significantly higher (p<0.05) than for the programme children (which was 94.3 % ±11.1 of RDA).

Figure 3: Dietary Caloric Adequacy for Children in Programme and Non-Programme Schools

Caloric Adequacy (% RDA)
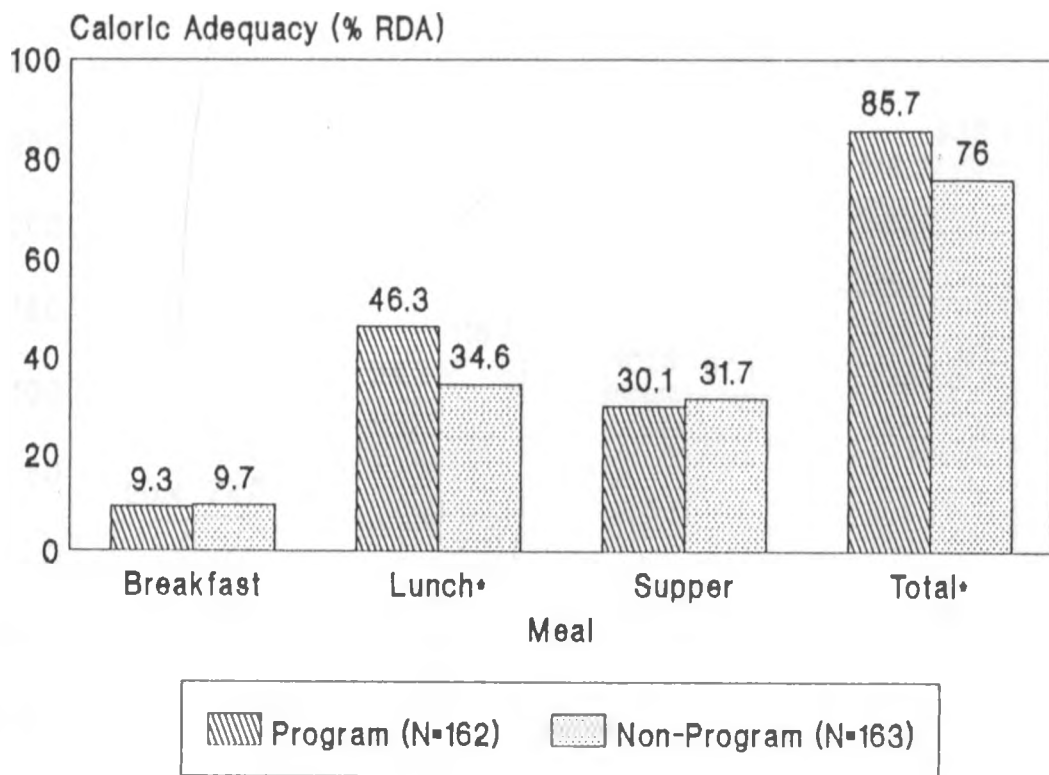
** T-test significance at p<0.05

Figure 4: Dietary Protein Adequacy for Children in Programme and Non-Programme Schools

Protein Adequacy (% RDA)

Program (N=162) Non-Program (N=163)
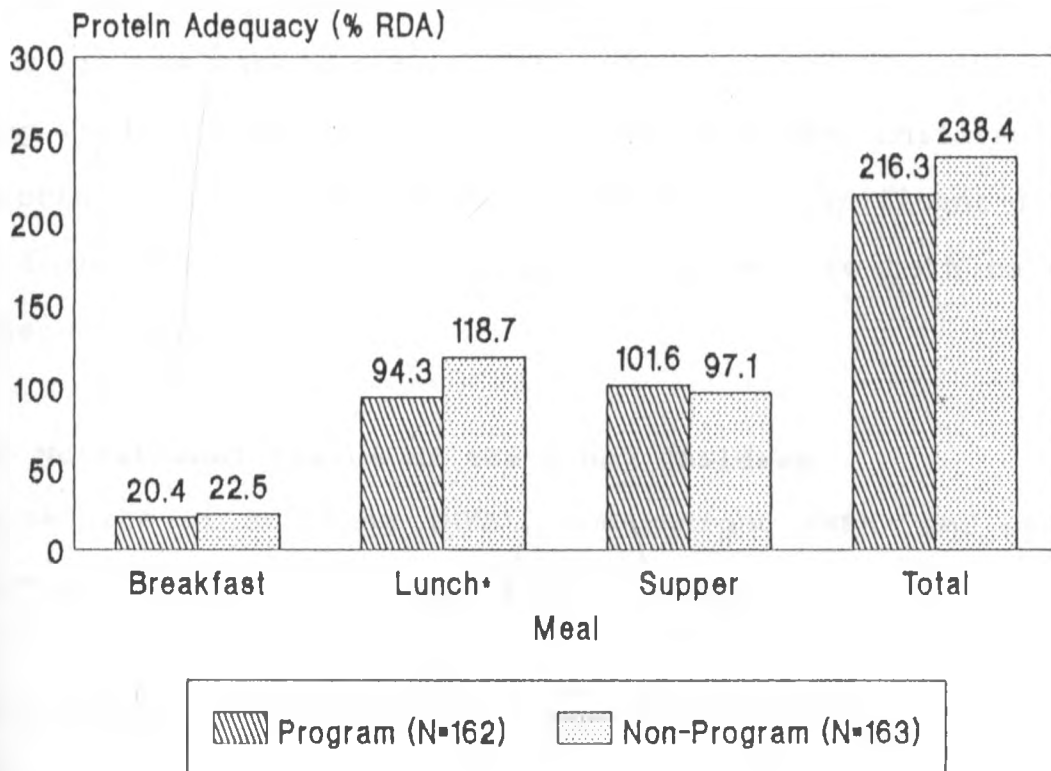
** T-test significance at p<0.05.

A combination of home breakfast and home supper for the programme group provided a lower contribution (39.4% of the caloric RDA) than it did for non-programme children who obtained 41.3% of the RDA [t=-0.6]. The same meals provided more proteins for the programme group (122.0% RDA) than it did for non-programme children [t=0.1], who obtained 119.7% of the RDA. However, no significant difference was found between the two groups in respect to both caloric and protein consumption.

4.4 Nutritional Status of the Study Children

The results of stunting (HFA), underweight (WFA) and wasting or acute malnutrition (WFH) are shown in Figure 5.

The prevalence of chronic malnutrition manifested as stunting among children in the feeding programme (23.5%) was lower but not significantly different from that of the non-programme children (which was 25.2%). The proportion of underweight children in programme group (22.2%) was neither significantly different from that (18.4%) of children in out of programme. Significantly more children in the feeding programme (8.6%) showed signs of acute malnutrition (i.e. wasting) than did those out of the programme (2.4%, p<0.05).

