A STUDY OF THE PRINCIPAL DETERMINANTS OF SEVERE MALNUTRITION IN PRESCHOOL CHILDREN IN A SEMI-ARID AREA OF KENYA

By

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THESIS

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other university.

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ABSTRACT

In order to investigate aetiological and epidemiological determinants of malnutrition, two groups of preschool children were compared. The study group comprised the total in-patient population of the Kibwezi Rehabilitation Centre for severely malnourished children in Machakos District, Kenya. The control group comprised children matched for age, sex and location who were determined to be adequately nourished.

It was found that the study group differed significantly from the control group with regard to many of the variables examined. Using discriminant analysis, it was found that income (amount and source), education, marital status, birth interval and land availability were the most significant variables differentiating the two groups. A table was developed which, using selected indicators of risk, is able to correctly identify between 73.4 and 92.5% of children potentially at risk of becoming severely malnourished.

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CHAPTER I

INTRODUCTION

1.1 Statement of the Problem

One factor that is invariably associated with malnutrition is poverty. This seems to be true the world over, and contributes to what Taylor and Taylor term "the multifactorial causation of malnutrition"(1). Countries that are less developed industrially suffer from more poverty than those which are industrially developed. They also have higher rates of malnutrition. Small children are at higher risk of suffering from malnutrition than other sectors of the population. Their high death rate is the chief factor that distinguishes between the state of health there and in the more developed world. In many of the poorer countries, two thirds of all deaths occur among children under the age of five years (2).

One of the effects of malnutrition on infants and small children is a retardation of growth. This is associated with a lowering of immune competence which renders them susceptible to more infection. Childhood diseases such as measles and diarrhoeal disease affect children everywhere. Yet, while fatalities from these illnesses have long been rare

in developed countries, death rates among children who contract these diseases in poorer countries still constitute a significant proportion of total deaths. Neither a variation in the virulence of the measles virus in different countries nor variations in human immunity explain these differences (3). Evidence points to nutritional factors as the primary cause of these radical disparities in the diseases' impact. Kielmannn and McCord have shown that the risk of mortality doubles with each ten percent decline below eighty percent of the Harvard median of weight for age (4).

In Kenya, a developing country, poverty is widespread. There is no exception to the universal pattern of high death rates among children caused by the interaction of infection and malnutrition. But while the basic aetiology of malnutrition within Kenya does not vary, there are considerable differences in the prevalence of the disease from one area to another and from one tribal group to another. Some of these differences may be accounted for by geographical and climatalogical variations. There is greater nutritional stress in an environment where rainfall is unpredictable. Kibwezi Division is one of the more drought-prone and sparcely populated parts of Machakos District. *It has one of the highest rates of severe*

malnutrition both in the District and in the country as a whole (5,6).

Apart from poverty-related factors, social and cultural practices including the treatment of measles and diarrhoea, and local taboos, may be factors which contribute to the prevalence of child malnutrition in the area.

1.2 Overall Aim and Scope of Interest

It was with the above considerations in mind that I decided to investigate the factors associated with severe malnutrition in preschool children of Kibwezi Division. Severe malnutrition in children is defined as weight-for-age below sixty percent of a reference median. Children who are severely malnourished constitute a risk group for increased mortality.

The aim of the study, therefore, is to improve the understanding of the causes of severe malnutrition. Are there any within- or between-family characteristics that could be used to act as predictive indicators of children who may become severely malnourished? Why do some families who live under harsh conditions manage to keep their children moderately - or even well - nourished while children of other families with comparable poverty levels succumb to the synergistic effects of nutrition and infection?. Are there any subtle

socio-economic or cultural characteristics that result in differential risks being present in what appears to be a homogeneous ecological and cultural milieu?

Identification of the factors that are important in the aetiology of severe malnutrition could assist planners to develop appropriate interventions and enable health workers to identify "at risk" families as early as possible. Early identification and intervention would prevent hospitalisation or mortality of children in this Division.

1.3 Research Objectives

Having delineated the broad area of interest and having decided on overall priorities of the investigation, specific research objectives were worked out, the main objective being:

To study and establish principal determinants of severe malnutrition among hospitalized preschool children in the Kibwezi Division of Machakos District.

This main objective was subsequently broken down into the following sub-objectives:

To determine a possible relationship between the nutritional status of a child and:

1. The family composition (variables: mother's marital status, number of children on compound, sex of the head of household, caregiver of child, age of the mother).
2. The socio-economic status of the family (variables: education, sources and amount of income, land ownership).
3. The sex of the child or whether any one specific age group is at greater risk of malnutrition than others.
4. Multiple birth or birth interval between siblings.
5. Cultural practices that might contribute to the development of severe malnutrition. (variables: taboos associated with infant and child feeding practices).
6. Knowledge about the aetiology of one common childhood disease (diarrhoea) and how it is recognised.

These objectives and subobjectives were intended to be both pertinent to achieving my aim as well as being attainable under the constraints of the time available for fieldwork.

1.4 Chronological Overview of Investigation

The original protocol for this investigation was worked out in a course on "Project Planning and Development" early in 1986. The particular area of research was chosen for several reasons:

1) The African Medical Research Foundation (AMREF), was agreeable to allowing a student doing a research project within the framework of one of their projects.

2) The administrator of the rehabilitation centre in Kibwezi, Ms. R. Biteyi, was a personal friend. She had worked at the centre since its inception and felt that the children admitted for severe malnutrition had certain family characteristics that seemed to be consistently present.

   Dr.P.Stanfield, Head of the Department of Community Health, AMREF, who support the Rehabilitation Centre, endorsed the idea of testing empirically the intuition of Ms. Biteyi.

A subsequent search of the literature on severe malnutrition and its determinants revealed that this type of research had already been undertaken in other parts of the world. My supervisor and I thought it might be important to

repeat the research in Kenya to see if we would obtain comparable results.

Investigations were spread over seven months, from January 1987 to August 1987. Data cleaning and analysis were done between September and December 1987.

CHAPTER II

REVIEW OF THE LITERATURE

2.1 Severe Malnutrition - Causes & Consequences

In 1974, Henry Kissinger made a plea to the world. This plea was that, by the year 1984, no child should go to bed hungry. It is debatable whether global hunger decreased at all during that decade (3). Certainly, hunger as manifested by levels of malnutrition, is increasing in some parts of the world (2). The problem is not so much that public health programmes are failing, as that there is a demographic expansion of the world's child population. This expansion actually assures that the absolute number of children with severe clinical forms of malnutrition will continue to increase (2). Progress has been made, however, in the understanding of the causes and consequences of malnutrition not only at the individual and family levels but also at national and international levels.

"Poverty as a primary cause of malnutrition underlies most other causal factors" (1). It is, for the most part, a problem of the developing world. Consequently, poverty-related malnutrition continues to be a major public health problem in these regions. No developing country is spared the tragedy

of malnutrition that results in the unnecessary and premature death of millions of children every year. Sub-Saharan Africa has the greatest poverty levels in the world. Statistics show that African populations have poor standards of health and that levels of malnutrition are increasing.

The poor in Africa mostly live in rural areas. They comprise almost entirely subsistence and small scale farmers (2). It is this sector of the population, and particularly their young children, that are most vulnerable to malnutrition.

The social consequences of malnutrition are manifested every day in poor countries. The death of a child resulting from malnutrition, is tragic not only for the immediate family but also for the whole community.

Although death is the final outcome for many children suffering from severe malnutrition, survival leaves those affected with permanent handicaps. Studies show that chronic malnutrition can affect a child's learning ability and mental development as well as its physical growth (7).

2.2 Relationship between Malnutrition & Infection

Apart from dying from malnutrition, many children in developing countries continue to die from illnesses and infections that are, in the developed world, considered to be innocuous illnesses of childhood. They include; diarrhoeal disease (DD), measles and

acute respiratory tract infection (ARI). These three illnesses alone account for up to three quarters of childhood deaths in Africa, Asia and South America (3).

It is not a coincidence that children continue to die from childhood diseases since concomitant to severe malnutrition, susceptibilily to illness is increased (8). These two factors have been shown to be inextricably linked. Although only recognised and understood recently, it is now known that there is a synergistic effect between these two factors. "The relationship is synergistic because the consequences of malnutrition and infection together are usually greater than would be predicted from studying either alone"(8).

Malnutrition has been found to be associated with a lowering of immune competence which renders an already malnourished subject susceptible to infection, which in turn, further affects the nutritional status of the subject. The result of this complex interaction is a downward spiral leading to nutritional dwarfism (stunting), increased mortality risk and ultimately, for many children, death (4).

Infections of almost any degree of severity worsen nutritional status. The complex interactions involved in such infections include; decreased appetite, vomiting and increased catabolism

resulting from fever and intestinal malabsorption (8).

One recent study on the biochemical aspects of malabsorption in marasmic children showed that the malabsorption may stem from an interplay of a number of factors. These include diminished pancreatic function and changes in the intestinal microflora and mucosa (9).

2.3 Poverty-related determinants of malnutrition

Although poverty is the underlying cause of malnutrition, specific determinants that are poverty-related have been pinpointed by researchers as being important in its aetiology and epidemiology. The studies which have been undertaken have not just been confined to one country or continent, but have been repeated in every region where malnutrition is prevalent.

The variables that have been examined and found to be associated with malnutrition are numerous and diverse. They have been drawn from the social, cultural and economic environments of populations that are vulnerable to malnutrition.

2.4 Determinants that have been studied.

Socio-economic status has frequently been shown to be associated with malnutrition. However, this factor can be measured in many ways and many different aspects have been examined. These include

land tenure, agricultural production, household income, educational level of mother or father, cash cropping and father's occupation. Other demographic and cultural variables have also been implicated as factors that influence nutritional status.

2.4.1 Land ownership.

One measure of wealth - especially in traditional societies - is land ownership. This is understandable, for it is within traditional, "underdeveloped" societies that there still exists a heavy dependence on the soil to produce the subsistence crops necessary to feed a farmer's family.

Land tenure is an important determinant of the quality of life in Latin America and therefore most probably affects the health, growth and mortality of small children. Most of the evidence for linking land ownership and nutritional status comes from this region. However, rather than just making a division between landowning and non-landowning groups, some researchers have sought to link the amount of land that a family owns with mortality and malnutrition (10,11,12).

Findings are, however, sometimes contradictory. While all studies seem to agree that landlessness is a risk factor in malnutrition, not all studies agree that land size is associated with malnutrition.

In Guatemala, there were high prevalences of low weight/age in children of farmers and labourers (29% & 28%). However, nearly all the farmers owned only a small amount of poor quality land, below the minimum recommended by most agrarian reform laws. Among the children of farmers, there was an inverse relationship between the prevalence of malnutrition and the amount of land owned (11).

In Costa Rica, one study revealed a higher prevalence of low weight-for-age among children of labourers and farmers owning less than 1.4 hectares (3.5 acres) relative to those of larger landowners (12). However, in another Costa Rican study (13), prevalences of low weight/age were only marginally higher for children of labourers compared to those of farmers. This study failed to detect an association between the nutritional status of the children and land size in the landowning group.

Victora and his colleagues (10), in Southern Brazil, found that mortality risk was greater in children of the landless than of landowners. However, this study also failed to detect an association between the amount of land owned by the family and malnutrition.

In India, landlessness was cited as a factor linked to malnutrition and child mortality (4). Kielmann and McCord observed that the children of the landless suffered more frequently from seasonal malnutrition than those of landowners and that the

mortality risk was, therefore, greater. In a parallel study in the same region, it was found that parents of well-nourished children tended to be landholding farmers - probably more a reflection of their high caste than any other factor. Within the high caste group there were, however, some families who did not own land. It was found that those who were high caste and owned land had the least number of undernourished children out of all the groups. The difference was, however, not statistically significant (14).

In one study in Nepal, landholding was found to be positively and significantly associated with almost all measures of nutritional status (15). In a later Nepalese study, Nabarro (16) also linked nutritional status with landholding. He found there was a higher prevalence of wasting among children of small farmers as compared to large farmers - particularly in the 36-59 month age group. The children of small farmers also had a higher prevalence of stunting in the 12-35 and 60-95 month age groups.

The relationship between socio-economic status, morbidity, food intake and growth was the subject of a Bangladeshi study (17). In this investigation, one of the socio-economic variables used as an indicator of wealth was land for "possession of land is a crucial indicator of wealth in Bangladesh". They showed that children coming from low socio-economic

groups consumed less food and experienced longer episodes of diarrhoeal disease than children from high socio-economic groups. The author noted also that there was considerable inequality in landholding between the groups.

Likewise, in another study from Bangladesh looking primarily at sex difference and nutritional status, it was found that "the better nutritional status of boys and girls in the highest land-tax group (i.e. the larger landowners), is a reflection of the positive impact of resource availability" (18).

In Africa, fewer studies have examined the relationship between land tenure and nutritional status of children. In one Nigerian study examining the epidemiology of malnutrition, the authors noted that "good nutritional status in children was significantly associated with the paternal occupations of tradesman, mechanical and clerical workers, while poor nutritional status was significantly more common in children of farmers and herdsmen" (19).

In Kenya, there has been a considerable amount of research into nutritional status and land size and ownership. Indeed, nationwide there have been three Rural Child Nutrition Surveys within the last ten years. The 1979 - 1983 Development Plan listed the landless poor as a nutritionally deficient group within the country (20).

One recent Kenyan study discussed the extent of child malnutrition among strata of the rural Kenyan population as defined by province, occupation of the head of household, size of landholding and cropping patterns. For this study, the authors took the disaggregated data from the nationwide nutrition surveys and combined it so that national generalisations could be made. They note that "Because land varies greatly in economic value - due to differences in soil fertility, rainfall, location and use of agricultural inputs - the association of land holding area with household income and with the prevalence of malnutrition is not likely to be same in all areas" (21). Their findings show, however, that rural non-agricultural households in occupations other than those which could be classified as "professional" have a prevalence of malnutrition (as measured by stunting) of 21%, that is, midway between those of small and large landholders. Landless agricultural workers and smallholders have slightly more malnutrition - 24%. Households with larger farms had a lower prevalence of stunting than smallholders.

