RELATIONSHIP BETWEEN HOUSEHOLD SIZE , DEPENDENCY RATIO, LANDHOLDING AND CHILD NUTRITIONAL STATUS IN BUGWERE, UGANDA

BY

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

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DEDICATION

To my parents

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LIST OF DEFINITIONS OF TERMS USED

The following definitions were used in this study:

1. HOUSEHOLD: A group of people living together and eating from one Kitchen. In this study, only those households with at least a child below 5 years were included.
2. FAMILY: A group of people living together and related by blood, adoption or marriage. A family may comprise one or more households sharing one compound, and usually has one overall head.
3. PRESCHOOLER: A child aged 0 to 5 years.
4. DEPENDENCY RATIO: Sum of children under 15 years and adults aged over 64 years in a defined place divided by the sum of adults with ages 15-64 years living in the same place.
5. MONOGAMOUS MARRIAGE: This is a marriage in which the husband is married to only one woman.
6. POLYGAMOUS MARRIAGE: A marriage in which the husband is married to more than one woman.
7. ADULT: A person aged 15 years or more.
8. STRONG ADULT: A person aged 15 to 64 years.
9. EXTENDED FAMILY: A family composed of husband and wife or wives, children, grand parents, and other relatives (as opposed to a nuclear family of parents and their children only).
10. SMALL HOUSEHOLD: A household of not more than four people.

12. LARGE HOUSEHOLD: A household comprising eight or more people.

ABSTRACT

The prevalence of protein-energy malnutrition (PEM) in Bugwere, a rural farming community in Tororo District, Eastern Uganda, was established. Also the relationship between household size, household dependency ratio, number of females aged 8 to 64 years, per household, landholding and child nutritional status in the area were determined.

A cross-sectional survey was conducted from January to May 1987. Data were collected by interviewing parents and taking anthropometric measurements of 502 children of age 5-59 months, using standard techniques, as described by Jelliffe (1966).

The prevalence of PEM was quite low; 27.1% of the sampled children fell below 80% of standard weight-for-age, 21.0% below 90% of the standard height-for-age, and 1.2% below 80% of the standard weight-for-height. There was no significant (>.05) association between the child's nutritional status and household size, dependency ratio, number of females in the household of age 8 to 64 years, and the total amount of land available to the household.

The study provides local area-specific information on the current nature of PEM in Tororo district.

CHAPTER 1

INTRODUCTION

1.1 Statement of the Problem

The main nutritional problem in Uganda as in many parts of the developing world is protein-energy malnutrition (PEM) of childhood (Bennett and Stanfield,1971). In the 1960's the prevalence of PEM as reported by Rutishauser (1971) in the country ranged from 34 to 76 per cent (weight-for-age, first degree malnutrition using Gomez classification). The amount of kwashiorkor and marasmus varied between 0 and 2.7 per cent (ibid) with Bukedi (now Tororo) and Mengo districts having the highest rates.

In recent years, very few nutrition studies have been done in Uganda (Alnwick, 1981; Herbert, 1983; Kakitahi et al., 1985; Bogan and Wangwe, 1982). The results of the surveys invariably indicate the existence of differences in the baseline parameters of nutritional status of young children in various parts of the country. This may be attributed to the fact that the nature and extent of the underlying causes of malnutrition vary from community to community and from family to family (Welbourn,1955; Welbourn, 1959; Farmer, 1960; Jelliffe and Bennett, 1960; Schneideman et al., 1971).

Bennett and Stanfield (1971) in their review on

the patterns of malnutrition in Uganda, have identified the immediate causes of malnutrition as: (a) infections and (b) dietary inadequacy. They indicate that among the factors probably associated with dietary inadequacy are: small land plot in relation to family food demand, low occupational status, lack of education, large family size and poor spacing of siblings, isolated or neglected adults or children, widows or immigrants, bottle feeding with dilution of milk, poor knowledge of food value and children's dietary requirements, and inadequate frequency of meals.