More children (5%) in the programme group had the combination of the three types of nutritional deficiencies than those (2.5%) in the non-programme group.

Figure 5: Prevalence of Malnutrition among Children in Programme and Non-Programme Schools

% Undernourished Children
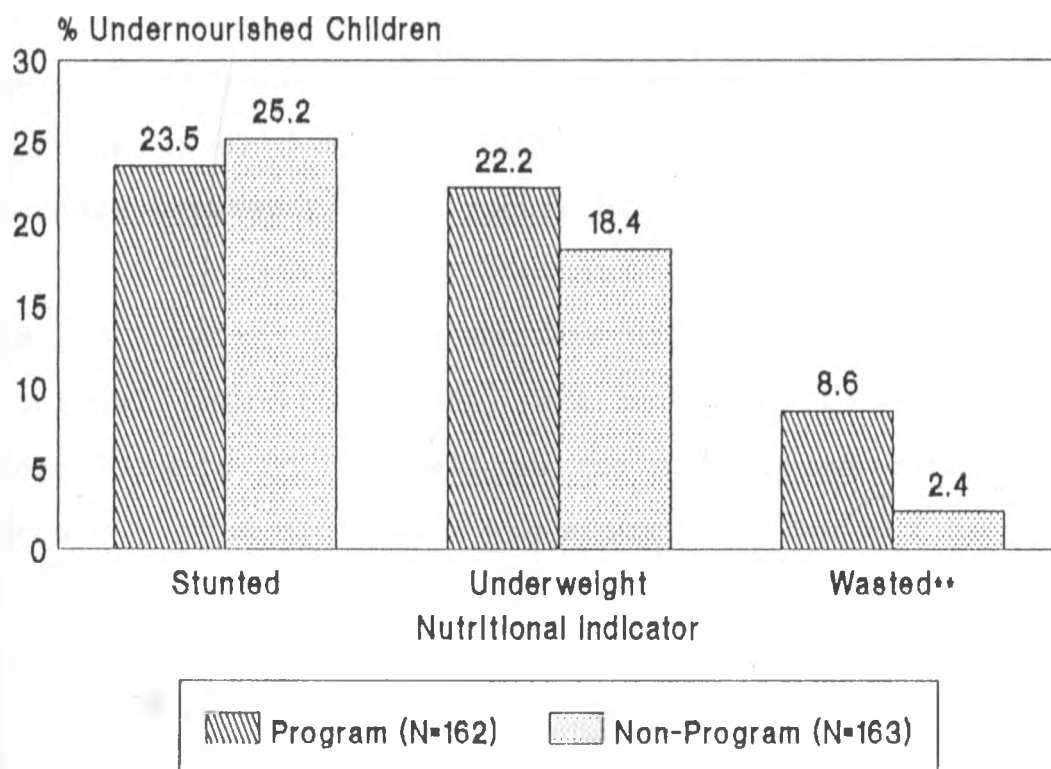
*** Chi-square significance at p<0.05

4.4.1 The Nutritional Status of Children by Age and Sex

There was a progressive increase in the prevalence of stunting with increasing age (Appendix 2). Prevalence of underweight and wasting decreased with increasing child age. However, for each of these age categories (5-6, 7-8 and 9-10 years) there was no significant difference between the two groups of children.

Girls had a better nutritional status than boys across the three nutritional indicators (HFA, WFA and WFH) for both groups of children (Table 10) as well as for the pooled child population (Appendix 3). The difference was significant for HFA ($p < 0.005$) and WFA ($p<0.05$), for those in Group A and HFA ($P<0.05$) for those children in Group B as shown in Table 10.

Table 10: Prevalence of Malnutrition by Group and Sex

Sex	N	HFA (Stunted)	<-2 SD WFA (Underweight)	WFH (Wasted)
IN PROG. Boys Girls	70 92	23 (32.8)+ 15 (16.3)**	22 (31.4) 14 (15.2)**	8 (11.4) 6 (6.5)
Chi-square		6.1	6.0	1.2
OUT OF PROG. Boys Girls	74 89	24 (32.4) 17 (19.1)**	16 (21.6) 14 (15.7)	2 (2.7) 2 (2.2)
Chi-square		3.8	0.9	0.04

+ Figures in parenthesis percentage.

** Chi-square significance at <0.05

As is evident in Table 11, the levels of stunting for all boys and all girls in the two groups of children was similar. Boys outside the feeding programme, however, had a slightly better nutritional status than those in the feeding programme. Whereas 32.9% of those in the feeding programme were stunted, this was 32.4% for those outside the programme. The prevalence of underweight for the programme boys was 31.4% and that of the non-programme boys 21.6%. The prevalence of acute malnutrition (wasting) for the programme boys (11.4%) was significantly higher than that of non-programme boys, which was 2.7% (p<0.05).

Girls in the feeding programme had a slightly better nutritional status than those outside the programme based on stunting. Prevalence of stunting for the feeding programme girls was 16.3% as compared to that of the non-programme girls which was 19.1%. The level of underweight was practically the same for both groups of girls, i.e. 15.2% for those in Group A and 15.7% for Group B. However, though not significantly, the level of wasting was higher in the feeding programme girls (6.5%) than out of programme which was only 2.2%.

Table 11: Prevalence of Malnutrition by Sex

Sex and Group	N	< -2SD		
		Stunted	Underweight	Wasted
BOYS				
In prog.	70	23 (32.9)+	22 (31.4)	8 (11.4)
Out of prog.	74	24 (32.4)	16 (21.6)	2 (2.7)**
Chi-square		0.003	1.8	4.2
GIRLS				
In prog.	92	15 (16.3)	14 (15.2)	6 (6.5)
Out of prog.	89	17 (19.1)	14 (15.7)	2 (2.2)
Chi-square		0.2	0.009	2.0

+ Figures in parenthesis percentages.

** Chi-square significance at p < 0.05

4.5 Factors Associated with Nutritional Status of the Study Children

In both groups, there was a negative and significant relationship between the children's age and their nutritional status, based on level of wasting, i.e. WFH (p<0.05) for those in Group A and p<0.005 for Group B children (Appendices 4 and 5).

There was a negative and significant relationship between child age and underweight (WFA) in the two groups of children, (p<0.05 for Group A children and p<0.005 for Group B children). In Group B children, there was a significant and positive relationship between child's age and stunting, i.e. HFA (p<0.001).

CHAPTER FIVE

DISCUSSION

5.1 General Characteristics of Study Population

The results of this study indicate that the population of economically inactive persons had not changed much since 1994. The CBS and GoK 1987 and 1994 surveys, respectively, showed that 53% were economically inactive compared with 56% in the study area. This indicates a high dependency ratio (1.2:1 in programme and 1.1:1 in out of programme households) which characterises many communities in developing countries.