In summary, they found that the "substantial majority of the malnourished are among the smallholders and the landless and that there is an association between increased landholding, increased income and better nutrition" (21). This result is

other proposed risk factors was reduced when income was considered (23).

Another Brazilian study looked at the influence of economic deterioration on the nutritional status of infants (0 - 24 months) in that country. A severe economic deterioration, affecting employment, family income and purchasing power and accompanied by inflation, occurred in the years following 1978. However, no adverse anthropometric effects were observed suggesting a certain degree of buffer capacity among the prevailing dietary habits (24). Although land tenure was found to be the primary variable affecting nutritional status in the study by Victora and his colleagues (10), they also noted that income and land tenure were inter-related, and that the men who laboured for cash income were those who owned less than 1.5 hectares (3.7 acres) of land. Among those who obtained a cash income, there was such a limited range in the variation that a division of the group for analytical purposes was not possible. However, in an earlier paper, the authors use data from the national census which is taken every ten years to investigate trends in infant mortality. Their analysis revealed that higher infant and child mortality is associated with poorer levels of nutritional status. They also observed that although there has been a general decline in infant mortality during the decade 1970

-1980, the relative risk of child mortality for low status employees (labourers) is greater than for high status employees (self-employed and employers). This latter group have mortality levels significantly below those of low status employees (25).

One extensive aetiological study in Colombia found that there was less malnutrition in the higher income groups but that in respect to nutritional status of children, family income made a difference at every level (26).

In Guatemala an investigation of an ethnically homogeneous infant group living in a relatively undifferentiated preindustrial peasant community was conducted. The investigators observed that higher weight gain children tended to come from families having a higher per capita annual income (27). Also in Guatemala, Valverde tested the hypothesis that there is a relationship between father's occupation (and therefore income) and the nutritional status of young children. He also observed that the amount of land owned significantly influenced nutritional status. When the variables were subjected to multivariate analysis, however, he no longer found the difference to be significant. In this analysis, father's occupation was the variable most strongly correlated with nutritional status (11).

In contrast to the above findings, in Mexico, a case-control study, was undertaken in which the cases (severely malnourished children) were matched at birth for gestational age, body weight and total body length. The authors found no significant association between family income and the presence or absence of severe malnutrition (28).

Indian studies investigating nutritional status and family income or father's occupation offer more consistent evidence for such factors to be considered as determinants of severe malnutrition. An early study in rural India divided people of all ages and both sexes into three income groups depending on the type of house they lived in. Previously, they had found this to be a reliable proxy indicator of income. The people of the highest income group were found to be taller and heavier than those of the lowest income group. They also found preschool children in the lowest income group were malnourished (29).

Likewise, another study in rural Punjab, which was part of the extensive Narangwal Project, found that the monthly incomes of families of underweight children were significantly lower than those of well-nourished children regardless of caste (14). A very recent study in another Indian state examined ecological factors and the nutritional status of nursery school children. They found mild and

moderate malnutrition to be common among rural children but that the incidence appeared to be lower at the higher economic levels. Using an income level score comprising land size, daily wages, assured monthly income and cattle ownership, they found that nutritional status was significantly related to income level (30).

Nepalese studies confirm these findings (15,16). Matorell and his colleagues examined the characteristics and determinants of child nutritional status in two districts of the Terai region of Nepal. Children between the ages of 3 and 10 years were studied and anthropometric measurements taken. The extent of malnutrition found in the study is among the highest that has been reported outside of extraordinary deprivations occurring during events such as war and famine. One of the findings was that household income was positively and significantly associated with almost all measures of nutritional status (15).

Two studies from Bangladesh, although not offering conflicting results, suggest that the case for always assuming household income to be a determinant of malnutrition may not be valid. One study, investigating the relationship between socio-economic status and morbidity, food intake and growth in young children, found that after controlling for age and sex, the values of weight

and arm circumference varied directly with the wealth and income indicators used. Futhermore, they concluded that "As found in other studies in other parts of the world, the children in rural Bangladesh with richer or better-educated parents are more likely to consume a greater variety and quantity of foods, are less likely to be ill and will have better than average growth" (17).

The need for caution is, however, expressed in the second Bangladeshi study in which weight-for-age showed some relationship with socio-economic status (as measured by ownership of land and specific household articles, taxes paid, and education). The model that they used was significant, but they observed that a large amount of the variation in the dependent variables was unexplained. For this reason, they question whether the stratification of households by the socio-economic categories is the best approach. By using such categories in the analysis they couldn't really differentiate well enough between the strata to observe a wide variation in child nutritional status (17).

Very few studies of malnutrition appear to have been carried out in the Middle East. However, one Jordanian study, entitled "The Patterns of Protein-Energy Malnutrition in Early Childhood in Jordan", compared 99 children hospitalised for malnutrition with a control group. The authors found

that "compared with the controls, the malnourished had lower incomes" (31).

African studies investigating the determinants of malnutrition support the general findings that family income and/or father's occupation are important factors related to the nutritional status of young children. In Nigeria, West Africa, a study that used socio-economic variables in a survey with the aim of identification and integrated management of children at risk of becoming severely malnourished, showed that a "nutritional advantage" exists for children whose fathers are in skilled - and therefore better paid - employment (19).

In another region of Nigeria, a study was undertaken to investigate the feeding patterns of 115 consecutive cases of protein-energy malnutrition as seen at a paediatric outpatient clinic of the university teaching hospital. Although the study was not specifically investigating the determinants of malnutrition, the authors point out that the majority of the cases seen had parents who were petty traders (e.g. vegetable hawkers) or subsistence farmers. The inference that can be drawn from this study, is that it is within the low socio-economic groups that malnutrition is most common (32).

A recent West African study - in The Gambia - examined the socio-economic factors associated with

child growth. The authors concluded that, among the group of children they studied, height-for-age is the index most closely associated with socio-economic factors (e.g. father's occupation, sanitation, size of house, number of livestock on compound). When looking at seasonal factors which influence child growth, they found that the children from both the well-off families and not so well-off families suffer nutritionally during the lean and rainy seasons. This is reflected in reduced growth velocities for both groups. The catch-up growth of well-off children during the best seasons however, is greater than for the not so well-off. This observation accounts for the nutritional advantage as shown by the greater height increases in the well-off group (33).

In Southern Africa, a comprehensive body of research has aggregated in the field of nutrition. However, only one study on malnutrition and its associated variables was found. This was a study in South Africa, where the study group were children of Indian ethnic origin in a region of Natal Province. The study took children from three dwelling areas where the majority of inhabitants worked for the same group of companies. This allowed for an in-depth assesment of occupational characteristics of the children's' parents. The children were classified according to their nutritional status.

The findings of this study conflict with most studies already mentioned for they observed that "no significant differences were found between per capita income of the severely malnourished, moderately and adequately nourished families" (35). East Africa has been another area of intensive nutritional research. Kenya, especially, has been the focus of attention for investigation into patterns of malnutrition. However, few investigations seem to have examined the epidemiology or aetiology of severe malnutrition. What can be gleaned from the available literature, is that in Kenya, the factors associated with malnutrition are consistent with those found elsewhere, that is, there is a general association between increased income and better nutrition (5,6). A major work entitled "Food poverty and consumption patterns in Kenya" was published in 1986 by the International Labour Organisation (I.L.O.), a body of the United Nations. The study, while not concerning itself with the issue of nutrition per se, offers results that have important implications for the present study. If one makes the assumption that food scarcity is an important factor in malnutrition, the findings of this study are relevant. The authors state that "On the basis of expenditure elasticity estimates.....it can be argued that food energy alone is very nearly

luxury good for poor households" and "household income was by far the most important variable affecting food consumption". They further add that "Food consumption is highly sensitive to prices" (34). The implications that can be drawn from this study are that household income does affect nutritional status in Kenya. This study, therefore, appears to support the evidence from the majority of studies reviewed, namely, that income is an important determinant of nutritional status in young children (34).

Although income is important in determining nutritional status, it remains, nevertheless, only a contributory factor in the "multifactorial cause of malnutrition".

This is borne out by a study from Ethiopia that looked at the change in nutritional status of children as a result of increased household income. The authors observed that the cultivation of khat (miraa) has appeared to change the lifestyle of many farmers in the region under study. They noted that those farmers who have begun to grow khat have replaced their thatched roofs with corrugated iron and have aquired prestige items such as transistor radios and vehicles - in other words - their incomes have increased as a result of growing this lucrative cash crop. The farmers who cultivated khat were found to have a cash income three times higher than

farmers who did not. The authors postulated that if income determines nutritional status, then children from khat producing families should be expected to show a higher nutritional status than children from families producing other crops.

The results showed that the nutritional status of children in khat producing families is slightly better in the khat growing families but the differences are smaller than might be expected from the large differences in cash income of the two groups (35).

One further East African study discusses the possibility of income being important in the aetiology of severe malnutrition. The investigation was carried out at the university teaching hospital of Dar-es-Salam in Tanzania. The results of this study, which was investigating the aetiological factors associated with marasmus and Kwashiorkor among hospitalised children, revealed that the employment status of the father was an important factor. The fathers of the majority of the severely malnourished cases studied (59%) were either unemployed or peasants. They also observed that, among those fathers who were employed, only 10% earned more that US$300 per year. In addition to this, the authors note that "Some of the mothers gave a history of family neglect by those fathers who earned a salary" (36).

2.4.3 Parental Education.

Another widely investigated variable in the search for determinants of malnutrition is education - particularly that of the mother for it is she who usually has the responsibility of feeding and caring for the children. Lack of education - and therefore knowledge - in the caregiver is a plausible explanation for a child being malnourished.

Evidence from the literature, relating low education with poor nutritional status in children, is not as strong as might be expected.

One Brazilian study shows that there is some degree of association between a mother's education and the nutritional status of her children but that it is not a major risk factor (23).

Several studies in Mexico have investigated this determinant with varying success.

Sanjur (38), remarks of his study that "the findings confirmed the character of the typical familial complex in developing societies that is held to be the root of malnutrition problems in those areas; large families, high birth rate, low levels of education and minimum contact with contemporary knowledge". He also found that mother's education was consistently associated with infant feeding practices. "The more education a mother had, the more modernizing practices she used, and conversely,

the less education the more traditional practices she used".

A later Mexican study, however, found no significant relationship between the presence or absence of severe clinical malnutrition and the variables of literacy and educational level (28).

The author's observations in Mexico conflict with his results from some earlier research in Guatemala. While investigating the ecology of infant weight-gain in Guatemala, he reported that "a significantly higher proportion of fathers and mothers of the low weight-gain children were totally illiterate" (27).

Mata's observations from Guatemala and Costa Rica led him to propose that "the ultimate causes (of malnutrition) are low socio-economic development, deficient education, and low sanitation". He then develops the concept of "maternal technology" and explains how this technology is a distinct determinant of the malnutrition complex. He defines maternal technology as "pertaining to practices, traditions and beliefs relating to food preparation, feeding techniques, child care during illness and convalescence, handling of drinking water and faeces and personal hygiene" (39). Plainly, all the factors in the definition refer to the education of the mother and her cultural beliefs and practices

In Costa Rica, Rawson and Valverde found that the educational level of neither parent was significantly related to nutritional status. They do, however, note that, although 75% of the fathers and 60% of the mothers did not go beyond the third grade in school, most are functionally literate. They also observed a high level of awareness of the nutritional quality of specific foodstuffs (12).

A Columbian study may elucidate the issue. When using mother's education as a variable in the investigation of causal factors in P.C.M., the authors found no significance when education was divided into 0-2 years of schooling versus 3 or more years in a subsample of the group. However, dividing the mothers into literate versus illiterate in the total study population, the association was highly significant (26).

Studies from the Indian subcontinent support the possible value of educational status as a causal factor. Rao, investigating the nutritional status of nursery school children, observed that "lack of knowledge (in mothers of malnourished children) seemed to be a contributory factor since most of the women had access to low cost foods such as cereals, pulses, oilseeds and vegetables" (30).

In Bangladesh mothers' education was found to have a positive impact only on the nutritional status of male children. However, when fathers educational

status was also taken into consideration (more than 5 years' schooling), there was a positive impact on both boys and girls nutritional status (17).

Evidence of the positive correlation between educational status and nutritional status is further supported by another Bangladeshi study where the "education of the head of the household was correlated with the intake of all types of protein, energy and Vitamin A. Mothers' education was significantly correlated with the amount of protein from animal sources specifically. The authors conclude that children in rural Bangladesh who are born to richer or better-educated parents are more likely to consume a greater variety and quantity of foods, are less likely to be ill and will have better than average growth (17).

In Nepal, however, neither mothers' nor fathers' educational status was found to be significantly related to the nutritional status of their children (15).

African evidence relating nutritional status with education is fragmentary and conflicting. In Tanzania, one study shows in the form of a diagram that illiteracy is an important maternal factor in the aetiology of marasmus and Kwashiorkor but fail to discuss it in the text (36).

A study from South Africa failed to demonstrate a relationship between malnutrition and educational

level. In this study it was found that, in Indian preschool children, there was no significant difference in the the mothers educational status of the well-nourished and malnourished groups (34).

2.4.4 Family-related Variables

Studies examining the aetiology of malnutrition rarely consider only one factor. Although some variables (e.g. land size and income) are tested more often than others, other sociological variables are often included in a survey. These include demographic variables such as family size, mother's parity, marital status, age and mortality experience as well as variables such as birth order and interval, sex of the head of the household and average age of the malnourished children in the community.

In a Columbian study, investigating the epidemiology of malnutrition, both birth order and family size were found to be statistically significant. Differences in the prevalence of malnutrition were found between children who were the 5th or less, or 6th or subsequent child in the family. "The prevalence increases with birth rank much as it does with family size per se" (26). Birth interval did not reach significance ($p < 0.065$) although the authors observed that "almost three fourths of these (the malnourished) children were followed by a sibling in less than two years". They recommend a

birth interval of at least three years between children in this community to protect the older sibling (26).

Conflicting results were obtained in Mexico. In one study, no significant difference was found between malnourished and control groups with respect to family size (27), yet, in an early study, the findings of one of the authors supported the hypothesis that large families and high parity were important factors in the quality of infant feeding (38).

In Costa Rica, the presence of more that one preschool child in the family constituted a statistically greater risk of the children being below normal weight for age (12).