Socio-economic factors such as household size, total household landholding (Valverde, 1976), mother's education, parent's occupation, and income, when they are associated with the nutritional status of young children in a household can be used as proxy-indicators of health and nutritional status of the household. Thus a health worker may use this information to identify families whose children are at high risk of developing malnutrition and, therefore, need attention.

The use of household size and size of household landholding as proxy indicators of nutritional status has not been widely employed in Uganda. This is perhaps because the association between these variables and nutritional status of young children often varies from

community to community depending on the prevailing conditions. For each area or community the degree of the association may have to be established, a situation which requires conducting localised studies.

This study, in general, sought to establish the prevalence of PEM as well as to determine its relationship with specific socio-economic and demographic factors which could be the underlying causes of malnutrition in a rural farming community (Bugwere). The community is located in Tororo district, Eastern Uganda, and covers about a quarter of the total area of the district.

The choice of the study area was influenced by several factors. It was noted that Tororo district lacked documented information about the current prevalence and nature of PEM, particularly the mild to moderate forms. The district had one of the highest rates (2.6%) of severe malnutrition in the country in the 1960's (Rutishauser, 1971). With an increasing population the socio-economic and demographic characteristics of the area are likely to have changed over the years - with possible profound consequences for child nutritional status. There is need, therefore, for studies to establish the present nature of PEM in several communities in the district - especially among children. In general, there is a growing emphasis on the importa-

nce of studies focusing on mild and moderate PEM of early childhood (Martorell and Ho, 1984).

The study area (Bugwere) is densely populated, and has a representative rural population in Tororo district. In this community, as in many others in the district, the staple foods are high in carbohydrates, e.g. millet, maize, sweet potatoes, bananas, and cassava. A large proportion of the population does not get diets adequate in protein and consequently PEM seems common. Large families are also common, most of them being of the extended type.

In the present study, efforts were made to: (a) establish the prevalence of PEM in the study area, and (b) examine the relationship between household size, dependency ratio, total landholdings, and the nutritional status of underfives in the area.

1.2 Objectives of the study

1.2.1 Objective 1

To establish the prevalence of protein-energy malnutrition in Bugwere area.

1.2.2 Objective 2

To determine the relationship between selected factors and the nutritional status of preschool children of small scale farmers in the study area.

1.2.2.1 Sub-objective 1

To determine the relationship between total number of people living in a household and the nutritional status of children aged 5-59 months.

1.2.2.2 Sub-objective 2

To determine the relationship between the number of females of age 8-64 years in a household and the nutritional status of children (5-59 months).

1.2.3 Objective 3

To determine the relationship between the dependency ratio of a household and the nutritional status of preschoolers in the household.

1.2.3 Objective 4

To determine the relationship between amount of land available to a household and the nutritional status of pre-school children in the household.

1.3 Statement of Hypotheses

The study had the following hypotheses:

1.3.1 The prevalence of PEM in the study area is high.

1.3.2 Household size is significantly ($p < 0.05$) associated with nutritional status of pre-school children in the household.

1.3.3 The dependency ratio of a household is significantly ($p < 0.05$) associated with the nutritional status of pre-school children in the household.

1.3.4 The nutritional status of pre-school children in a household is significantly ($p<0.05$) associated with the number of females of age 8-64 years in the household.

1.3.5 There is a significant ($p<0.05$) association between the amount of land available to a household and child nutritional status.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The main immediate causes of malnutrition are known to be infection and dietary inadequacy. However, the basic causes of poor nutritional status in the developing countries are socio-economic (Kielmann and McCord, 1978; Martorell and Ho, 1984).

In much of the developing world poverty is pervasive, and the capacity of families to purchase and/or produce food is limited. The population is growing rapidly. This operates both directly, limiting the amount of food and arable land available per capita, and indirectly, exacerbating other social ills that foster malnutrition (Taylor and Taylor, 1976). Often, there is ignorance of the special needs of children and inappropriate cultural beliefs and practices which contribute to the causation of malnutrition. Environmental sanitation is often inadequate. This, combined with limited access to preventive and curative health care, results in high incidences and increased severity of infectious diseases, problems that in turn adversely affect nutrient utilization (ibid).