The significantly higher mean age of both parents in the programme than non-programme groups has a bearing on the educational status of the study population. The findings on parental level of education made here is similar to that of other parts of Kenya (CBS, 1987) which show that younger persons are on the average normally more educated than older ones. Consequently as expected, the average level of schooling of the younger parents of children not in the feeding programme was higher.

The higher literacy rate of male parents compared to that of females is not surprising considering that more males than females in Kenya are educated (GoK/UNESCO, 1991). This is inspite of the fact that the overall educational status of the community (based on the number of years spent in school) was very low, due to high

school drop out rates which has been attributed to the growing of *miraa* (Section 3.1.3). This probably, accounts for the low ranking of permanent employment (second to last) as a source of family income in both groups of households (Section 4.2).

The high URI morbidity observed in Group A children may account for the higher school absenteeism rate in the children compared to those in Group B. GoK/UNESCO (1991) reported that URI was among the most important causes of school absenteeism in Kenya. The irregularity of the feeding programme might also have played a part in this, as was the case in an Indian study (CARE, 1977) where it was found out that poor supply of food commodities to a SFP was responsible for high school absenteeism.

5.2 Food Sources and Dietary Intakes

Though the production of the two main staple foods for the population (cereals and legumes) was not the same both groups of households (Sections 4.3), the frequency of consumption was practically the same in the two groups (Section 4.3.1) which is explained by use of the market as a source of food. This and the similarity in household caloric and protein availability as well as contribution of different meals to their total nutrient availability between the two groups of households (Section 4.3.2) is not unexpected since the community's agricultural activities, family characteristics, sources of income and expenditure on food are practically not different.

The frequency of consumption of vegetables and fruits (though very low) was higher in the programme group of households than that in the non-programme households despite the production of the two being higher in the non-programme households. This suggests that the non-programme households sell more of these foodstuffs and/or they attach less importance to consuming them than the programme households.

The greater dependence of the population on purchased food rather than own production (Section 4.3) is mainly due to the growing of *Miraa* which is difficult to intercrop and shortage of rain and water in the region. This has made the area heavily dependent on market food supplies from outside the district (MALM, 1995 and GoK, 1994)

The amount of calories derived from breakfast (less than 10% of RDA) in the two groups of children (Section 4.3.3) was in the researcher's view too little to enable the children perform adequately through to lunch time. This suggests that the children were hungry for most part of the morning before lunch time. The proportionately higher contribution of lunch and supper than breakfast to daily nutrient intake implies that more emphasis was laid on these two meals than on the first meal of the day (breakfast).

Though there was a deficit, for the programme children, the lunch

programme was a more important source of calories compared to home supper (Section 4.3.3). The low caloric intake observed in both groups of children is of concern. Even with the introduction of the lunch programme the caloric intake has not improved much as is borne by the data in the study; 86% of RDA for the programme group and 76% for non-programme group. Sigman et al in 1989 observed that school children in Embu district, an area of similar ecological zone, also took less calories than the RDA.

Although protein intake levels are shown to be in excess in both the programme and non-programme groups, it should be noted that the proteins are mainly of plant origin, whose biological value will be approximately 40-50 compared to 60-85 for animal protein. Less than 10% of the total protein taken was of animal origin and the frequency of consumption of the same was very low in both groups of children. A similar low intake of animal protein was found by Sigman et al., (1989) for school children in Embu, where over 90% of the protein intake by children was from plant sources, and therefore, probably of inferior quality.

Combinations of foodstuffs in the right proportions, however, can give protein profiles similar to those of animal proteins. The community should be encouraged to keep small animals which can be supported by the income from *miraa* to improve the amino acid balance. In addition the population should be instructed to the mixing of cereals and legumes in appropriate ratios.

The next precaution should be to ensure energy and protein balance. Thus it should be ensured that there is no excessive protein adequacy level since excess proteins are not stored in the body. Sigman et al., (1989) have observed that insufficient intake of food can be aggregated as insufficient intake of energy, while Waterlow (1992), notes that correct calculations of protein requirement and intake relate to a situation in which energy intakes are adequately met. Since nitrogen balance cannot be achieved if energy intakes are inadequate, this makes a caloric deficit of more consequence in determining nutritional status than excessive protein intake.

The caloric adequacy findings (Section 4.3.5) lead to the rejection of the null hypothesis (H_0) which stated that "the caloric adequacy level is not significantly different in the two groups of children" and the alternate hypothesis (H_A) that, "children participating in the school feeding programme have a significantly higher caloric adequacy level than those who do not" is not rejected.

The H_0 which stated that "protein adequacy level is not significantly different in the two groups of children" is accepted. The slightly lower protein intake by the programme group of children is explained by the fact that their intake of protein from the school lunch as well as at home during breakfast and supper is lower than that of the non-programme group.

The very low frequency of consumption of fruits and vegetables in the two groups of households (Section 4.3.1) suggests that the children subsist on a diet that is lacking in some important vitamins and minerals.

5.3 Nutritional Status of Study children

The stunting level of children in both groups (Section 4.4) implies similar past nutritional experience in both groups of children. Stunting levels observed here were higher than levels reported by CBS (1987) for children under five years which was 22.3%. Similar results were obtained by Kielmann et al., (1988) in Samburu district where stunting increased with age. Other studies have reported comparable levels in areas of similar ecological zones in Kenya for school children. A CBS survey (1979) showed that 24% school children in Kitui district and 26% in Kwale district were stunted. It should, however, be stressed that it is not possible to directly link stunting with the feeding programme due to the latter's existence only during the period spent in school by the children in the programme group.

The effect of the feeding programme, however, is evident from the observation that wasting levels were significantly higher in programme than in non-programme groups. Infact, the level of wasting in the programme school (8.8%) was more than three times the national level for children under five years as reported by CBS (1987). Hence, based on this finding, the H_o which stated that

"there is no significant difference in wasting (current nutrition) between school children participating in a feeding programme and those not in the programme" is rejected and the H_A that, " children participating in the feeding programme are more wasted than those not in the feeding programme" is not rejected.

Possible explanations to this are the irregurality of the school lunch programme coupled with lower dietary intake (Section 4.3.3) for programme children at home and the high incidence of URI (Section 4.2) amongst the programme children. Had children in the feeding programme obtained a 100% of the nutrients they should have had and had the programme diet been balanced, probably their nutritional status would have been better. For this reason, it is prudent to say that the existence of the feeding programme (as it was) had not conferred better protection for the participating children as measured by wasting in this particular area.