When birth order was examined in India there was no statistical evidence to prove that it was an important factor in the aetiology of protein calorie malnutrition. Family size, also, did not reach significance although the authors state that the underweight children tended to have more siblings than their well-nourished controls (14). In a second Indian study, nutritional status was related to the number of children in the family. Interestingly, the total family size and birth order had no significant bearing on nutritional status (30).

Birth order as a risk factor did obtain significance in Nigeria (birth order greater than four years),

and in Indian children in South Africa, where it was observed that weight for age was lower in later born children than their siblings (34).

In Tanzania, it was observed that among hospitalised marasmic and Kwashiorkor children multiparity was a common factor in the mothers' histories. The average number of pregnancies per mother was five and over fifty percent of the mothers had lost one or two children" (36).

Although the literature available from the lesser developed countries of South East Asia is scarce, in the Phillipines, Guzman and her colleagues found a correlation between nutritional status and family size; the greater the number of children in the family , the more malnutrition (40).

2.4.5 Cultural and Demographic Factors

A range of other factors that may be classified as cultural or demographic have also been examined in relation to nutritional status. Of the cultural variables that have been researched, sex bias as shown by the differential feeding or nutritional status of children, is definitely the most widely found. The results depend for the most part on the society being investigated. Generally, in societies where there is a pronounced preference for male children, the evidence supports a sex bias in nutritional status (17,14,31,42,). In societies where there is a less pronounced preference for male

children (or no preference at all), no differential in nutritional status is observed (12,15). Contradictions do exist however, where studies in the same ethnic group have variously found evidence of sex bias or a trend towards it (12, 26).

When there is a preference for a child of a particular sex, it is usually a male child. Documented evidence of a preference for female children is less common. Two studies in Kenya, however, have reported differentials in nutritional status where girls were found to be better nourished than boys. (*personal communication). Yet another study, investigating food consumption of different household members, observed no difference in the type and quality of diet in either sex at different ages - except for toddlers who were generally considered a vulnerable group (42).

One notable result comes from South Africa where female children were found to be nutritionally better-off than male children. According to weight-for -age classifications, more males were severely malnourished than females. This result is interesting considering the study group was children of Indian ethnic origin (34).

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* 1. A.A.J.Jansen, results of a Kilifi study.

2. H.Wright, Embu report. 1986 (unpublished).

In Jordan, Kwashiorkor was found to be more prevalent in male children than in female children whereby marasmus was more common in the females (13). This could be evidence of a sex bias - especially when recent research on Kwashiorkor (suggesting that it is not a nutritional deficiency but a result of aflatoxin-contaminated food), is taken into account (43).

Other cultural factors that have been studied and were found to be associated with nutritional status include breastfeeding and weaning practices, treatment of child illness and feeding taboos (33,38,40,45).

One demographic variable that has frequently been investigated is multiple birth. Research suggests that this factor is important as a determinant of malnutrition, especially in newborn babies. This is conceivable as, with two or more infants being born simultaneously, problems such as insufficient breastmilk, lack of time for each child, not to mention lack of financial resources to feed and pay medical expenses would be important factors.

Studies demonstrating an association between multiple births and malnutrition have shown only positive associations (36).

The age of the mother when she gives birth or when she delivers her first child and age of the child when it becomes malnourished have also been

implicated in the aetiology of malnutrition. Most studies demonstrate that age may be a risk factor or a determinant (16,19,26,34,38).

2.5 Summary

Within the field of malnutrition, the search for possible clues as to its epidemiology or aetiology has been extensive. This is understandable, for the problem of child malnutrition is one of the greatest challenges of the world today. Methodologies and designs have varied considerably from one research project to another, as have the factors under study. Some studies have examined food intake and associated variables while others have concentrated on child growth and the variables that seem to be crucial to child wellbeing and survival. Some studies have concentrated on socio-economic factors, others on possible cultural indicators. As well as this, studies have been undertaken in different countries. vulnerable groups have been drawn from widely differing cultural backgrounds. Some studies have focused on rural populations and others on urban dwellers.

Considering that the evidence from the literature as to the existence of specific factors associated with malnutrition is so diverse, there exist only minor contradictions.

Certainly, poverty is the underlying malady, "in fact, some authors assert it is meaningless to

separate the interactive effects of poverty and malnutrition" (45) But this is not the sole component of malnutrition. There certainly exists an interaction between income, education, cultural practices and taboos that are, in specific environments, the deciding factors between malnutrition and good nutrition in children.

2.6 Justification for Study.

The one universal determinant of malnutrition is poverty and it is its alleviation that is the most pressing problem of the world today. However, to alleviate poverty per se is a gargantuan undertaking that no one country or group of countries can tackle alone. We must, therefore, be content with doing what we are able to alleviate specific problems where it is feasible. Certainly, the move towards community self-help and community based health care in a move in the right direction.

The main justification of this study therefore, is to provide a tool for the early recognition of children potentially "at risk" of becoming malnourished by determining specific markers of risk within a specific community. If one can determine a realistic and reliable group of indicators of high risk, this may be used by community health workers in Kibwezi Division to identify high risk families and take appropriate preventative measures. It is envisioned that preventative interventions may

include monitoring of the risk families, early vaccination of the children and nutrition education for the parents.

It is also envisaged that this identification method, if successful, could be applied to other high risk communities in Kenya.

Lastly, this investigation may fill a gap in current knowledge of severe malnutrition and its determinants in East Africa as very few studies of this nature have been so far been undertaken.

CHAPTER III

STUDY SITE POPULATION AND EXISTING INFRASTRUCTURE

3.1 Research Site.

The study was conducted in Kibwezi Division, Machakos District, Eastern Province. The town of Kibwezi is situated two hundred kilometers from Nairobi on the Nairobi-Mombasa road. The Division is bordered by the Chyulu Hills to the west and the Athi river to the east.

The area is semi-arid with an average annual rainfall of 510mm. The rainfall has a bimodal distribution. Overall, however, the rains are very unpredictable, failing five out of every seven years. This, in combination with infertile and eroded soils in much of the Division, results in generally poor agricultural yields.

The Athi River area, which forms the eastern boundary of Kibwezi District, has river-fed irrigation schemes where commercial crops for both home and export markets are grown (okra, brinjals, beans, lemons, grapes).

For the most part, however, subsistence farming remains an important economic activity with maize, beans, pigeon peas and cowpeas being the most important crops.

The population of the Division was just under 100,000 according to the 1979 census. However, because of high in-migration - especially from other parts of Machakos District - the present population may be as high as 150,000. The majority of the people are ethnic Kamba who live in traditional rural compounds composed of mud roundhuts with thatched roofing. A small, but growing, population have a more urban lifestyle. These people live in Kibwezi town and villages such as Machinery, Makindu, Kambu and Mtito Andei all of which are situated on the Nairobi - Mombasa road. They are usually engaged in either trade ("hotel owners") or wage labour.

Two important industries in the area are Dwa sisal estate, that employs labourers, teachers, health staff and technical staff and the Kibwezi Womens' Beekeeping project. There are also many self-help projects in the area. The Kenya Railways, the District Administration and a few other government or parastatal bodies provide some employment.

3.2 Health Facilities

Apart from the Makindu District Hospital, the main health care facility in the Division is the Kibwezi Health Centre. The Centre is the result of a project started in 1977 by AMREF. The project, called the Kibwezi Rural Health Scheme, consists of two mutually supportive components. One component is a

centrally located health centre which has both out-patient and in-patient facilities, training facilities, a nutrition rehabilitation unit and a Mother Child Health (MCH) unit. The other component is the community-based health care programme that trains community health workers and traditional birth attendants.

The Kibwezi Health Centre is now run for the most part by the Ministry of Health. The African Medical and Research Foundation (AMREF) is only responsible for the nutrition rehabilitation centre and the community-based health care programme. The rehabilitation centre was set up initially to cope with the acute malnutrition caused by the 1984 drought. After the drought ended, mothers continued to bring severely malnourished children to the centre. As a result of this apparent need, the rehabilitation ward was retained. The ward has now been in operation for two and a half years. During this time, approximately three hundred children have been admitted suffering from severe malnutrition - an average of ten per month.

The staff of the rehabilitation centre consists of an administrator, an agricultural officer, a nutritionist, one nurse, two assistants (nurse aids) and a driver.

Children are usually admitted to the centre together with their mother or caregiver. The children are

weighed on admission and an extensive family history is taken of each mother. During her stay in the clinic, each caregiver is given nutrition education theory which is reinforced by the her having to assist with the cooking of meals for the inpatients. There is also an agricultural component to the programme whereby the mothers can obtain information and advice on crop husbandry. Seeds are also distributed to the mothers.

Apart from the centre activities, the staff go into the field, assisting with mobile clinics and following up former in-patients. Follow-up is done in all parts of the Division.

The existing nutrition rehabilitation unit thus provided the infrastructure for this investigation. Information on each patient was extracted from the records of the centre so that the mother or caregiver of each in-patient could be traced. Because there was already home-visiting by the centre staff, the two data collectors were able to accompany them and perform the interviews. The centre also provides fortified dried skim milk powder (DSM) to former in-patients who come to the centre to collect it. This enables them to monitor the children's nutritional status. For these reasons, the location of the study population was ensured.

The control population was drawn from the adjacent MCH clinic. As mothers brought their children in for immunisation or for treatment of minor ailments, the clinic nurses would single out suitable controls for the study (i.e. same age, sex and sub-location as the study children). As well as this, where possible, controls were located in the field, once again during mobile clinic expeditions and follow-up visits.

3.3 Problems encountered

The first problems encountered were in the initial phase of the research. There was a delay in the granting of the research permit due to a misunderstanding with the granting authority. Permission for research was finally granted in January 1987. A problem also arose with the interviewers. Both interviewers were resident in Nairobi. They had to relocate in order to do the interviewing. Both interviewers agreed to this but there was a delay with the vehicle that had been promised to transport their household. For these reasons, the pilot study was delayed by five weeks.

It became evident during the pilot study that our original method of finding controls (which had been to draw the control child from the village of the study child) was not feasible. The nearest family was often more than half a mile away and more often than not there was no suitable control in the

family. Therefore it was decided to draw control children from the health centre who came from the same location. At the same time, as many controls as possible were obtained while in the field. On comparing the two types of controls, there did not appear to be any bias so our final method was to draw controls from both sources.

CHAPTER IV

STUDY DESIGN & METHODOLOGY

4.1 Introduction

The objective of the study calls for the identification of maternal and household risk factors associated with severe malnutrition. The methodology for this investigation was to interview mothers whose children had been severely malnourished to determine how they differ from mothers whose children had not suffered from severe malnutrition.

A case-control design was used. The study was partly retrospective and partly prospective. Mothers of severely malnourished children constituted the cases (high risk group). The controls (low risk group) were mothers of adequately nourished children. High risk households were defined as those which had a child admitted to the Kibwezi Rehabilitation Centre suffering from severe malnutrition between January 1984 and July 1987. Low risk households were defined as those households with a child of the same age and sex as the high risk household from the same geographical location who, using standard anthropometric criteria (mid upper arm circumference and weight-for-age), were adequately nourished.

4.2 Identification of Risk Factors

Many clues as to possible relevant risk factors were provided by the Head of the Rehabilitation Centre, Ms R.Biteyi or her staff. Suggestion of other possible risk factors were provided by Dr A.Ferguson as a result of his two studies, "The Kibwezi Integrated Study" and "The Kibwezi Health Risk Study".

4.2.1 Income as a Risk Factor

There were two questions asked about income: the sources of income and the amount of cash income available to the family.

Within Kenya, many men live away from their families in the cities where employment is more readily available. These workers often send money home to their families on a regular basis. Not only do married men send money home, but often an unmarried relative or a relative who has a moderately high income will support the family in the rural areas. It had been observed that the presence of a remitted income seemed to make the difference between adequate nutritional status and malnutrition. For this reason, sources of income was included as a variable.

Income in any subsistence economy is very difficult to assess. This is because a family may obtain a very low cash income but may own a large plot of

land from which they produce enough food to feed themselves adequately. They may even produce a small surplus which they sell or barter. For this reason, some researchers have used proxy variables when investigating income. For this study, cash income only was used although other researchers in Kibwezi Division have attempted to develop proxy variables for income (46).

4.2.2 Land as a Risk Factor

Many studies have examined whether ownership of land is an important determinant of nutritional status among children. In this study, one question that the mothers were required to answer was whether the family own land or not and how much land was available to them to cultivate.

4.2.3 Caregiver as a Risk Factor

The relationship of the caregiver to the index child was a variable suggested by the rehabilitation centre staff. They had observed that many children who were admitted to the centre were living with the grandmother rather than the mother. They had observed that many of the children who had been admitted appeared to be illegitimate children of young women - often schoolgirls. The practice observed was that the child would be given to the grandmother to care for while the mother sought work, often outside of the division in a town. This

observation prompted the inclusion of three variables, the age of the mother at the birth of her first-born child, the age of the mother at the birth of the index child, and whether the index child lived with the mother or some other caregiver.

4.2.4 Marital Status as a Risk Factor

It had been observed that many of the mothers of severely malnourished patients were either single, separated or divorced. For this reason this factor was included as well as another possible factor, polygamy.

4.2.5 Migrant Status as a Risk Factor

Another variable which is related to land ownership and "wealth" generally is the migrant status of the family. If a family has migrated recently to the area, it would seem likely that they may still be struggling to establish themselves. It would also seem to be likely that the people who migrate to Kibwezi Division in search of land stem from the poorer socio-economic groups as this Division is, for the most part, semi-arid and the ground is unfertile. A family was defined as being a migrant family if they had moved to the Division within the last ten years.

4.2.6 Educational Status as a Risk Factor

The educational status of the caregiver of the index child was examined as it had been found in other studies that education of either parent may be a contributing factor in the aetiology of malnutrition. In this study, the educational status of the caregiver was examined rather than of the mother or father. The reason for using the caregiver rather than the mother was that it had been observed that some children lived with their grandmother as opposed to their mother. This would be the person who would be responsible for taking the major decisions about the child's diet and health.