In Africa and other developing areas, protein-energy malnutrition (PEM) today is the most serious

nutritional condition affecting health during childhood (Bennett and Stanfield, 1971; Latham, 1979).

The aetiology of Protein Energy Malnutrition in any specific community is complex and, depending on the local situation, may require examination of a wide spectrum of political, socio-economic and clinical parameters for it's elucidation (Kielmann et al., 1976). Immediate causes for the individual child, on the other hand, can be more readily identified and are found to be similar if not identical in most parts of the less developed world. An examination of these is essentially limited to the identification of reasons for decreased food intake, decreased food utilization, and/or increased food expenditure (Kielmann et al., 1976). Decreased food intake itself may be caused by a number of underlying conditions, among which lack of food because of insufficient food production or poverty is one.

In most developing countries agriculture is the greatest source of employment, ranging between 50 and 70 percent (Myrdal, 1970). Food production in a particular area or by certain families is affected by many factors. These include climate, the suitability of the soil for certain crops, limited knowledge of agriculture, the availability of seeds, tools, time spent working the land, labour, and the amount of land available (Latham, 1979).

Latham (1979) further points out that among the factors causing malnutrition in Africa (1) over population and land shortage and (2) large families raised in households with too little land or income are most important.

Many factors, drawn from the social, cultural and socio-economic environments of vulnerable populations, have been examined as possible determinants of malnutrition. The socio-economic and demographic variables studied include land tenure, agricultural production, household size, household income, preference of child's sex, parents' education level, cash cropping, and father's occupation.

The effects of socio-economic factors on nutritional status vary from region to region depending on the socio-economic conditions prevailing in the area, and other factors such as morbidity patterns, and political climate.

2.2 Prevalence of PEM in Uganda

Several nutrition surveys have been done in Uganda. In the 1960's, the prevalence of PEM in the country as reported by Rutishauser (1971) varied from 34 to 76 per cent (first degree malnutrition, Gomez classification). The amount of severe malnutrition in children (Marasmus and Kwashiorkor) ranged from 0 to 2.7 per cent (ibid).

Alnwick (1981) investigated the nutritional status of young children in the slum areas of Kampala city. The prevalence of wasting (weight-for-height below 80% of the NCHS reference standard) ranged from 0 to 4.2 %. In the same study, the prevalence of nutritional stunting was high, 22.5% of children being less than 90% of their expected length-for-age. Bogan and Wangwe (1982) conducted a nutrition survey in Mbale district. They found 3.9% of the chidren to be wasted and 29.0% to be stunted.

A nutrition survey carried out in West Nile area (Herbert, 1983) found the prevalence of severely low weight-for-height (under 80% of the NCHS reference median) to be 3.9 per cent. No Kwashiorkor was seen but 2 to 3 per cent of the children examined had dispigmented hair. Kakitahi et al. (1985) have conducted a baseline survey for the Rural Health Water and Community Development project in North-eastern Uganda. Their results on nutrition indicate that 16.5 per cent of the underfives studied were below 80% of the median weight-for-age, 13.5 per cent were below 90% of the median height-for-age, and 1.1 per cent below 80% of the median weight-for-height.

2.3 Household landholding and child nutritional status:

The amount of land owned is a measure of wealth, especially in traditional societies which still depend heavily on subsistence farming for a livelihood.

Several investigators have sought to link the amount of land available to a family with child mortality and malnutrition. Varying results have been obtained.

Valverde et al. (1977) studied the relationship between occupation, land owned and/or rented by the family and the nutritional status of young children in four rural Guatemalan villages. There were high prevalences of low weight for age in children of both farmers (29%) and labourers (28%). However, most (76%) of the farmers owned only a small amount of poor quality land, below the minimum recommended by most agrarian reform laws. For the families classified as farmers, the total amount of land available and the nutritional status of children were significantly ($p<0.05$) and positively associated.