Although it was outside the scope of this study to explain why this was so, it should not justify the phasing out of the school from the feeding programme, but rather its improvement in terms of nutrient quality and regularity. It is only by doing this that adequate evidence would be adduced as to the usefulness of the programme with the children receiving the meal on a regular basis. This suggestion is in agreement with findings elsewhere (i.e. Kirinyaga District) by Pieters et al., (1977) where the nutritional status of children participating in a school feeding programme

under the NSFCK improved.

The observation made that the nutritional status of girls was generally better than that of boys conforms with results of studies on school children in other parts of Kenya including Samburu by Kielmann et al in 1988 and Kitui and Kwale by CBS (1979) which showed that girls have a better nutritional status than boys. Similar findings were reported by Kimati and Scrimshaw (1985) in mainland Tanzania. In this study, it is the researcher's view that this, among other reasons, could be as a result of girls being socially more actively involved in food preparation activities and ultimately more advantaged when it comes to consumption than boys in the study area, as is customary among the Meru people.

The children who had combinations of present and past history of malnutrition were more in the programme than in the non-programme group (Section 4.4). This is not surprising considering the significantly higher prevalence of wasting in the programme than non-programme group and the slightly higher level of underweight among the programme children (Section 4.4). Although slight, the higher household per capita caloric and protein availability (Section 4.3.2) placed the non-programme children at a greater advantage compared to the programme group considering the irregurality of the school lunch programme (Section 4.3.3). The significantly higher prevalence of URI among Group A children might also have had a part to play due to the synergistic relationship

between infections and nutrition.

The negative significant relationship between child age and wasting in the two groups of children (Section 4.5) indicate that younger children are more likely to be wasted than older ones. This is logical considering the higher proportionate nutrient demand of younger children compared to older ones for growth and development as pointed out by Davidson and Passmore (1987). The positive significant relationship between child age and stunting shows that stunting increases with age as earlier indicated in this section, which is in agreement with findings from another study on school children in Samburu district, Kenya, by Kielmann et al., (1988).

There was no relationship between caloric and protein intakes and nutritional status of the children. This suggests that the 24-hour dietary recall was not a good predictor of nutritional status for the children aged 5-10 years in the study area. Similar findings were reported by Amanda et al., (1995) in an Australian Aborigin Community.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The household per capita and the children's intake of calories and proteins at home are not different between the programme and non-programme groups because the households' socio-cultural and socio-demographic characteristics and per capita expenditure on food are similar and the fact that they derive their income from similar sources.

On the basis the results obtained from this study, the school feeding programme apparently does not attract and retain or improve school attendance as well as the nutritional status of participating children. The programme should continue but with improvements in terms of nutritional quality and regurality since the school is in an ASAL area and the nutritional status of the children is still poor.

6.2 Recommendations

A bean to maize ratio of 30:70 (or 1:2) for optimal nutritional value and addition of vegetables and fruits to balance the feeding programme diet is recommended.

Introduction of a mid-morning snack; consisting of cereal/legume

porridge is recommended since the nutrient intake from breakfast contributes only a small proportion of nutrients to the RDA with regard to calories.

For improved programme effectiveness, efforts should be made to ensure availability of adequate stocks of ingredients in the school to last throughout the school term to ensure regular meals. Further investigation is recommended to identify the reasons as to why the performance of the programme was poor. Such an investigation should find out the extent of involvement and support of the local community in the school feeding programme.

The WFP school feeding programme should be evaluated to identify areas of weakness to help improve the programme throughout the country. Targeting of programme beneficiaries should involve nutritional surveys so as to make monitoring and evaluation easy and accurate.

REFERENCES

Akinadewo, O. (1981). The Importance of Health Education on Child Feeding and Development. Federal Health Education Division. Official Report of the 1st International All Africa Conference on Health Education, Lagos, Nigeria. PP 406-411.

Amand, J.L., Smith, A., Bryce, S., Kerin O'Dea, Rutishauser, I.H.E. and Mathews, J.D. (1995). Measuring Dietary Intake in remote Australian Communities. In: Ecology of Food and nutrition. An International Journal. Vol.34. (eds) Kuhnlein. H.V., Pellett, P.L. and Wilson, C.S. PP 13-30.

Babu, S.C. and Hallam, J.A. (1989). Socioeconomic Impacts of School Feeding Programmes: Empirical Evidence from a South Indian Village. Indian Food Policy Vol.14 No.1 PP 58-66.

Beaton, G.H., Milner, J., Corey, P., et al. (1979). Sources of Variance in 24-Hour Dietary Recall Data: Implications for Nutrition Study Design and Interpretation. American Journal of Clinical Nutrition Vol. 32 PP 2546-2559. In: Manual on Methodology for Food Consumption Studies. (eds) Cameron, M.E. and Van Staveren, W.A. (1988). PP 83-88.

Beaton, G. (1993). Which Age Groups should be Targeted for Supplementary Feeding? In: Nutritional Issues in Food Aid. ACC/SCN Symposium Report. Nutrition Policy Discussion Paper No.12. (ed) Mason B. M. Geneva, Switzerland. PP 49.

Berg, A. (1981). Malnourished People: A Policy View. Poverty Basic Need Series. A World Bank Publication. PP 26.

Cameron, M.E. and Van Staveren, W.A. (1988). Manual on Methodology for Food Consumption Studies. Oxford Medical Publications. Published in the United States by Oxford University Press, New York. PP 13-31.

CARE. (1977). School Feeding in Karnataka, India : Impact on Enrolment and Attendance. In: School Feeding Programmes in Developing Countries: An Analysis of Actual and Potential Impact. (ed) Levinger B. 1986, Washington DC. PP 34-35.

CBS. (1987). Fourth Rural Child Nutrition Survey. Ministry of Planning and National Development. Nairobi, Kenya. PP 44.

CBS. (1989). Kenya Population Census, Nairobi, Kenya. PP 172.

CBS. (1991). Report of the Height Monitoring in Primary Schools (Kwale and Kitui Districts). Nairobi, Kenya. PP 22-25.

Cotten, J. (1982). Evaluation Research on the Plan 480 Title II School Feeding Programme in Haiti (Port-Au-Prince: USAID Haiti). In: School Feeding Programmes in Developing Countries: An Analysis of Actual and Potential Impact. (ed) Levinger B. 1986, Washington DC. PP 15.

Coursin, P. (1965). Effect of Undernutrition on Central Nervous System Function. Nutrition Reviews Vol.23 PP 65.

Daily Nation. (Sept. 22nd 1995). World Food Programme Cites Woes. A Nation Newspaper Publication. Nairobi, Kenya. PP 22.