4.2.7 Birth Interval as a Risk Factor

Within this culture, there is a taboo against breastfeeding a child after becoming pregnant with another child. A mother will usually stop breastfeeding her infant within a couple of months of conception of the next child. The early onset of weaning and the early cessation of breastfeeding has been shown consistently to be detrimental to the nutritional status of infants. This is especially so in poor communities where families may lack the money to feed the infant an adequate substitute. It has been shown that in poorer communities, the longer that a mother is able to breastfeed, the better off the child will be nutritionally. If this is the case, then the converse should also be true,

that is, that short duration of breastfeeding is detrimental to the nutritional status of infants and young children. Using this reasoning, it was hypothesised that in this community, whereby a mother ceases to breastfeed after conceiving another child, the spacing between the index child and its next-born sibling may be a determinant of malnutrition.

4.2.8 Age at First Clinic Contact as a Risk Factor

The age of the child at the first contact with a health facility was also a variable suggested by the staff at the rehabilitation centre. They had noted that the mothers of the severely malnourished children admitted to the centre either had no clinic card (and therefore had not been to a mobile clinic or health centre before) or the first entry on the card was later than would be expected.

4.2.9 Cultural Practices as Risk Factors

Many authors have suggested that traditional taboos may influence the nutritional status of children. In this study, we decided to examine whether the taboos relating to the witholding by mothers of food and drink during the illness of young children was a factor associated with severe malnutrition. The taboos that we examined were witholding sustenance during measles episodes, and diarrhoeal episodes and witholding breastmilk during the illness of a child.

A further question was asked to estimate the mothers knowledge of diarrhoeal disease because within this community diarrhoea can be a life-threatening illness for a young already-undernourished child. For these variables, only the data of mothers of study children who were admitted to the rehabilitation centre after January 1987 was used in the analysis. The reason for this was that previous to this, all mothers received some nutrition education while resident in the centre.

4.2.10 Other Risk Factors

Other factors that were thought may be detrimental to a child's nutritional status were: number of children living on the compound (less than five years and less than 15 years of age), child mortality history of the family, multiparity of the mother and sex of the head of the household.

4.3 Tools of Measurement

The main tool used in this investigation was an interview schedule. The questions in the schedule were designed to elicit the indicators of risk of severe malnutrition. Questions pertaining to socio-economic, cultural and demographic information were included.

Other tools used in the investigation were those used for determining the nutritional status of the

study group. These tools were an infantometer, a tapemeasure and a Salter scale.

4.3.1 Development of Interview Schedule

Interview schedule questions were developed to elicit the selected indicators of risk for severe malnutrition. Identifiers were included on the schedule for easy and accurate recognition of subjects. Anthropometric data that was to be collected was also recorded on the front page of each interview schedule.

The schedule was then discussed with other people who had done research in the same area, the rehabilitation centre staff and the two interviewers (who had had many years of interviewing in Machakos district). This was to verify the relevance of the question to be asked and to ensure that the schedule would be acceptable to the target population. We endeavoured to ensure that no questions were included that the target population would find invasive or against cultural taboos. The schedule was then translated into the Kamba language by the two interviewers who worked alongside the principal investigator so that the exact meaning of each question was understood and no ambiguities arose. The schedule was then taken to another Kamba speaker (a medical officer at the Kibwezi Health Centre),

for translation back into English so that the meaning could once again be verified.

4.4 Sample Selection and Sample Size

Purposive sampling to interview all possible former and current in-patients of the Kibwezi Rehabilitation Centre was carried out. Cases consisted of every child that could be located that had passed through the centre. Hence, children included for interviews were selected in three ways:

1. All children who presented themselves at the health facility between 1/1/87 and 31/8/87, and who were diagnosed as severely malnourished, were referred to the rehabilitation centre and subsequently admitted.
2. All children who had been admitted to the rehabilitation centre between 1/1/85 and 31/12/86 and who could be traced by the investigator on one try only (between 1/1/87 and 31/7/87) while accompanying rehabilitation centre staff on follow-up visits to the villages.
3. All former patients who had been admitted to the centre between 1/1/85 and 31/12/86, who presented spontaneously at the centre between 1/1/87 and 31/8/87.

4. All former patients of the centre who the community health workers saw in or around Kibwezi town.

Only one child in each family served as study child although, in many cases, there had been several children from the same family admitted to the clinic at one time. The study child was randomly selected from all eligible siblings and a control was sought for this child.

Children who were not included in the survey were:

1. Present and former patients of the centre who, at the time of interview, were more than sixty months of age.
2. Present and former patients of the centre who had travelled from outside Kibwezi Division to seek treatment.
3. Children who, although they were former patients of the centre, were not found on the scheduled visit made by the investigator and who did not present themselves simultaneously at the health centre.

4.4.1 Identification of the Study Population

The Kibwezi Rehabilitation Centre keeps a day book which records details of every patient who is admitted for severe malnutrition. On entry to the clinic they are assigned an in-patient number and demographic information is recorded. In addition, a

staff member has an in-depth interview with each mother or caregiver during her stay in the centre in order to obtain pertinent family details.

This information was used to identify and locate the study group. Daily trips were made to the villages of the division and families of the study group located. A detailed interview was then conducted with the mother or caregiver of the study child.

If the caregiver of the child was not present a message was left, usually with the community health worker, requesting that the mother visit the centre as soon as possible. This usually meant leaving busfare.

4.4.2 Identification of the Control Population.

In order to act as a control for a study child certain criteria had to be met. These were:

1. Age

   A child, was considered to be the same age as the study child if his birthdate fell within 3 months of the study child's birthdate. For children younger than 18 months, comparable age was considered to be within one month of the study child's birthdate.

2. Sex

   Both study and control child had to be of the same sex.

3. Location

   Where possible, a child from the same village was used but being from the same sublocation was considered satisfactory.

4. Well nourished

   A child was considered as a suitable control only if its weight was above 75% weight-for-age median (NCHS standards).

Because the above calculation is complicated, the interviewers measured only the child's mid upper-arm circumference in the field. The caregiver of any child with a mid upper-arm circumference greater than 80% of the median (Jelliffe) was interviewed providing she fulfilled the other criteria. As well as interviewing the caregiver, the enumerator also weighed and measured the index child. They were not required to determine the subject's weight-for-age. This calculation was subsequently determined by the principal investigator at the rehabilitation centre. If the child fell below 75% of the median (using NCHS standards) it was discarded and a substitute control sought.

Where possible, matching control children were located at the same time as the study child within the same village. Their mother or caregiver was then interviewed. If no suitable child was found, a child from the health clinic was sought. If the child

fitted all of the above criteria, its mother or caregiver was interviewed. The possibility of bias was avoided by interviewing from both the village and health centre during the pilot survey. The two sources of data collected were then compared. No significant difference was found between the answers given by the mothers from the health centre and those obtained in the village.

A low cut-off point for the nutritional status of the control group was deliberately selected in order to screen out the most important factors related to severe malnutrition in the division.

4.5 Procedure for taking Anthropometric Measurements.

Although only the measurements of control children were required, the interviewers were obliged to take the measurements of the study population also. This was done so that if there was any doubt as to the age of a child, a height measurement could indicate whether the age given by the mother was within range of the norm. If it was not, the information was discarded. The following procedures were used in order to determine nutritional status:

1. Mid upper-arm circumference

   The child stood with its left arm at right angles to its body. With the observer standing behind the subject, a

mark was made vertical to the olecranon process and mid-way between the the tip of the olecranon and the acromion process. The arm was measured at this point with the arm hanging relaxed and using a non-stretch flexible fibreglass tape held snugly around the arm. Each measurement was taken by both interviewers independently of each other. If the difference in measurement was greater than 0.2cm, the measurement was repeated.

2. Weight

A Salter spring balance was used with the scale measuring up to a maximum of 25kg with increments of 100g. The balance was usually attached to the house frame or a nearby tree. The child was weighed in light clothing in a bag suspended from the balance. Each measurement was taken by both interviewers. If the difference between measurement was greater that 0.1kg, the measurement was repeated.

3. Length

An infantometer was used to measure the recumbent (crown-heel) length of the children. The wooden length board was calibrated to 0.1cm increments. The child was laid on the flat surface of the board. The head was positioned firmly against the fixed headboard with the eyes looking

vertically upwards. The knees were extended by one of the interviewers using firm pressure. The feet were flexed at right angles to the lower legs. The upright, sliding footpiece was then moved to obtain firm contact with the heels. The child's length was measured. Each measurement was taken by both interviewers and if the difference was greater than 0.5cm, the measurement was repeated.

4.6 Procedure for Determining Age of Children

Wherever possible, reliable documentary evidence was used to determine the ages of all the family members. Reliable evidence usually constituted MCH clinic cards for young children and identification cards or Kanu membership cards for adults. Where no documentary evidence was available, an alternative method of determination was used (e.g. stage of dentition, psychomotor development, comparison with siblings dates of birth or a local events calendar). If there was still doubt about the age of an index child, the height of the child was checked with the NCHS median for its age to verify its plausibility.

4.7 Selection and Training of Interviewers.

The criteria for selection to become an interviewer were; Kamba speaking (mother tongue) preferably female (because of the nature of the questions) with experience in nutrition data collection and anthropometry. Personal traits that were also

required were; a pleasant, sympathetic personality, conscientiousness and the ability to pay attention to detail when recording data. Interviewers were selected who fulfilled all these criteria.

Prior to training, the interviewers read the research proposal and assisted in the writing of the schedule so that they better understood the aims and objectives of the research and knew why each question on the schedule was important.

4.7.1 Objectives of Training.

The main objectives of the training were;

- To explain again the aims, objectives and methodology of the study.
- To develop a sense of responsibility both to the subjects and to the research aims.
- To train the interviewers in reliable procedures for collecting and recording anthropometric data.
- To train the interviewers in accurate interviewing and recording methods.
- To develop a sense of team spirit and involvement with the aim of promoting inter-enumerator cooperation.

4.7.2 Training Procedure

The two interviewers took part in the first training session which was held in Nairobi. The research project was explained again including the objectives

and benefits of the research and the meaning of terms such as case-control, bias and variable. Anthropometric measures were revised. Both interviewers had had extensive experience in the collection of anthropometric data. Nevertheless, inter- and intra-observer error were checked. The necessity of accurately calibrated instruments was reinforced.

The second training session took place at the Rehabilitation Centre. All the staff from the centre took part as well as the two interviewers. The training session included;

- Practice of the administration of the interview schedule.
- Discussion of problems and questions relating to the schedule in either content or delivery.
- Discussion of any queries relating to the research as a whole.
- Discussion as to the importance of reading out the questions as they are written to avoid bias.

4.8 Pretesting of the Tools of the Investigation and the Interview Process

Following the translation of the interview schedule into Kamba, it was pretested in the field along with the other tools of the investigation (scales,

infantometer and tape measures). The interview process was tested for time requirements and feasibility. The interview schedule was tested for clarity, criterion and content validity, and reliability.

Subjects for the first pretest were mothers attending the MCH clinic. Appropriate modifications to the schedule and the data collection process were made after this pretest. The whole process was then repeated.

Mothers and caregiver of the in-patients of the rehabilitation centre were used for the second pretest. The controls drawn from the MCH clinic and the villages of the in-patients who took part in the second pretest.

Dummy tables were then constructed to ensure that the data was in an acceptable form for analysis.

4.9 Description of the Interview Process

The interview process involved locating a child from the appropriate group (as described above). Following identification of a suitable child, the child was weighed and measured by both interviewers The measurements recorded on the front of the interview schedule. These measurements were then compared to ensure that they were within the previously defined range required. If they were not, they repeated the measurements.

The child's mother was then interviewed in privacy. Her answers were recorded on the interview schedule in the appropriate space left after each question. The interview process usually lasted fifty minutes. As each study child was located and the mother interviewed, an interview number was entered beside the in-patient number. When a study child was matched successfully, the number of the corresponding control was entered beside the study number.

4.10 Data Processing and Entry

Data for the investigation was gathered from two sources. The main source was the interview schedule administered to the mothers of the study and control groups. The study group was, however, only a subsample of the total population of children who had passed through the centre. For this reason, information relating to variables that did not need a control group response (i.e. age at entry to the clinic, sex of the children admitted to the clinic), was derived from the total clinic population by way of the centre records.

4.10.1 Assembling the Rehabilitation Centre Records

Appropriate demographic data from the records of each study child were transferred onto the data base of an "Appleworks" integrated programme of an Apple

IIc computer. Information recorded included: names of both parents and study child, date of birth, sex, and inpatient number of the study child, the admission date of the study child to the centre and its weight on admission. To facilitate location of the child and its family, a precoded village identification number was included.

In order to obtain this data, the day-book of the centre and the more extensive case records (which contain detailed family histories) were used. If information was contained in the family history that was relevant to the study (e.g. if there was an answer to a question which was contained in the interview schedule), it was noted and also included on the data base. At the same time, the data was checked if there were any contradictions.

4.10.2 Data Cleaning

All interview schedules were checked before the data was coded. This included ensuring that all questions on the schedule had been answered and that the answers were credible. Where extra information had been obtained from the family histories, the data was cross-checked. If the information on the clinic records and on the interview schedule did not agree, the interviewer returned to the interviewee to seek clarification.

4.10.3 Data Analysis

Once cleaned and checked, the data from both the interview schedule and the centre records were coded and entered onto another "Appleworks " data base. This database was then transferred to another operating system (MSDos) and an editing system ("KEdit") used to facilitate statistical analysis. The SPSS package (Statistical Package of the Social Sciences) was used for data analysis.

Continuous and discrete data were recoded where appropriate to generate contingency tables.

Data were subjected to both univariate and multivariate (discriminant) analysis.

CHAPTER V

RESULTS

5.1 Description of Population

There were 307 children admitted to the rehabilitation centre between January 1985 and July 1987. Of these, 268 were eligible to be used as study children, the remainder being discounted for being over age, being siblings from the same family or being from outside the study area. One child could not be identified at all. Of the remaining 268 eligible children, 149 (56%) were contacted and their mothers interviewed. For each of these subjects a corresponding control child was located and its mother interviewed. From these complete paired interviews, 14 were discarded during the data cleaning because the control was incorrectly matched. This left 135 valid paired interviews which were able to be used. A second control was found for some of the cases bringing the number of valid controls to 143.