The pattern of land tenure was considered in a household anthropometric survey (Victora et al., 1986) of children aged 1-3 years in the Brazilian state of Rio Grande do Sul. Children of labourers were more likely to be malnourished than those of landowners, while children of sharecroppers presented intermediate

levels. Among the landowners, there was no association between the area of land owned by the family and child nutritional status.

In a study in Costa Rica, Rawson and Valverde (1976) linked child malnutrition with the size of household landholding. There was a significantly higher prevalence of low weight for age among children of labourer and farmers owning less than 1.4 hectares, relative to those owning more land. Another Costa Rican study showed malnutrition prevalences of 6.1 percent for children from small farms and 8.4 percent for those of labourers ($p<0.005$) according to the same criteria. Among landowners, on the other hand, there was no association between prevalence of malnutrition and land size (Cervantes et al., 1981).

Nabarro (1981) has studied some environmental and socio-economic determinants of malnutrition in children in East Nepal. He noted that children who had abnormally low weight for age and height-for-age values came mostly from families cultivating very small areas of land. In the Terai region of Nepal, Martorell et al. (1984) also found the amount of land available to the family and the amount of crop production to be significant determinants of child nutritional status.

Very few studies relating child nutritional status to the size of household landholding have been done in

Africa.

Cherian, et al. (1985) examined the epidemiology of malnutrition in young children in Zaria, Nigeria. They noted that, on the whole, children of traders and salaried workers had a better nutritional status than children of farmers and herdsmen.

In a baseline survey in Bondo division of Siaya district, Kenya, Kaseje et al. (1983) found that the amount of land owned or cultivated by a household in the previous year did not influence nutritional status significantally ($p=0.60$). They attributed this to the fact that in the previous two years there had been inadequate rainfall and little food harvested. Thus food production was poor for everybody and depended neither on the size of land owned nor cultivated.

A study done in Machakos district of Kenya, under the Integrated Development Programme (FAO, 1984) showed that nutritional status and size of landholding and landholding per capita in the household were strongly related. Among those households holding less than 0.25 hectares, a significantly higher proportion of children was stunted. This relationship was maintained when land holding was standardized by household size. In the same district, Onchere (1984) found that households whose children were more vulnerable to malnutrition tended to, among other things, produce less food, and to have

less money to spend on food than households whose children were less vulnerable. The latter tended to have more land and own more livestock.

Data from the 1978-79 Rural Child Nutrition Survey in Kenya were linked to Agricultural data from the Integrated Rural Surveys and used to establish the extent of chronic malnutrition among children (Haaga, et al, 1986). " The children sub-populations" were classified by province, occupation, landholding and cropping pattern. With respect to landholding, landless agricultural workers and small holders had roughly the same prevalence of stunting. The height-for-age cut-off point was 90 % of a reference median. Households with larger farms (>1.5 ha) had a lower prevalence of stunting than smallholders, 19.4% compared to 24.5%, "statistically significant at the 0.10 level".

Kakitahi, et al. (1985) have conducted a baseline nutrition survey for the Rural Health, Water and Community Development Project in North-eastern Uganda. They found that the prevalence of low weight-for-age was significantly higher among children in households owning less than 10 acres of land than in those with more acreage. Also, households having to hire labour generally had higher levels of low weight-for-age among their children than those that did not have to hire labour.

2.4 Family size and child nutritional status

Van Schaik (1964) noted that a family's surroundings, its composition, its size, the relationship between the members, the function of the members in the family and society - all affect the family's food pattern, and hence nutritional status.

One half of the population in developing areas are below nineteen years of age (Taylor and Taylor, 1976). The youthfulness of any rapidly growing population results in a high ratio of young dependents to economically active adults.

Large family size, apart from limiting the amount of food *per capita* in a household, may lower the quality of attention given to individual children (Williams and Jelliffe, 1972). In the clinic of the Indian National Institute of Nutrition, it was observed that 61 per cent of all cases of PEM were in children with three or more siblings (Rao and Gopalan, 1969).