Davidson, P.S.L. and Passmore, R. (1987). Human Nutrition and Dietetics. 8th Edition. Longman UK Group Ltd. PP 48-52.

Dobbing, J. (1985). Infant Nutrition and Later Achievement. The American Journal of Clinical Nutrition Vol.41. PP 477-484.

Ebomoyi, E. (1986). A Comparative Study of the Nutritional Status of Children in Urban and Rural Areas of Kawara State, Nigeria. Ecology of Food and Nutrition Vol.19. PP 19-30.

Fisher, A.A., Laing, J.E. and Townsend, J.W. (1991). Handbook for Family Planning Operations Research and Design. Operations Research, Population Council. USA. PP 43-46.

Florencial, C. (1991). Alternative School Nutrition Programme (ASNP) in Piliphines. In: Managing Successful Nutrition Programmes. ACC/SCN State-Of-The-Art Series. Nutrition Policy Discussion Paper No.8. (eds) Joan J., Stuart G., John M., Mahshid L. and Tom S. Geneva, Switzerland. PP 113.

GoK/UNESCO. (1991). National Planning Workshop "Child Health, Nutrition and School Participation". UNESCO Paris. PP 10-29.

GoK/UNICEF. (1992). Children and Women in Kenya - A Situational Analysis. A Publication of the GOK and UNICEF, Kenya Country Office. Regal Press Limited, Nairobi. PP 93-103.

GoK. (1994). Meru District Development Plan 1994-1996. Government Printer Nairobi, Kenya. Office Of The Vice-President and Ministry of Planning and National Development. PP 11-37.

Hamil, P.V.V. (1979). Physical Growth: NCHS. American Journal of Clinical Nutrition, Vol.32, PP 607-629.

Hijazi, S.S. and Abdulatif, D. (1986). The Nutritional Impact of School Feeding Programme in Mafraq Area. Journal of Tropical Paediatrics, Jordan Vol.32 No.4. PP 174-180.

Kennedy, E.T. and Pinstrup-Anderson, P. (1983). Nutrition-related Policies and Programmes: Past Performances and Research Needs. Int. Food Policy Research Institute, New York, U.S.A. PP 7-12.

Kielmann, A.A. and Applied Human Nutrition Unit (U.O.N). (1988). "Assessment of the Nutritional Impact of the Wamba Food Security Programme". Unit of Applied Human Nutrition, Dept. of Food Technology and Nutrition, U.O.N. PP 31-36.

Kimati, V.P. and Scrimshaw, N.S. (1985). The Nutritional Status of Tanzanian Children: A Cross-sectional Anthropometric Survey Report. East African Medical Journal, Vol.62 No.2. PP 105-117.

Levinger, B. (1986). School Feeding Programmes in Developing Countries: An Analysis of Actual and Potential Impact, Agency for International Development (AID), Office of Evaluation, Bureau for Food and Voluntary Aid. Washington DC. PP 15-24.

Maose, O.M., Pontio, M. and Airhihenbuwa, C.O. (1988). Nutritional Assessment of Primary School Children in Papua New Guinea: Implications for Community Health. International Quarterly of Community Health Education Vol.8 No.2 PP 157-179.

Miller, R.I. (1982). Internal Report 1: Preliminary Results of School Feeding/Attendance Study, Srilanka. In: School Feeding Programmes in Developing Countries: An Analysis of Actual and Potential Impact. (ed) Levinger B. 1986, Washington DC. PP 20.

MoED. (1985). Guidelines on School Feeding Programme. Jommo Kenyatta Foundation, Nairobi. PP 13 and 30.

Muroki, N.M. (1981). Utilization of the Pigeon Pea (Cajanus Cajun) for the Fortification of Maize Flour (Zea Mays). Phd. Thesis, University of London. PP 7-13.

Neumann, G.C. and Bwibo, N. (1987). "The Collaborative Research Support Programme on Food Intake and Human Function". Final Report. USAID Grant No. DAN-1309-G-SS-1070-00. PP 327.

Noriega, V.A., Mejia, L. A., Sauceedo, S. and Palacios, M.R. (1990). Psychological, Nutritional, Socioeconomic and Family Relations Background of Mexican Children with Low School Performances. Archivos Latinoamericanos De Nutricion Vol.40 No.4. PP 475-489.

Payne, P. (1986). Appropriate Indicators for Project Design and Evaluation. In: Food Aid and the Well-being of Children in the Developing World. UNICEF. New York. PP 109-141.

Pieters, J.J.L., De Moel, J.P.C., Van Steenbergen and Van Der Hoeven, W.J.M. (1977). Effects of School Feeding on Growth of Children in Kirinyaga District, Kenya. East African Medical Journal Vol.54 No.11. Nairobi, Kenya. PP 624-629.

Pollit, E. (1990). Malnutrition and Infection in the Classroom. UNESCO, Paris. PP 92-131.

Rabeneck, S. (1986). The Development of a Built-in Monitoring and Evaluation System for Project KENYA 2502: "Feeding of Primary and Pre-primary School Children". Mission Report, WFP, Nairobi, Kenya. PP 2 & 14.

Rajalakshmi, P. (1967). A Good Designed School Lunch Removes Deficiencies in Home Diet. Baroda Journal of Nutrition. PP 113-115.

Roy, P. and Rath, N.R. (1970). School Lunch in Orissa (New Delhi: Council for Social Development). In: School Feeding Programmes in Developing Countries: An Analysis of Actual and Potential Impact. (ed) Levinger B. 1986, Washington DC. PP 15.

Sigman, M., Neumann, C., Jansen, A.A.J. and Bwibo, N. (1989). Cognitive Abilities of Kenyan Children in Relation to Nutrition, Family Characteristics, and Education. Society for Research in Child Development, Inc. Vol.60. Los Angeles, U.S.A. PP 1463-1474

Simko, M.D, Cowell, C. and Gilbride, J.A (1984). Nutrition Assessment. A Comprehensive Guide for Planning Intervention. An Aspen Publication. Rockville, Maryland. PP 69-71.

Rewal, S. and CARE. (1983). Results of a School Lunch Programme in India. Food and Nutrition Bulletin Vol.3, No.4. PP 13.

UNICEF. (1990). Strategies of Improving Nutrition of Children and Women in Developing Countries. New York. PP 1-12.

UNICEF/GOK. (1991). Report of the Height Monitoring in Primary Schools. Ministry of Planning and National Development, Nairobi. PP 10-22.

UN/WFP. (1992). Food Assistance to Pre-Primary and Primary Schools in ASAL Areas. Plan of Operations. WFP, Nairobi. PP 3-10.

Van Der Vynckt, S. (1986). Malnutrition: Major Handicap to School Children. Nutrition Magician Brochure, Paris, France. PP 4.