5.2 Description of the In-patient Population

The mean age of the 289 preschool children admitted to the Kibwezi Rehabilitation Centre

whose records were available was 18.4 months. The median age was 15 months.

Although only severely malnourished children below 60 months are usually admitted to the centre, 6 children older than this were admitted during this period.

The ages for twelve children were not available. Table 5.1 & Figure 5.1 show the distribution of the ages of children admitted to the centre between 1/1/85 and 15/7/87.

5.3 Sex Distribution

Of the 307 children admitted to the rehabilitation centre between January 1985 and July 1987, 154 were male and 152 were female. No details were available for one child.

5.4 Univariate Analysis of Proposed Risk Factors

Each risk factor constituted one independent variable. Crosstabulation of each discrete variable was performed followed by Chi^2 test for signifcance. Analysis of variance was used for normally distributed continuous variables. Where continuous data had a skewed disribution, they were grouped so that Chi^2 could be performed on the grouped frequencies. Results are reported by each

independent variable. The dependent variable in every case is the nutritional status of the child (study or control).

Table 5.13 gives a summary of the significance levels obtained for the following variables which were tested.

5.4.1. Monthly Income.

This variable was designed to determine how much cash income came into the family per month. Sale of home-grown produce and cash crops were not included. The median income for the study group was KSh200 with a range of KSh0 - KSh3,200 per month. The control group had a median income of KSh480 per month with a range of KSh 0-5,500.

For ease of analysis, incomes were grouped. Classes were: no income, KSh 1-500, KSh 501-1000 and KSh 1001+. Using a Chi^2 test on the crosstabulation, the two groups differed significantly by income (p=.0000). Table 5.2

5.4.2 Education of Caregiver.

The mean years of schooling for the study group was 3.3 with a median of 4 years. Mean years of schooling for the control group was 5.4 with a median of 6 years. The range was 0-12 years and 0-18 years for the study and

control groups respectively. The number of years of education was divided into: no education, primary school only and high school or above. Contingency tables were then generated and a Chi² test of significance performed. A Chi-squared value of 22.338 was obtained. This value was found to be significant demonstrating that the two groups differed in their education levels (p=.0001). Table 5.3

5.4.3 Sources of Income.

For analysis, sources of income were classified into the following:

- Those households that obtained no income,
- Those that obtained cash income from labour only (whereby the wage-earner lived in the household).
- Those households that received a remitted income (whereby the wage-earner did not live in the household but sent cash to the family on a regular basis).

Families that received money from more than one source (e.g. remitted and labour) were included within the remitted catagory.

This variable was crosstabulated with the two catagories of nutritional status. A subsequent Chi² test showed that with regard to sources of income the two groups differed significantly (p=.0001). Table 5.4

5.4.4 Multiple Birth

The only multiple births recorded were those of twin births. To analyse this variable, the frequency of twins in the study group was compared with the frequency in the control group. There were 12 sets in the study and 1 set in the control group.

A contingency table was generated and a Chi^2 value of 21.974795 was obtained. This showed that with regard to multiple birth, the two groups were significantly different (p=.0001). Table 5.5

5.4.5 Age at First Clinic Contact

The data were crosstabulated into two catagories; those who took their children to the health centre before the age of three months and those mothers who took their children after this age.

Chi^2 analysis of crosstabultions showed that there is a significant difference between the study and control groups with regard to the age of the children at their first contact with a health facility (p=.0013). Table 5.6

5.4.6 Marital Status of Mother.

This variable was to test whether children from one-parent families were more vulnerable to severe malnutrition than children from two

parent homes. Initially there were six categories: single, married, widowed, divorced/separated, polygamously married and "other".The "other" category was included to cover the possibility of a case which does occur periodically in Kamba culture whereby one (usually barren) woman "marries" another younger woman and then breeds children with her through a surrogate father. There was only one such case encountered during the study. These catagories were cross tabulated and a Chi^2 test performed. The test revealed significance in all cells, especially when regrouped "married versus non-married" ($p=.0016$). Table 5.7

"Polygamously married" was not significant as a determinant or causal factor in severe malnutrition.

5.4.7 Birth Interval between Siblings.

Birth interval (i.e.spacing between the index child and the next-born child) was examined as a possible determinant of nutritional status. The mean birth interval between the index child and the next-born sibling in the study group was 25.1months with a median of 24 months. Mean birth interval between the index child and the next-born sibling in the control group was 29.5 months with a median

of 27.5 months. Analysis of variance between the two means showed that the two groups differed significantly with regard to the number of months of spacing between the index child and its next-born sibling (p=.008).

5.4.8 Caregiver of the Index Child.

This variable was to determine who the child actually lives with. Although the centre records seemed to show many children lived with someone other than the mother, the numbers within the sample interviews were small (12 cases). Within the control group there were only 2 cases of a child living with someone other than the mother. A Chi^2 test did, however, show that the difference between the two groups is significant (p=.0099).Table 5.8

5.4.9 Amount of Land Available

In the study group, the mean amount of land available for cultivation was 5.7 acres with a median of 4 acres. The mean for the control group was 10.0 acres with a median of 6 acres.

Analysis of variance showed that the amount of land available for use by the two groups differed significantly (p=.0000). To investigate the relationship further, the

data was regrouped in several ways, crosstabulated and analysed once again using a Chi^2 test. No matter how the data were grouped, the value of Chi^2 showed the groups to be significantly different with regard to the amount of land available. (p=.0136 - p=.0136) Table 5.9 & Appendix 2.

5.4.10 Migrant Status of Family.

This variable was to examine how long the family had lived in Kibwezi Division.

Three catagories were used; "not a migrant" meant that the family had live on their land for more than ten years; "Kamba migrant" which meant that the family was from the same tribe but had migrated to their land from elsewhere within Machakos District within the last ten years; "other" was defined as migrants from another tribal grouping which had migrated to their present land within the last ten years.

Within the third grouping, that is "other", there were only four cases - all falling within the study population. Using all three catagories for analysis, a Chi^2 value of 3.25482 (p = .02) was obtained.

The second two catagories were then combined so as to classify the families as either "migrant " or "non-migrant".

Crosstabulation were performed followed by a Chi^2 test. The results showed the two groups did not differ significantly with regard to the amount of time they had been residing in the Division (p=.0712) Table 5.10

5.4.11 Mother's Age at the Birth of her First Child

Analysis of variance was used for this variable. A p value of .095 was attained, indicating that there is no significant difference between the study and control group as to the age at when they bear their child. The mean age of the mothers at the birth of their first child was 19.086 for the study group and 19.669 for the control group. The median was 19 years for both groups.

5.4.12 Number of Offspring that have Died.

It was suggested that the number of children that a mother had given birth to which had died may be a proxy measure for her ability to cope as a mother. The data were grouped into two catagories, either the mother had born children who sublsequenly died or had no children who had died. Only children who had died before reaching the age of 60 months were included. A verbal autopsy was also included in the interview schedule and if the

child died as a result of an accident it was also discounted. Although the mothers in the study group had suffered more child deaths, the difference using the Chi^2 test on the frequencies was not significant (p .1684). Table 5.11

5.4.13 Land Ownership.

A further question in the interview schedule concerned the ownership of the land which the family was using. The catagories were defined as "owned" or "not owned" the latter catagory including the landless, those who rent land and those who borrow land - usually from a relative.

Most of the families did own land. There were only 8.7% of the total population who did not own land.

A contingency table was generated, the nutritional status of the children against land ownership. Chi^2 analysis of the difference between the two groups gave a p value of .2235 showing that, with regard to ownership of land, the study group is not significantly different from the control group as shown in Table 5.12

Crosstabulation of land ownerhip with income source revealed that those families who did not have access to land usually had a remitted income.

5.4.14 Mother's Age at the Birth of Child

Analysis of variance was used for this continuous variable. A p value of .22 was attained, indicating that there is no significant difference between the study and control group as to the age at when they bear the index child.

5.4.15 Witholding Sustenance during Illness.

Three questions were asked to determine whether there was any difference between the cultural practices of the two groups. These practices were; whether food and drink are usually witheld from the child during diarrhoeal and measles episodes and whether breast milk is witheld during illness of a child.

The sample size for these questions was smaller than for the other variables as only the study children and their matched controls from 1987 were included. This was because the study group prior to 1987 had undergone some nutrition education while in the facility with their children.

Crosstabulation of the results of each variable showed that there was no significant difference between the two groups in the way they treat these childhood illnesses (p=.1153, .3416, .4483, 1.000).

5.4.16 Number of Children Living on the Compound

Two variables were used to determine whether there were more children living in the malnourished households as opposed to the well-nourished households. These were: the number of children less than 5 years and less than 15 years of age living on the compound. This included not only children of the nuclear family but also children of relatives who reside with the family.

The mean number of children under 5 years of age were 1.83 and 1.79 for the study and control groups respectively. The median was 2 children per family for both groups. Analysis of variance revealed that there is no significant difference between the number of children under 5 years living in the two respective households ($p=.714$).

The mean number of children under 15 years of age were 3.96 and 4.08 for the study and control groups respectively. The median was 2 children per family for both groups. Analysis of variance revealed that there is no significant difference between the number of children under 15 years living in the two respective households ($p = .566$).

5.4.17 Sex of the Head of Household

A contingency table was generated for this variable. The value of Chi^2 was .01018 (p=.9196) which indicates that there is no difference between the study group and control group with regard to this factor.

5.4.18 Recognition of Diarrhoeal Disease.

This question was asked to determine whether the two groups differed in their recognition of a common childhood disease that is prevalent in this area. Only the data from the study and controls of 1987 onwards were used because of the proir knowledge of caregivers who had passed through the rehabilitation centre before January 1987.

In this question the mothers answers were graded by the investigatior on a scale of 0 - 4 marks. Testing the crosstabulation of these frequencies showed that there was no significant difference between the two groups in their knowledge of the sign and symptoms of diarrhoeal disease (Chi^2 = 1.46075, p=.6914).

5.4.19 Number of Children Born to Mother.

Whether the mother of the study children had borne more children was of interest. The mean number of children born to the study group

mothers was 3.5 while the mean was 3.6 for the control group. The median was 3 children for both groups. The range for the study group was 1-11 children while the range in the control group was 1-8 children. The data were grouped into: 1. mothers who had more than four children 2. mothers who had borne four or fewer children. These groups were then crosstabulated with the nutritional status and Chi^2 test subsequently performed. The two groups were not different with regard to the number of children the mothers had given birth to ($p = 1.000$).

5.5 Multivariate Analysis of Proposed Risk Factors

Multivariate regression analysis was carried out by taking nutritional status (study versus control) as a discrete dependent variable. The determinants being studied were the independent variables. A regression model was developed by forward stepwise procedure. In the case of significant interaction terms, the main effects were included in the model. If the variables did not approach significance (<15%) they were not included in the final equation. The variables included in the discriminant analysis were: income

(source and amount),land availability, education, spacing (birth interval), marital status and age of first clinic contact. Introduction of the other remaining variables did not achieve better separation.The only variable that was significant during the univariate analysis but subsequently dropped out was the age at which the child first had contact with a health facility.

The lack of association between all the major variables which were found to be significant in the univariate analysis was brought out by the stepwise discriminant analysis. Not included in the analysis were twinship and the relationship of the caregiver to the index child because there was less than ten percent of the total population in the risk category. A table of the the risk factors for severe malnutrition was developed whereby 92.5% and 79.2% (including spacing in the equation) and 73.4% and 77.1% (excluding spacing in the equation) of the severely mlanourished children were correctly identified.

Correct identification of adequately nourished children was 63.3% and 68.3% (including spacing in the equation) and 51.2% and 71.7% (excluding spacing from the equation) Table 5.15

Figure 5.1

AGE OF CHILDREN AT ENTRY TO KIBWEZI REHABILITATION CENTRE
JANUARY 1985 - JULY 1987

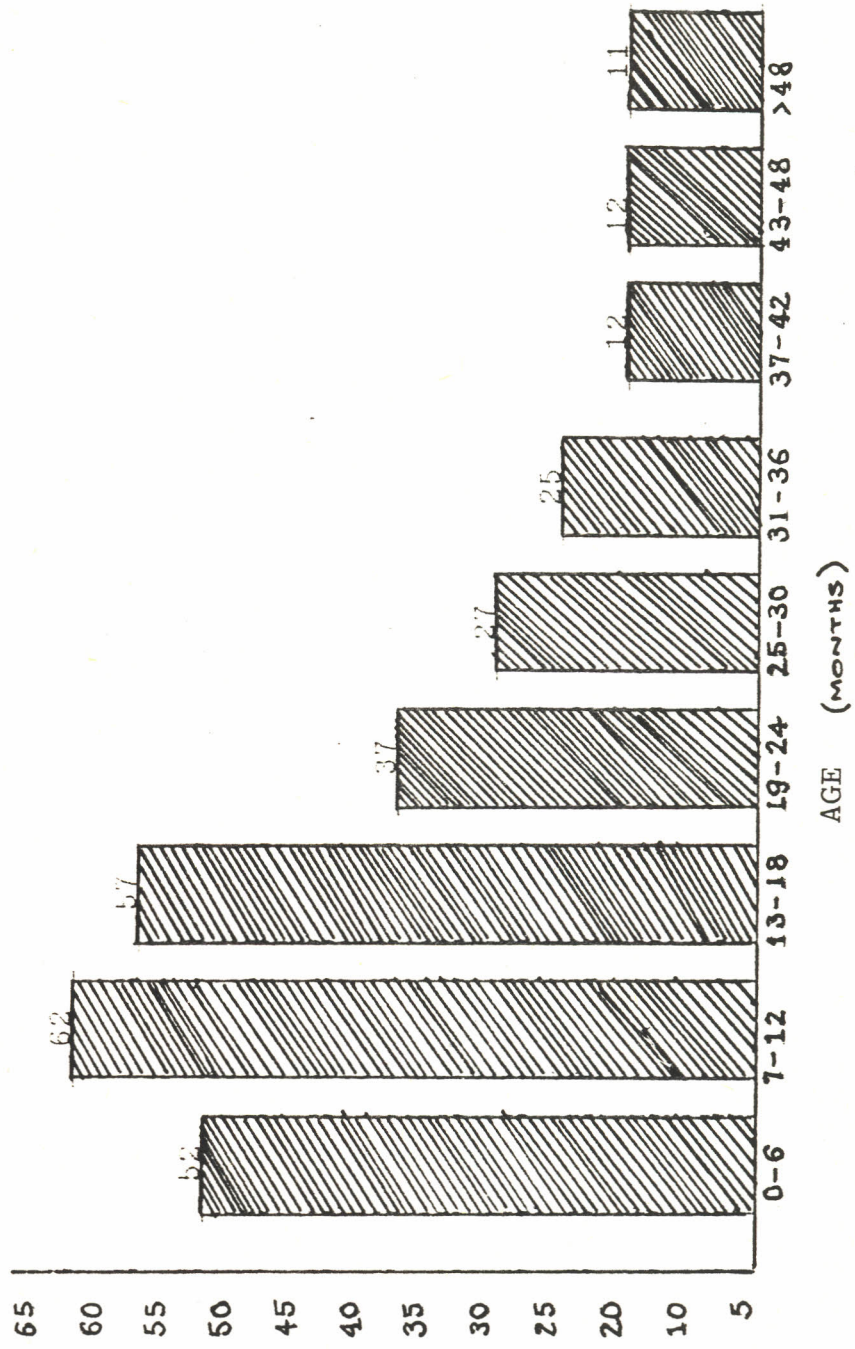

Table 5.1

Frequency distribution of age and sex of children admitted to Kibwezi Rehabiltiation Centre Jan 1985 - July 1987

a) Distribution of children by age*

Age (months)	Frequency	Percent	Cumulative percent
0-6	52	17.6	17.6
7-12	62	21.0	38.6
13-18	57	19.3	57.9
19-24	37	12.5	70.4
25-30	27	9.2	79.6
31-36	25	8.5	88.1
37-42	12	4.1	92.2
43-48	12	4.1	96.3
48 +	11	3.7	100.0
Total	295	100.0	