Waterlow, J.C. (1977). "The Presentation and Use of Height and Weight Data for Comparison of Nutritional Status of Groups of Children Under 10 Years". WHO Bulletin. Vol.55. PP 489-498.

Waterlow, J.C. (1992). Protein Energy Malnutrition. Published in Great Britain. PP 241.

WHO. (1983). Measuring Change in Nutritional Status. Guidelines for Assessing the Nutritional Impact of Supplementary Feeding Programmes for Vulnerable Groups. Geneva. PP 12-14.

WHO. (1986). Use and Interpretation of Anthropometric Indicators of Nutritional Status. WHO Working Group - Bulletin of the WHO. Geneva. PP 14-26.

WHO. (1987). ECSA/CTA Food Composition Tables. Geneva. PP 1.

WHO. (1995). Physical Status: The Use and Interpretation of Anthropometry. WHO Expert Committee. Geneva. PP 6-12.

WHO/FAO. (1992). Kenya Country Position Paper on Nutrition. International Conference on Nutrition. PP 55-86.

Wolf, M. (1985). Nutritional Status of Children in Health District of Cusco, Peru. American Journal of Clinical Nutrition. PP 42.

World Bank. (1995). Skills for Development: World Development Report 1995. Workers in an Integrating World. PP 36.

Appendix 1:   Distribution of Parental Education by Group

Group	No Educ.	Primary Educ.	Above Primary
IN PROGRAM			
Fathers (N=158)	85 (54)+	62 (39)	11 (7)
Mothers (N=158)	110 (70)	41 (26)	7 (4)
OUT OF PROGRAM			
Fathers (N=158)	65 (41)	66 (42)	27 (17)
Mothers (N=158)	95 (60)	52 (33)	11 (7)

+ Figures in parenthesis percentage.

Appendix 2:   Prevalence of Undernutrition by Age (Pooled Child Population)

Age category (yrs)	N	< -2 SD		
		%Stunted	%Underweight	%Wasted
5-6	65	14 (21.5)+	14 (21.5)	6 (9.2)
7-8	148	33 (22.3)	30 (20.3)	9 (6.1)
9-10	112	32 (28.6)	22 (19.6)	3 (2.7)
Chi-square		1.7	0.1	3.5

+ Figures in parenthesis percentage.

Appendix 3:   Nutritional Status of Boys and Girls (Pooled Child
                Population)

Sex	N	< -2SD (%)		
		HFA	WFA	WFH
Boys	144	47 (32.6)+	38 (26.4)	10 (6.9)
Girls	181	32 (17.7)*	28 (15.5)*	8 (4.4)
Chi-square		9.8	5.9	1.0

+ Figures in parenthesis percentage.

* t-test significance at $p < 0.05$.

Appendix 4:   Pearson Correlation Coefficients of Independent
Variables with Specific Nutritional Indicators for
Programme Children

Variables	HAZ	WAZ	WHZ
HHAGE	0.0460	0.0200	0.0115
MATAGE	-0.0086	-0.0124	0.0753
FATEDUC	0.0242	-0.0747	-0.1079
MATEDUC	0.0165	0.0948	0.0963
HPCFEXP	-0.0013	-0.0214	-0.1230
HHSIZE	0.0979	0.1287	0.1461
CAGE	0.1367	-0.1854*	-0.1532*
TCKCAL	0.0238	0.0818	0.0672
TCPROT	0.1990	0.2018	0.0272
ENEAD	0.0622	0.1158	0.0881
PROTAD	0.2077	0.2124	0.0069

HHAGE   - Head of households' age
MATAGE - Mothers' age
FATEDUC - Fathers' education
MATEDUC - Mothers' education
HPCFEXP - Household per capita food expenditure
HHSIZE - Household size
CAGE   - child age
TCKCAL - Total child kilocalorie intake
TCPROT - Total child protein intake
ENEAD   - Energy adequacy
PROTAD - Protein adequacy
   * - Significance at P < 0.05

Appendix 5:   Pearson Correlation Coefficients of Independent
              Variables with Specific Nutritional Indicators for
              Non-Programme Children

Variables	HAZ	WAZ	WHZ
HHAGE	0.2217	0.1143	0.0583
MATAGE	0.0419	0.0426	0.0095
FATEDUC	0.0902	0.1005	-0.0221
MATEDUC	0.0065	0.0964	0.0311
HPCFEXP	0.1241	0.1064	-0.0102
HHSIZE	0.0166	-0.0199	0.0297
CAGE	0.3251*	-0.2491*	-0.2450*
TCKCAL	0.1077	0.0918	-0.1243
TCPROT	0.1723	0.1761	-0.0662
ENEAD	0.1566	0.1071	-0.1145
PROTAD	0.1915	0.1982	-0.6970

HHAGE   - Head of households' age
MATAGE - Mothers' age
FATEDUC - Fathers' education
MATEDUC - Mothers' education
HPCFEXP - Household per capita food expenditure
HHSIZE - Household size
CAGE   - child age
TCKCAL - Total child kilocaloric intake
TCPROT - Total child protein intake
ENEAD   - Energy adequacy
PROTAD - Protein adequacy
  * - significance at $P < 0.05$

Appendix 6:   Child/Household Identification Form

Please take this form home with you and fill in your father's
name, your village and the date you were born.

Child's name   _____

Father's name   _____

Village   _____

Date of birth |_____|_____|19____|

                        THANK YOU!!

Appendix 7: Food Composition Table (Calories and Protein)

FOOD	KCAL	PROT(g)	FOOD	KCAL	PROT(g)
White maize (dry)	345	9.4	Yellow maize(dry)	353	10.4
Roasted maize	364	8.0	Maize Flour (unga)	341	9.3
Maize flour(60-80% ext)	334	8.0	Finger millet flour	318	5.6
Bulrush millet flour	339	10.0	Rice (polished)	333	7.0
Sorghum flour	337	9.5	Wheat flour (85%extr)	340	11.0
Wheat flour (70% extr)	333	10.0	White bread	240	7.7
Brown bread	233	7.7	Pancakes	132	1.9
Cakes (bought)	337	7.8	Cassava	318	1.6
Sweet potato	109	1.6	Yams	111	1.9
Beans/Peas (fresh)	104	8.2	Beans/peas (dried)	320	22.0
Delichos purpurea	304	23.0	Chickpea (dried)	327	20.0
Cowpea (dried)	318	23.0	Kidney bean (dried)	320	22.0
Pea (dried)	299	22.0	Pigeon pea (dried)	309	20.0
Green grams	312	24.0	French beans (green)	39	3.7
Bean sprouts	130	13.0	Carrots	35	0.9
Amaranth leaves	46	4.0	Cowpea leaves	45	4.7
Leaves (pale green)	26	1.7	Leaves (medium green)	25	1.8
Leaves (dark green)	58	4.5	Pumpkin leaves	25	4.0
Tomatoes	22	1.0	Avocado	121	1.4
Banana (ripe)	82	1.5	Orange/tangerine	44	0.6
Lemon (ripe)	40	0.6	Mango (ripe)	60	0.6
Tree tomato	45	1.5	Soda	45	0.0
Sugar cane	54	0.6	Sugar	375	0.0
Beef (moderately fat)	234	18.0	Egg	140	12.0
Goat (moderately fat)	171	18.0	Chicken	138	20.0
Mutton (moderately fat)	257	17.0	Milk (cow, whole)	79	3.8
Margarine	747	0.0	Vegetable oil/fat	900	0.0