Mean = 18.4 mode = 1 median = 15

b) Distribution of children by sex*

Sex	Frequency	Percent	Cumulative percent
Male	148	50.3	50.3
Female	147	49.7	100.0
Total	295	100.0	

*excluding children >60 months

Table 5.2

Crossstabulation: Nutritional status by family's monthly income

Count Row Pct Col Pct	study 1	control 2	Row Total
0 (no money)	30 65.2 22.2	16 34.8 11.2	46 16.5
1 (KSh1-500)	82 54.7 60.7	68 45.3 47.6	150 54.0
2 (KSh501-1000)	15 35.7 11.1	27 64.3 18.9	42 15.1
3 (KSh1001 +)	8 20.0 5.9	32 80.0 22.4	40 14.4
Column Total	135 48.6	143 51.4	278 100.0

Chi-Square	D.F.	Significance	E.F.<5
23.18509	3	.0000	None

Number of Missing Observations = 0

Table 5.3

Crosstabulation: Nutritional status by education of the caregiver

Count / Row Pct / Col Pct	Study 1	Control 2	Row Total
none	54 62.8 40.0	32 37.2 22.4	86 30.9
1-7 years	70 47.9 51.9	76 52.1 53.1	146 52.5
>7 years	11 23.9 8.1	35 76.1 24.5	46 16.5
Column Total	135 48.6	143 51.4	278 100.0

Chi-Square	D.F.	Significance	E.F.<5
18.18106	2	.0001	None

Number of Missing Observations = 0

Table 5.4

Crosstabulation: Nutritional status by sources of income for the family

Count Row Pct Col Pct	Study 1	Control 2	Row Total
no income	30 65.2 22.2	16 34.8 11.2	46 16.5
labour only	85 52.8 63.0	76 47.2 47.8	161 57.9
remitted	20 28.2 14.8	51 71.8 35.7	71 25.5
Column Total	135 48.6	143 51.4	278 100.0

Chi-Square	D.F.	Significance	E.F.<5
18.08394	2	.0001	None

Number of Missing Observations = 0

Table 5.5

Crosstabulation : Nutritional status by multiple births

Count Row Pct Col Pct	study 1	control 2	Row Total
no twin	111 44.0 82.2	141 56.0 98.6	252 90.6
twin	24 92.3 17.8	2 7.7 1.4	26 9.4
Column Total	135 48.6	143 51.4	278 100.0

Chi-Square	D.F.	Significance
21.974795	1	.0001

Number of Missing Observations = 0

Table 5.6

Crossstabulation: Nutritional status by age at which the child was first taken to the health facility

Count Row Pct Col Pct	study 1	control 2	Row Total
< 3 mths	86 41.7 67.7	120 58.3 85.1	206 76.9
> 3 mths	41 66.1 32.3	21 33.9 14.9	62 23.1
Column Total	127 47.4	141 52.6	268 100.0

Chi-Square	D.F.	Significance	E.F.<5
10.40604	1	.0013	None

Number of Missing observations = 10

Table 5.7

Crossstabulation: Nutritional status by marital status of index child's mother

Count Row Pct Col Pct	study 1	control 2	Row Total
Single	41 67.2 30.4	20 32.8 14.0	61 21.9
Married	94 43.3 69.6	123 65.7 86.0	217 78.1
Column Total	135 48.6	143 51.4	278 100.0

Chi-Square	D.F.	Significance	E.F.<5
9.94830	1	.0016	None

Number of Missing Observations = 0

Table 5.8

Crossstabulation: Nutritional status by caregiver of the child

Count Row Pct Col Pct	Study 1	Control 2	Row Total
SC			
Mother	123 46.6 91.1	141 53.4 98.6	264 95.0
Grandmother	12 85.7 8.9	2 14.3 1.4	14 5.0
Column Total	135 48.6	143 51.4	278 100.0

Chi-Square	D.F.	Significance	E.F.<5
6.65571	1	.0099	None

Number of Missing Observations = 0

Table 5.9

Crossstabulation: Ntritional status by amount of land owned by the family

Count Row Pct Col Pct	study 1	control 2	Row Total
0-2.5 acres	39 65.0 30.5	21 35.0 16.3	60 23.3
2.6-5.0 acres	45 51.7 35.2	42 48.3 32.6	87 33.9
5.1-10.0 acres	31 43.1 24.2	41 56.9 31.8	72 28.0
>10.0 acres	13 34.2 10.2	25 65.8 19.4	38 14.8
Column Total	128 49.8	129 50.2	257 100.0

Chi-Square	D.F.	Significance	E.F.<5
7.37209	3	.0136	None

Number of missing observations = 21

Table 5.10

Crosstabulation: Nutritional status by how long the family have lived in Kibwezi District

Count / Row Pct / Col Pct	study 1	control 2	Row Total
Not Migrant	70 43.5 52.6	91 56.5 64.1	161 58.5
Migrant	63 55.3 47.4	51 44.7 35.9	114 41.5
Column Total	133 48.4	142 51.6	275 100.0

Chi-Square	D.F.	Significance	E.F.<5
3.25482	1	.0712	None

Number of Missing Observations = 3

Migrant = Family have moved to Kibwezi District within the last ten years.

Table 5.11

Crossstabulation: Nutritional status by number of children of index child's mother who died before age 5 years

Count Row Pct Col Pct	study 1	control 2	Row Total
none died	94 45.9 69.6	111 54.1 77.6	205 73.7
1 or more died	41 56.2 30.4	32 43.8 22.4	73 26.3
Column Total	135 48.6	143 51.4	278 100.0

Chi-Square	D.F.	Significance	E.F.<5
1.89685	1	.1684	None

Number of Missing Observations = 0

Table 5.12

Crosstabulation : Nutritional status by land ownership

Count Row Pct Col Pct	study 1	control 2	Row Total
Family Owns Land	119 47.2 88.8	133 52.8 93.7	252 91.3
Family Doesn't Own Land	15 62.5 11.2	9 37.5 6.3	24 8.7
Column Total	134 48.6	142 51.4	276 100.0

Chi-Square	D.F.	Significance	E.F.<5
1.48166	1	.2235	None

Number of Missing Observations = 2

Table 5.13

Univariate Analysis

By Anova

	P	D
Inverval between index child & next	.008 **	-
Mothers age at birth of firstborn	.095 *	-
Mothers age at birth of index child	.228	-
Children <5 living on compound	.714	na
Children <15 living on compound	.566	na

** = statistically significant

* = trend

D = direction. (-) = lower score/higher risk.

(+) = higher score/higher risk.

Table 5.14

Univariate Analysis

By Chi^2

	P		D
Total monthly income for family	.0000	*	-
Education of caregiver of child	.0001	**	-
Sources of income for the family	.0001	**	na
Multipartiy (twinship)	.0001	**	na
Child first taken to clinic	.0013	**	+
Marital status of childs mother	.0016	**	na
Who the child lives with	.0099	**	na
How much land is owned by family	.0136	**	-
Length of time living in the area	.0712	*	-
Sustenance witheld during measles	.1153	*	na
How many children have died	.1684	*	+
Whether the family own land	.2235		na
Breastmilk witheld during illness	.3416		na
Sustenance witheld during diarrhoea	.4483		na
Sex of household head	.9196		na
Whether diarrhoea is recognised	1.0000		na
Number of children born to mother	1.0000		na

** = statistically significant

* = trend

D = direction. (-) = lower score/higher risk.

(+) = higher score/higher risk.

Table 5.15

Stepwise Discriminant Analysis

Stepwise introduction of the following variables results in the correct classification of the severely malnourished (1) and adequately-nourished children (2). The figures are in percentages of children able to be correctly identified.

1. Income
2. Land Available
3. Education of Caregiver
4. Marital Status of Mother

	Including Remit*	Excluding Remit*
Including Spacing**	*(1) 92.5* (2) 63.3	*(1) 79.2* (2) 68.3
Excluding Spacing**	(1) 73.4 (2) 51.2	(1) 77.1 (2) 71.7

* Remit = the variable presence or absence of a remitted income

** Spacing = the variable birth interval between the index child and the next

CHAPTER VI

DISCUSSION AND CONCLUSIONS

6.1 Introduction

The most important finding of the research was that there do appear to be family characteristics that predispose a child to risk of becoming severely malnourished. This finding confirms that in Kenya, as in other parts of the economically "less developed" world, severe malnutrition has an identifiable aetiology for which specific interventions could be developed.

6.2 Demographic Data from the Records of the Rehabilitation Centre

6.2.1 Age at Entry to the Centre

The data from the records show that there is a skewed distribution of age of admission. Most children are admitted during the first 18 months of life with the period from 6-18 months of age being a particularly vulnerable time.

Although the most frequent age groups to be admitted to the centre due to severe malnutrition are 7-12 and 13-18 months, infants 0-6 months also appear to be at risk. However, the reason for children being admitted between 0-6 months is usually not so much that they have already become malnourished but that

they are underweight at birth. Prematurity is the usual cause of low birth-weight. Twins tend to be admitted very soon after birth as they are often of low birth-weight due to being premature. Half of the twins admitted to the centre were admitted before the age of 6 months. Twin births account for twenty three percent of the infants admitted. If these subjects are excluded the age group 0-6 months is much smaller. If there were still a high proportion of children in this age group after the twin births had been excluded, this would indicate that there is need for an investigation into the factor associated with perinatal malnutrition.

There could be several reasons for the skewed distribution of the data for age-at-admission. First, it is often during infancy that most mothers begin to wean their infants. The reduction or cessation of breastfeeding is frequently accompanied by a reduction in nutritional status which is reflected in the flattening-off of a child's growth trajectory. Second, it is also during this early period that mothers tend to take their children to the health centre to be immunised. This may mean that the children between 6-18 months do not constitute a high risk group, but that more children in this group are identified because they are brought to the health facility. After the age of 18 months, fewer children enter the rehabilitation

centre. The most likely explanation for this is that these children are at less risk of becoming malnourished because (a) their immune systems already have been exposed to virtually every type of infection and, (b) they can better express their desire to eat and can consume larger quantities of food thus increasing their nutrient intake.

6.2.2 Sex and Nutritional Status

There is no significant difference in the sex of the malnourished children as reflected in admissions to the rehabilitation centre.

The present findings agree with other research that has been undertaken on a community-based sample within Machakos district (42). Similar results were also obtained in Nepal and South America (15,12,26). There would be very tenable reasons for no sex preference within this culture. Although it is a patriarchal society, the females are the farmers and agriculturalists. Their main work, apart from child rearing, is the production of subsistence crops. For this reason, women are a valuable resource. Indeed, there is evidence from other research within this province that there may be a female sex bias (*personal communication).

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* Embu Study Report. Heather Wright 1986 (unpublished).

A female bias with regard to better nutritional status has been observed in Southern Africa among children of Indian ethnic origin (34).

6.3 Univariate Analysis

Univariate analysis was performed on all variables as examined in the interview schedule against the nutritional status of the children (severely malnourished or adequately nourished).

The results of the univariate analysis revealed that the two groups differed with regard to income, marital status, education of caregiver, age at first clinic contact, multiple birth (twins), birth interval, land ownership and relationship of the caregiver to the index child.

6.3.1 Income and Nutritional Status

Analysis of this factor revealed that the two groups differ significantly with respect to income source and amount. Children from families that receive no remitted income were more frequently severely malnourished than children whose families received a remittance.

The present finding contrasts with that of Ferguson (44) who found no correlation between nutritional status (wt/age,ht/age,and wt/ht) and income in the same area a year earlier. The reason for the contradiction

might be that in the present study, the severely malnourished group represent the far end of the nutritional spectrum and because of this the effect of this factor was more apparent.

The other income-related variable investigated was monthly income from wage employment. If the family obtained an income from selling produce, livestock or poultry it was not counted. Because of this, it is possible (although unlikely) that some "wealthy" landowners who derive their income from growing cash crops were included in the "no income" group. However those who grew cash crops tended to be businessmen or those with professional qualifications who had an alternative income.

The study and control groups were significantly different in respect to this factor. The adequately nourished group (control) were the higher wage earners.

This result is consistent with most other studies that have investigated income as a determinant or indicator of nutritional status, regardless of whether proxy variables (29,30,31,46) or actual income was used (14,15,19,23,26,32,37). It is also consistent with studies of the relationship between income and both child growth and weight-gain (24,27,34).