Appendix 8: Recommended Daily Allowances (Calories and Protein)

SEX	AGE (yrs)	ENERGY (kcal)	PROTEIN (g)
Boys	5 - 7	1850	21
	7 - 10	2100	27
Girls	5 - 7	1750	21
	7 - 10	1800	27

Source: WHO (1987). ECSA/CTA Food Composition Tables.

Appendix 9: Questionnaire

QUESTIONNAIRE FOR SCHOOL CHILDREN AND THEIR RESPECTIVE HOUSEHOLDS

Group |___| Codes: Lukununu = 1
                    Mwerongundu = 2

Date of Interview |___|___|___|___|_9_|_5_|

Household/Child Number |___|___|___|

Name of Interviewer _____

Name of Father   _____

Name of Mother   _____

Name of School Child_____

Sex of School Child |___| 1=Male   2= Female

Date of birth of school child |___|___|___|___|___|___|

Clinic attendance card available? |___| 1=Yes   2=No

Village _____

SECTION A - HOUSEHOLD AND CHILD CHARACTERISTICS

1.   How old are you and your spouse?

     Age of Mother |___|___| (Years)

     Age of household head |___|___| (Years)

2.   How many years of schooling did you and your spouse complete?

         a) Mother's years of schooling |___|___| (YEARS)

         b) Father's years of schooling |___|___| (YEARS)

3. What has been the **main** source of the following foods in your
    household in the last 6 months? (Give appropriate examples).
    Codes:1 = Own production

        2 = Bought

    1.Cereals (e.g. maize, sorghum, millet) |_|

    2.Legumes (e.g. beans, peas, black beans) |_|

    3.Livestock products (e.g. milk, eggs, meat) |_|

    4.Vegetables (e.g. cabbage, sukuma, carrots) |_|

    5.Fruits (e.g. oranges, avocado, passion fruit) |_|

    6.Roots and Tubers (e.g. potatoes, arrow roots) |_|

4. What is/are the source(s) of income for the household? Of
    these sources, please rank from the one that gives you the
    highest to the lowest amount of money.

    (Tick appropriately and rank)

	Income Source	Rank
1 = Sale of food crops grown	|___|	|_|
2 = Sale of animals/their products	|___|	|_|
3 = Casual employment	|___|	|_|
4 = Permanent employment	|___|	|_|
5 = Miraa	|___|	|_|
6 = Given by child/children	|___|	|_|
7 = Business (self employment)	|___|	|_|
8 = Coffee	|___|	|_|

9 = Others (specify)_____

5. Please list for me the foodstuffs you have bought in the last one week and how much you spent on each. Note: This includes retail foodstuffs e.g. cooking oil, salt, bread, sugar etc.

    _____   _____   _____

    _____   _____   _____

    _____   _____   _____

    _____   _____   _____

    _____   _____   _____

6. Has (mention name of index child) been sick in the past one week? |___| 1=Yes   2=No

    [If yes,] What disease was he/she having? [Ask to see hospital/dispensary card if child attended health facility] (Tick appropriately)

    1=Cold/Cough |___| 2=Diarrhoea |___|

    3=Stomachache |___| 4=Headache |___|

    5=Fever |___| 6=Skin disease |___|

    7=Tonsils |___| 8=Had a wound |___|

    9=Ear ache/discharge |___|

    10=Others: (specify)_____

    _____

7. How many people are there in your household that you have cooked and eaten with in the last three months?

|__|___|

Please give me their names, ages, relationship to head of household, their level of education (years spent in school) and sex. (Fill in the following table.)

Name	Age (yrs)	Age (mons)	R/ship	Educ	Sex

Codes:

R/ship to HHH
1 = Head of HH
2 = Wife
3 = Son
4 = Daughter
5 = Grandchild
6 = Parent of HHH
7 = Relative other than above
8 = Servant
9 = Other (specify)

Sex
1 = Male
2 = Female

8.   Has any of your children been chased away from school this

term? |___| 1=Yes   2=No

[If yes,] What was the reason? (Tick appropriately)

Lack of school fees |__|

Lack of textbooks |__|

Lack of school uniform |__|

Broke school rules |__|

Other (specify)

SECTION B: DIETARY INTAKES

HOUSEHOLD FOOD FREQUENCY

9.   [Ask the mother of the household the following question].
     What foods does your family eat and how frequently are they
     eaten? Give examples appropriately.

	FREQ/ WEEK
FOODS	
1. Cereals (e.g. maize, sorghum, millet)	|__|
2. Legumes (e.g. beans, peas, black beans)	|__|
3. Vegetables (e.g. cabbage, sukuma, carrots)	|__|
4. Fruits (e.g. oranges, avocado, passion fruit)	|__|
5. Roots and Tubers (e.g. potatoes, arrow roots)	|__|
6. Tea with milk	|__|
7. Meats	|__|
8. Fats and oils	|__|

10.   [Ask the mother or caretaker the following questions and fill in the table next page].

    a)   Starting from morning, what did your family eat the whole of yesterday?

    b)   What was the amount of dish cooked?

    c)   What were the raw ingredients used in the dish and amounts?

    d)   What amount was left over?

    [Note: If food remained after a meal it is important to be shown the amount (volume) which should then be indicated under " Amount left over" column].

Time	Dish	Amount of cooked dish	Name of Ingredient	Amount of ingred. cooked for H/old	Consumed by number	Amount left over	Amount con-sumed
Breakfast							
Lunch							
Super							

FOR OFFICIAL USE ONLY BY RESEARCHER

Name of Ingredient	Amount of Ingredient consumed by no	Kcal 100g Ingr	g pro 100g Ingr	Kcal consumed	g protein consumed
Breakfast					
Lunch					
Supper					
Total					

11. [Ask the mother or caretaker the following questions about the school child and fill the following table].

    a)   Starting from morning yesterday, what did [mention name of index child] eat?

    b)   What amount of food was served to the child?

    c)   Did the child leave any of the food? [If left over] What amount?

CHILD'S 24-HOUR DIETARY INTAKE RECALL

Time	Dish	Name of Ingredient	Amt. of Ingred. in Family meal	Amt. of Food served to child (a)	Amt. of food left over by child (b)	Amount consumed by child (a-b)
Breakfast						
Lunch						
Supper						

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Dish	Prop. of Dish taken by child (amt taken/amt of dish cooked	Name of ingr	Amt of Ingr cons.child (prop. x total ing. in dish)	Kcal/100g of ingredient	g of pro/ 100g ing	Kcal consum ed by child	protein (g) consumed by child
B/FAST							
Total							
LUNCH							
Total							
SUPPER							
Total							
TOTAL							

SECTION C: ANTHROPOMETRIC MEASUREMENTS FOR CHILDREN

Date of interview |____|____|____|_____|_9__|_5__|

Name of child   _____

Sex of child |____| 1=Male   2=Female

Group   Codes: |____| 1=Lukununu   2=Mwerongundu

Name of school   _____   Class of pupil |____|

12.   Please allow me to measure your weight and height.

1)   **WEIGHT (KG.)**

Weight 1   Weight 2   Average weight

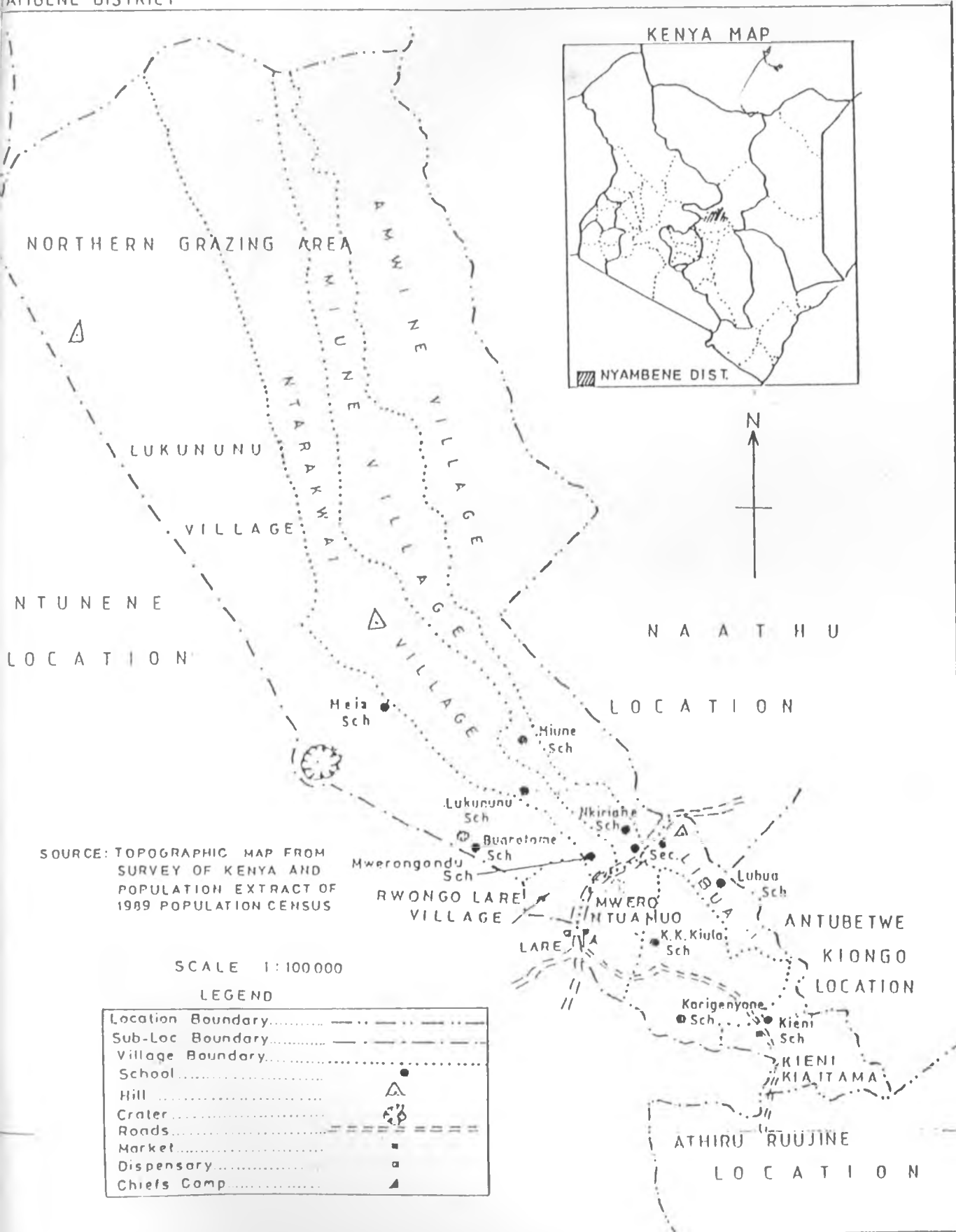|__|__|·|___| |__|__|·|__| |___|__|·|___|

2)   **HEIGHT (CM)**

Height 1   Height 2   Average height

|__|__|__|·|__| |___|__|___|·|__| |__|__|__|·|__|

13.   How many times has the pupil been absent from school this
       term? |__|__|

Appendix 10:
THE STUDY AREA — ANTUAMBUI LOCATION

NYAMBENE DISTRICT

KENYA MAP

NYAMBENE DIST.

N

NORTHERN GRAZING AREA

MWIINE VILLAGE

MICNE NTARAKWAI VILLAGE

LUKUNUNU

VILLAGE

VILLAGE

NTUNENE

LOCATION

NAATHU

LOCATION

Heia Sch

Hiune Sch

Lukununu Sch

Nkiriohe Sch

Buaretome Sch

Mwerongondu Sch

Sec.

Lubua Sch

RWONGO LARE VILLAGE

MWERO NTUANUO

ANTUBETWE

LARE

K.K.Kiula Sch

KIONGO

LOCATION

SOURCE: TOPOGRAPHIC MAP FROM SURVEY OF KENYA AND POPULATION EXTRACT OF 1989 POPULATION CENSUS

Karigenyone Sch

Kieni Sch

KIENI KIAITAMA

SCALE 1:100 000

ATHIRU RUUJINE

LEGEND

Location Boundary	—··—··—
Sub-Loc Boundary	—·—·—
Village Boundary	·········
School	●
Hill	△
Crater	
Roads	=====
Market	■
Dispensary	□
Chiefs Comp	▲

LOCATION