6.3.2 Landlessness and Nutritional Status

There was no difference between the two groups with regard to owning versus not owning land.

This finding conflicts with some studies which have found landlessness to be a factor in the aetiology of malnutrition (4,10). The reason for the contradiction is unclear. Land is very important in Kenya. Every family strives to own land even if it is only a small unfertile plot. Very few families studied did not have access to land and fewer still did not own any. The ownership of land does not equate with protecting against malnutrition.

Other Kenyan studies investigating landlessness have found this factor to be correlated with poor nutritional status (20,21). One explanation for the apparent contradiction with the present findings may be that the cut-off point for the well-nourished (control) group in this study was very low. Many of the children who acted as control children came from families who were only marginally better off than the study group. To observe a trend in a group that is virtually homogeneous shows that landlessness probably is an important factor in relation to nutritional status. In one of the Kenyan studies the group "smallholders" was included together with those who were landless. In the present study, when small land size was grouped together with landlessness it was found that there was a positive

correlation between this factor and nutritional status (Appendix 2).

Another finding of the present study was that those families who did not own land did have an income source.

6.3.3 Land Availability, Migrant Status and Nutritional Status

There is a strong positive correlation between the amount of land available to the family and the nutritional status of the children. The results of the present study found a significant difference between the study and control families no matter how the data were grouped (Appendix 2). The present finding confirms many other studies which demonstrate a positive correlation between increased landholding and better nutritional status of young children (11,12,14,15,16,17,18,21,22).The present result also supports a Kenyan study (22) that found:

- that any family with less than 1 hectare (2.5 acres) can be categorised as "very poor"
- that the average-sized family relying exclusively on its own production needs 2.6 hectares (6.5 acres) of land to provide an adequate income

It can be deduced from this result that most people in this area must have an additional source of income as the amount of land they have access to is not enough to support them.

There is obviously a complex relationship between land size and availability in this region. The result of this analysis confirms the general principle that, in this area as in other parts of the world where subsistence farming is still practiced, the ownership of land is a crucial factor in the aetiology of malnutrition among children.

The factor "migrant status (i.e.the amount of time that a family have lived in the Division) was not found to be significant between the two groups. However, there was a trend (p=.0712) towards children from the severely malnourished group coming from "migrant" families that were less well-established in the Division.

6.3.4 Education of Caregiver and Nutritional Status

If the caregiver was someone other than the mother of the index child, it was usually the grandmother. Occasionally we came across a situation whereby the mother of the index child had died or run away, in which case a second wife was usually caring for the child.

The caregivers of the well-nourished group were significantly better educated that those of the malnourished group.

This result confirms many of the studies undertaken in South and Central America and the Indian

subcontinent (17,27,30,31,37,39,40). It also confirms other studies from Kibwezi Division (44). All of these studies found the education of either one or both parents to be a significant factor in relation to the nutritional status of children (17,31).

The present results contradict a Mexican study investigating severe malnutrition and its determinants (27). In this study the investigators found no relationship between the presence or absence of severe clinical malnutrition and the variables of literacy and education of the parents. One explanation for the conflicting findings may be that the sample in this study (which was drawn from a larger prospective study) comprised only 22 severely malnourished children. The small size of the sample may account for the results obtained. One further Latin American study that also found no correlation between nutritional status and education. They qualify their finding however, as they observed that although the majority of both mothers and fathers had no schooling, most were functionally literate. They also observed that these parents had a high level of awareness of nutritional requirements and the nutritional quality of specific foodstuffs (12).

6.3.5 Family Variables and Nutritional Status

Family-related variables that were examined and found to be major factors in the aetiology of severe malnutrition were; birth interval, the relationship of the caregiver to the index child, the marital status of the index child's mother and the age of the child at its first contact with a health facility.

Birth interval, that is spacing between siblings, was significantly and positively correlated with nutritional status (p=.008). The mean difference in birth interval was 4.5 months between the study and control group. There is a valid reason why a longer interval between births is important in this culture. There is a taboo against a mother breastfeeding after she becomes pregnant with another child. If she conceives again soon after the birth of a child, the older child will be weaned from the breast onto a bulky diet much earlier than is advisable. This early weaning is detrimental to the nutritional status of the older child.

The variable "caregiver" (i.e. whether the child is living with its mother or another person) appears to be important in the aetiology of severe malnutrition The difference between the two groups as to who was the caregiver of the child was highly significant (p=.0099). A Tanzanian study investigating the aetiology of malnutrition had found that children suffering from marasmus and Kwashiorkor were often

living with someone other than the mother (36). Although the study suggests that the child was given away and then became malnourished, another interpretation is possible. It could be that the child was malnourished and therefore did not interact with the mother. This led to the mother becoming dispondent and neglecting the child and then giving the already malnourished child to a relative. A similar sequence of events is also possible in the present study.

A Nigerian study implicated maternal deprivation in the epidemiology of malnutrition (19). In this study, "deprived children" were those who were orphaned at birth or who had been given over into the care of relatives by their mother (who was usually young and unmarried).

Evidence from Uganda also supports the present finding. Here, it was found that children who were given over to the grandmother were more likely to suffer from malnutrition (45).

Marital status of the mother of the index child was identified as important. The present study found the difference in marital status between the study and control group to be highly significant ($p=.0016$). The mothers of the severely malnourished children were more frequently single, separated, divorced or widowed. This result is supported by another East African study (36). In Nigeria, family instability

was not found to be associated with severe malnutrition. However, the study fails to explain how family instability was measured (19).

Neither "Sex of the Household Head" nor "Polygamously married" were found to be important variables in the aetiology of severe malnutrition. This finding would appear to contradict the above finding that being unmarried (i.e. single, separated, widowed or divorced) is a determinant of severe malnutrition. This contradiction is explained by the fact that many unmarried women return to the home of their parents. In this case, the woman's father would be regarded as the head of the household.

The two variables investigating the importance of mothers' age as a determinant of severe malnutrition were not statistically significant. However, there was a trend towards the mothers of the severely malnourished group being younger at the birth of their first child ($p=.095$). The result does confirm Ferguson's et.al (44) finding in the same Division that the age of the mother is unrelated to the child's nutrition level. Both of these studies contradict one from Nigeria which found "youthfulness of the mother" to be an epidemiological determinant of severe malnutrition (19).

Analysis of the age at first clinic contact revealed that there is a significant difference in the age at which mothers of the two groups bring their children to a health facility ($p=.0013$). For many of the children admitted to the centre, it was their first contact with a health facility. When one considers the geography of this area, it is easy to understand why some mothers (especially if they are poorer and can't afford the fare) are reluctant to travel to get help for a child unless it is really very sick. The distances that must be covered are long and transport is costly. As well as this, the journey is costly in terms of time. A trip to the clinic and the waiting in the long queue for attention would act as a deterrent for any mother unless she knows her child is very ill. Mobile clinics do cover the Division but the areas covered are vast. As well as this, in order that a mother take her child for medical attention, she must neglect her daily chores of fetching water, carrying wood and cultivating the garden, not to mention cooking for the family and caring for her other children.

Other variables that were examined were the number of siblings of the index child (under 5 years of age) that had died and multiparity of the mother of the index child. Although some studies have found multiparity to be an important factor in the aetiology of malnutrition (40), it was not found to

be the case in this nor Ferguson's et.al research in Kibwezi Division (44).

The number of children living on the compound (less than 5 years of age and less than 15 years) was also not found to be related to severe malnutrition This results is also consistent with other research from Kibwezi Division(44).

6.3.6 Multiple Birth and Nutritional Status

There were twelve sets of twins in the study group. Six out of the twelve pairs were admitted to the centre before the age of 6 months. This appears to be most vulnerable time for twins followed by the 7-12 months age range. This result seems plausible because twins are usually born prematurely and are underweight. As well as this, the mother who gives birth to more than one child at one time may lack sufficient milk to feed both children adequately. This is especially so in an area where the energy needs of pregnant and lactating women may not be being met by their dietary intake. The present study found the difference between the two groups in the numbers of sets of twins to be significant ($p=.0001$), the greater numbers of twins coming from the severely malnourished rather than the well-nourished group. This finding is consistent with other studies who have examined this variable in relation to malnutrition (19,37).

6.3.7 Cultural Variables and Nutritional Status

The results indicate that there is no significant difference between the two groups with regard to the practice of the taboos which were investigated. However, a trend was evident whereby mothers of the severely malnourished group withheld sustenance more often during measles. It would appear that the practice of witholding breastmilk during illness is not as common as was anticipated. There were only two reported cases of witholding breastmilk during illness of a child.

There was also no difference between the two groups with regard to the mothers' knowledge of diarrhoeal disease.

6.4 Multivariate Analysis

Some variables that were significant when subjected to univariate analysis subsequently dropped out during multivariate analysis. This could mean that some of the variables included in the analysis were acting as a proxy variable. Alternatively, these variables are proxy variables for one that remained in the equation. Monthly income, the amount of land available, marital status of the mother of the index child and educational status of the caregiver of the index child were found to be the factors which achieved the highest differentiation between the two groups. When two other variables were added to the equation, the model seemed to fall apart. However, further analysis revealed that the model was

inconsistent due to the correlation between a remitted income and land ownership (those who owned no land whatsoever did receive remitted income). The analysis was performed four times, with the introduction of the variables birth interval and source of income separately.

Discriminant analysis, although unable to define variables in order of their aetiological significance, does single out the variables that best describe and separate the two groups, in this instance, the severely malnourished from the adequately nourished. As such, it constitutes an excellent tool for the determination of the most important variables that are to be included in a model that identifies children at risk of becoming severely malnourished. All of the determinants identified in the present study and incorporated in the model (Table 5.14) are readily measurable, either by staff of a health clinic or even by community health workers in the field.

The present study has much in common with another study undertaken in Kibwezi in which the perceptions of risk of the community health workers were used to identify high and low risk households with regard to health. The nutritional status of children within the households was one parameter used. The results of the present study broadly agree with the findings of the Kibwezi Health Risk Study and the

recommendations of the study are supported by the present findings (44).

6.5 Limitations of the Research Method

When interpreting the above results, one should bear in mind that approximately fifty percent of the children who had passed through the Kibwezi Rehabilitation Centre were not located. This was mainly due to constraints of time. However,because many of the those contacted and interviewed were former in-patients that had returned to the centre to collect a ration of dried skim milk (DSM), it is possible that they constitute a biased sample of the most concerned or even the wealthier mothers who can afford the time and busfare to visit Kibwezi. Although we did do extensive home visiting to contact former patients, it may be that the mothers not located and interviewed may be the transient, homeless group who drift from town to town and relative to relative making a living and feeding themselves (and their children) as best they can. The family histories bear this out in some instances. With some variables (migrant status, caregiver of the child), the proportion observed in the clinic records in not reflected in those contacted and interviewed.

The sample size to investigate birth interval was smaller than for the other variables as not all

mothers had borne another child after the index child. However, of those that had borne another child (44% of the study group against 36% of the control group), there was a positive correlation between the nutritional status of a child and number of months spacing between the index child and its next-born sibling.

With regard to the variable "caregiver", a relatively small proportion were living with someone other than the mother at the time of the interview. (8.9%). For this reason, caution must be exercised when interpreting the result due to the small numbers. Another point to be considered in this regard is that very often a grandmother will claim to be the mother of her daughter's child. Although the women were questioned carefully, it cannot be ruled out that this was sometimes the case especially as some of the women over 45 or 50 years of age were claiming to be the mothers small babies. This may also account for the negative results of one or both of the variables, "mothers age at the birth of her first-born child" and "mother's age at the birth of the study child".

6.6 Limitations of the Method of Analysis

The approach used in multivariate analysis should be borne in mind when in interpreting the results. In this type of analysis, if a risk factor remains the

same after adjustment it is evidence for an effect that is statistically independent of other factors. Alternatively, if a risk factor that was significant in univariate analysis falls out of the model when subjected to multivariate analysis, it may nevertheless be a link in the causal chain between the independent risk factor and severe malnutrition. In other words, the risk factor could itself be a proxy variable. Another possibility is that as the result of one strong variable (e.g. income) becomes stronger, the relative risks of the other variables are reduced so that differences are no longer statistically significant. This may be the reason why the variable "age at first clinic contact" dropped out of the equation. It may, nevertheless be an important factor in the aetiology of malnutrition.

6.7 Conclusions and Recommendations

The main objective of this study was to identify major and contributory aetiological and epidemiological determinants of severe malnutrition in the child community of the Kibwezi Division of Machakos district, Kenya.

It was hoped that this would offer some clues as to the interrelationship between socio-economic, demographic and cultural variables and their effect on the health status of preschool children. Armed

with this information, we thought that we would be able to develop a means of recognising children "at risk" of becoming severely malnourished before they actually start their downward decline.

To accomplish this objective, we intentionally selected previously severely malnourished children and matched them with children who, although not necessarily "well nourished", were by comparison better nourished. Kibwezi is a semi-arid region with few resources. Many of the children survive although they are undernourished. In order to differentiate between these "survivors" and those at risk of death due to malnutrition, I took a very low cut-off point (75%NCHS) for the "well-nourished" control group with the hope of indentifying the most important differences between these two groups.

The results obtained broadly agree with other studies undertaken in countries where children are malnourished. The one universal determinant of malnutrition is undoubtedly poverty and it is the alleviation of poverty which is the most pressing problem of the world today.

However, to alleviate poverty per se is a gargantuan task which no one country or group of countries can tackle alone without changing the whole world order. Perhaps that is what is needed, but until that happens we must be content with doing what we can to alleviate specific problems where it is feasible.

Certainly, the move toward community self-help and community-based healthcare is a move in the right direction.

Based on the findings of this study, the following recommendations would be made:

1. That we formulate a precise grid so that health workers in the Kibwezi Division can identify risk families before the children become severely malnourished. It is envisioned that preventative measures would include vaccination of the newborn infants and young children and nutrition education for the parents.
2. The so-identified families be monitored, especially during the first 18 months of life of the child and road to health cards kept which detail any decline in the growth trajectory.
3. To reinforce the efforts of family planners in the area and stress the importance of child spacing as a nutrition intervention.

The hypothesis of this study was that there is a demonstrable relationship between the occurrence of severe malnutrition in children and specific social cultural and familial factors. With the exception of cultural determinants (where no association between cultural taboos and severe malnutrition was found) the hypothesis was proven.

It was my goal to provide a useful tool for community health workers in Kibwezi. With the results that we have obtained and together with the research results of other studies in Kibwezi, it appears that this goal will be realised.

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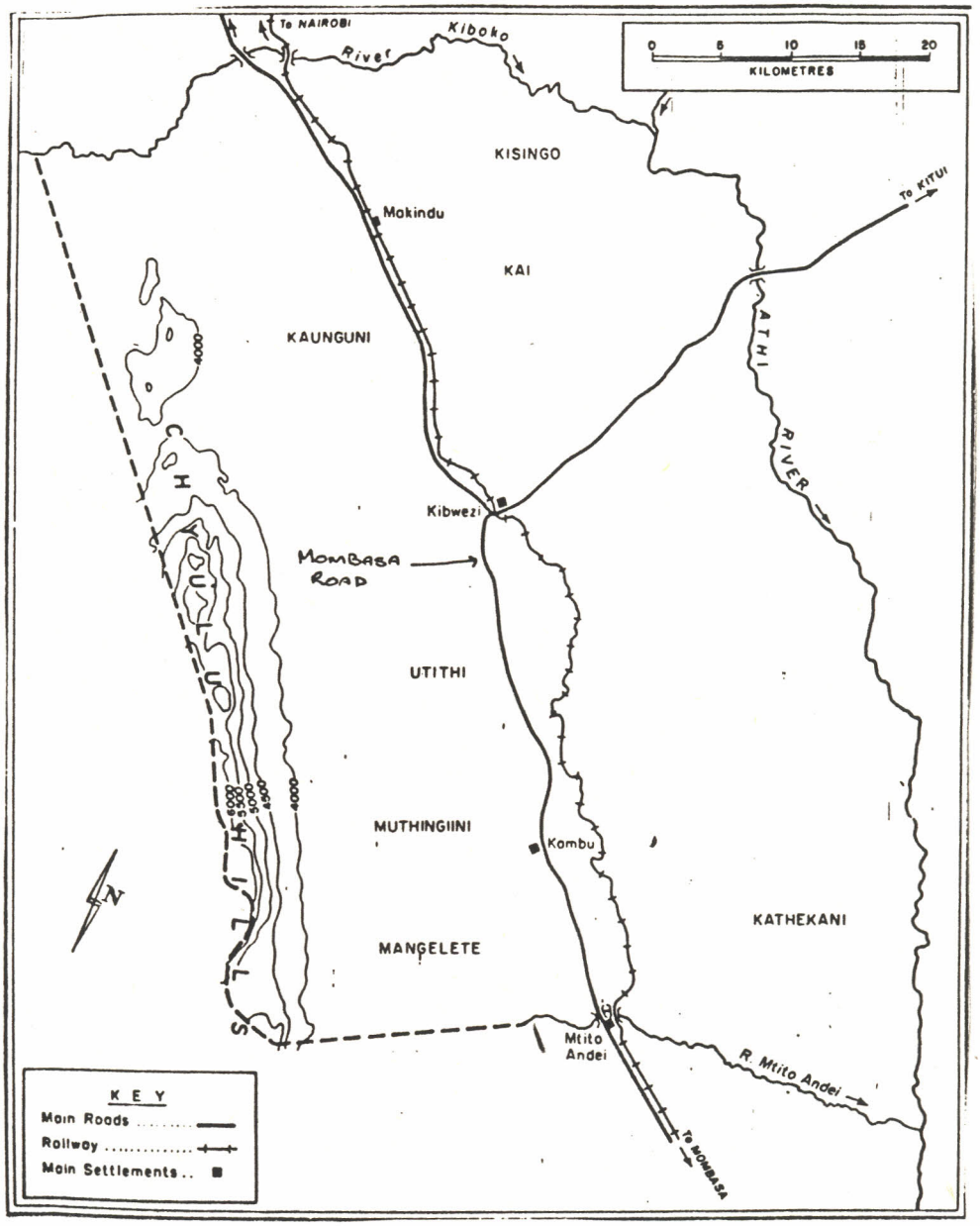
APPENDIX 1

Map of the Study Site



APPENDIX 2 (a)

Crossstabulation: nutritional status by amount of land owned by the family

Count Row Pct Col Pct	study 1	control 2	Row Total
0-6.5 acres	93 57.1 72.7	70 42.9 54.3	163 63.4
>6.5 acres	35 37.2 27.3	59 62.8 45.7	94 36.6
Column Total	128 49.8	129 50.2	257 100.0

Chi-Square	D.F.	Significance	E.F.<5
8.59322	1	.0034	None

Number of missing observations = 21

APPENDIX 2 (b)

Crossstabulation: nutritional status by amount of land owned by the family

Count Row Pct Col Pct	study 1	control 2	Row Total
0-3.5 acres	60 63.2 46.9	35 36.8 27.1	95 37.0
>3.5 acres	68 42.0 53.1	94 58.0 72.9	162 63.0
Column Total	128 49.8	129 50.2	257 100.0

Chi-Square	D.F.	Significance	E.F.<5
9.91744	1	.0016	None

Number of missing observations = 21

APPENDIX 2 (e)

Crossstabulation: nutritional status by amount of land owned by the family

Count Row Pct Col Pct	study 1	control 2	Row Total
0-2.5 acres	39 65.0 65.0	21 35.0 35.0	60 23.3
2.5-10.0 acres	76 47.8 43.1	83 52.2 56.9	159 61.9
>10.0 acres	13 34.2 10.2	25 65.8 19.3	38 14.8
Column Total	128 49.8	129 50.2	257 100.0

Chi-Square	D.F.	Significance	E.F.<5
9.49390	2	.0087	None

Number of missing observations = 21

INTERVIEW SCHEDULE

1.DATE..... 2.CHILDS NUMBER.....

3.NAME OF RESPONDENT..... 4.INTERVIEWER.....

5.NAME OF CHILD..... 6.SEX OF CHILD.....

7.MATCHED WITH..... 8.AGE OF CHILD (MONTHS).....

9.SUBLOCATION..... 10.VILLAGE.....

ANTHROPOMETRY

	OBS.1	OBS.2	AVERAGE
WEIGHT (+/- 0.1 Kg)	.....	.....	.....
HEIGHT.. (+/- 1 CM)	.....	.....	.....
MUAC (+/- 0.2 CM)	.....	.....	.....

PLEASE REPEAT THE ANTHROPOMETRY IF NOT WITHIN SET LIMITS

How old was.....(child) when you first took it to a health

centre.....?

11.What is your relationship to .....(child's name)

mother grandmother other.....state

IF NOT THE MOTHER OF THE CHILD, GO TO FORM B.

12.Could you list the people, including yourself and .....(child), who normally live in this household?

NAME	RELATIONSHIP to Respondent	AGE (D.O.B.)	SEX M/F
1.....	.....	.....	....
2.....	.....	.....	....
3.....	.....	.....	....
4.....	.....	.....	....
5.....	.....	.....	....
6.....	.....	.....	....
7.....	.....	.....	....
8.....	.....	.....	....
9.....	.....	.....	....
10.....	.....	.....	....

13.How many years did you go to school? .....

14. Are you:

never married married now divorced widowed

polygamously married other

15. Have any children in this household died within the last five years.

RELATIONSHIP to Respondent	AGE when DIED	SEX	Place
1.....	.....	.....	.....
2.....	.....	.....	.....
3.....	.....	.....	.....
4.....	.....	.....	.....
5.....	.....	.....	.....

I would now like to ask you a few questions about where you come from and how you get your food and where the food comes from. There is no right answer, just answer as honestly as you can.

16. How long have you been living in this sublocation?.....

17. Where did you come from?.....why?.....

.....

18.What sources of income does this household have?
(List everyhere this family gets money from, including money from family members living away who remit money home, cash crops etc.)

REMITTED FROM: (place)	RELATIONSHIP TO RESPONDENT	HOW MUCH	HOW OFTEN
1.....	.....	.....	.....
2.....	.....	.....	.....
3.....	.....	.....	.....
4.....	.....	.....	.....
5.....	.....	.....	.....
6.....	.....	.....	.....

LABOUR: 3PERSON EMPLOYED	WHAT WORK	HOW OFTEN	HOW MUCH
1.....	.....	.....	.....
2.....	.....	.....	.....
3.....	.....	.....	.....
4.....	.....	.....	.....
5.....	.....	.....	.....
6.....	.....	.....	.....

19. What food crops do you grow?

....

....

20. Is all the food eaten on the compound? yes no

21. How much land do you have? .....

22. Is the land owned or rented owned rented borrowed

I would now like to ask you a few questions about health and eating. Answer as well as you can. It doesn't matter if you don't know the answer....just say "I don't know".

23. How is diarrhoea recognised?.....

.....

24. What causes diarrhoea?.....

.....

25. How is diarrhea caused?.....

.....

26. Do you withold foods and drinks if a child is suffering from diarrhoea?

yes no

27. If yes, what do you withold?

....

28. Why?.....

.....

29. Do you withhold foods and drinks if a child is suffering from measles?

yes no

30. If yes, what do you withold?

....

31. Why?.....

.....

32.Do you ever withhold breastmilk during illness? YES/NO

33. Why?.....

.....

34. Is anyone in this home pregnant at the moment?

yes no maybe

If yes, how many months?.....

ANY OTHER NOTES OR COMMENTS

INTERVIEW SCHEDULE (Kamba)

1.DATE..... 2.CHILDS NUMBER.....

3.NAME OF RESPONDENT..... 4.INTERVIEWER.....

5.NAME OF CHILD..... 6.SEX OF CHILD.....

7.MATCHED WITH..... 8.AGE OF CHILD (MONTHS).....

9.SUBLOCATION..... 10.VILLAGE.....

ANTHROPOMETRY

	OBS.1	OBS.2	AVERAGE
WEIGHT (+/- 0.1 Kg)	.....	.....	.....
HEIGHT.. (+/- 1 CM)	.....	.....	.....
MUAC (+/- 0.2 CM)	.....	.....	.....

PLEASE REPEAT THE ANTHROPOMETRY IF NOT WITHIN SET LIMITS

Kana kaku kai na ukuu mwau uikatwaa yambee kutonywa singano sya kusiya mowau ? .....

11. Uilenye ata wina mutua? .....(Child's name)

Inyia Usue Ungi.....(state)

IF NOT THE MOTHER OF THE CHILD, GO TO FORM B.

---

12. Nutonya kundalila andu onthe ala mikalaa musyini uu vamwe naku na mutua?

ISYITWA	MUILENIE ATA	UKUU KASYAIWE INDII	M/F
1.....	.....	.....	.....
2.....	.....	.....	.....
3.....	.....	.....	.....
4.....	.....	.....	.....
5.....	.....	.....	.....
6.....	.....	.....	.....
7.....	.....	.....	.....
8.....	.....	.....	.....
9.....	.....	.....	.....
10.....	.....	.....	.....

13.Usomete sukulu miaka yiana ata?.....(Kisomo kya andu aima)

14. We?

Waatwawa wimutwae kana niwataanisye na muemeu

polygamously married Ni wakwiiwe ni muume Undu ungi

15. Musyini uu ve syana syaakwa nthini wa miakani itano mithelu?

RELATIONSHIP to Respondent	AGE when DIED	SEX	Place
1.....	.....	.....	.....
2.....	.....	.....	.....
3.....	.....	.....	.....
4.....	.....	.....	.....
5.....	.....	.....	.....

YU NINGWENDA UKUKULYA MAKULYO OMANINI MA VALA WAUMIE NA UNDU WIYONEAA LIU NA VALA U-LIU WUMAA, SUNGIA UW'O UNDU VATONYEKA.

16. Wikalite kivaloni / kisioni kwa ivinda yiana ata ? .....

17. Uyuka vaa wathamite va ?.....

Niki.?.....

18. Musyu uu wina nzia myau sya kwitetheesya ndalile nzia syonthe ila musyi uu ukwataa mbesa nasyo, kwongela mbesa kuma kwa andu ma musyi uu ala mathukumaa na maituma. Na maliu ala muvandaa mauthwoosya.

REMITTED FROM: (place)	RELATIONSHIP TO RESPONDENT	HOW MUCH	HOW OFTEN
1.....	.....	.....	.....
2.....	.....	.....	.....
3.....	.....	.....	.....
4.....	.....	.....	.....
5.....	.....	.....	.....
6.....	.....	.....	.....

LABOUR:

PERSON EMPLOYED	WHAT WORK	HOW OFTEN	HOW MUCH
1.....	.....	.....	.....
2.....	.....	.....	.....
3.....	.....	.....	.....
4.....	.....	.....	.....
5.....	.....	.....	.....
6.....	.....	.....	.....

19. Ni liu mwau muvandaa ?

....

....

20. Liu usu w'onthe uisawa vaa musyi ? ii aiee

21. Mwina kitheka kiana ata ?.....

22. Kitheka nikyenyu kana nikyakukomboa kana mwikite utuw'a

Yu ningwenda ukukulya makulyo manini iulu wa uima wa mii na miile sungia o-nesa und
utonya ethwa ndwisi asya ndwisi.

23. Kwituuwa kumanyikaa ata ?.....

.....

24. Kwituuwa kuetawe nikyau ? .....

.....

25. Kiu kietae kietae ata ?

.....

26. Ethwa kana nikekwituuwa nukavataa maliu na syindu syakunywa?. ii aiee

27 (if yes) Ni maliu meva na syindu syiva sya unywa uvata utonya uvata kana kayituuwa?

....

28. Niki?.....

.....

29. Ethwa kana kena mukambi nukavataa maliu na syindu sya kunywa? ii Aiee

30. (if yes) ni maliu meva nasyindu syiva sya kunywa uvataa kana kena mukambi?

....

31. Niki?.....

.....

32. Nuvataa mwana iya ya nondo yila muwau?

ii aiee

33. Niki ?.....

.....

34. Musyi uu ve mundu muito ?

ii aiee nokwithwa

Ethwa ni ii, yi myei iana ? .....

ANY OTHER NOTES OR COMMENTS.