A study in the Philippines (Balderrama-Guzman, 1973) investigated the influence of family size on preschool child nutritional status in a rural and urban population. In both groups, a trend of rising prevalence of malnutrition was noted with the increase in family size.

Wray and Aguirre (1969) studied the epidemiology

of PEM in pre-school children in Candelaria, a small town in Colombia. Family size, defined as the number of living children, was one of the factors considered. The rates of PEM were found to increase with family size, and with the number of pre-school children in the family.

Bhuiya, et al. (1985) have investigated the relationship between child nutritional status and household size, amount of cultivable land available to household, sex difference, and other socio-economic factors in rural Bangladesh. Household size had a significant negative effect on both boys' and girls' nutritional status, while possesion of more than two acres of land and a higher tax payment by the household had a significant positive influence. The results also suggested some discrimination against female children in the richer households. A recent study in two Bangladesh villages (Becker, et al., 1986) revealed that initial values for anthropometric indicators varied directly with household wealth but inversely with the number of pre-school children in the household. Over the year, however, the measures of change in anthropometric status were more closely associated with the income variables. The study also indicated that while a girl's growth was not significantly affected by the presence or absence of other young siblings, the presence of

another young child had a deleterious effect on a boy's nutritional status. However, the authours did not explain this particular finding.

In South Africa, Lazarus, et al. (1984) have investigated the relationship between selected socio-economic variables and the nutritional status of pre-school Indian children in Natal - an urban area. The variables studied were birth order, family size, sex differences, maternal education levels, and family income. Family size was defined as the total number of people in a family. None of these variables was significant.

In a baseline survey in Siaya district of Kenya, Kaseje, et al. (1983) found that household size affected the nutritional status of pre-school children in the area. Although this effect was shown in the survey data, the difference among household size categories regarding nutritional status was not statistically significant.

Hoorweg et al. (1983) studied the effect of selected socio-economic and ecological factors on the nutritional status of young children in Muranga district, Kenya. They found that larger families, which were referred to as "senior families", generally did better than the smaller families. This finding was explained by the fact that "senior families", on the whole, had the larger number of children aged seventeen years and

above. Generally, at this age, children in this community turn from "burdens into assets", contributing to the family income. Onchere (1984), in a study in Machakos, Kenya, found a significant negative relationship between household size and per capita food in take. This finding was consistent with the obsevation (ibid) that children from larger households generally had a lower nutritional status than those from smaller households.

The relationship between child nutritional status and the number or proportion of females in the household has not been documented. However, Kennedy, et al. (1986) found in South Nyanza, Kenya, that the percentage of females in the household was not significantly associated with pre-school child morbidity.

In Uganda, a recent nutritional survey (Kakitahi, et al., 1985) in four North-eastern districts found no significant association between child nutritional status, birth order and the crowding index of household. It was, however, noted that prevalence of low weight for age was high in households having less than three people working the land, and having to hire labour.

The current approach to the malnutrition problem in the country (Uganda) has been to shift nutrition activities from static health units to the community (Kakitahi, 1983). This is being done through training

of Primary Health Care Workers. It is emphasized that improvement of the nutritional status of people will be achieved through improvement in diet and by controlling diseases through immunization, early diagnosis and treatment at nearby health centres and proper environmental sanitation.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Type of Investigation

This was a cross-sectional study of analytic design. The study was done by conducting a cross-sectional survey of pre-school children of small-scale farmers in Bugwere, an area in Tororo district of Uganda. The survey had five basic components:

i) Household census and vital statistics

ii) Assessment of the nutritional status of underfives

iii) Morbidity history of the pre-school children

iv) Estimation of the amount of land available to a household, and

v) Environmental conditions of the households.

Data were collected by interviewing parents and taking anthropometric measurements of children aged 5-59 months.

3.2 Field Equipment/Materials

For the survey, the following equipment/materials were used:

3.2.1 Weighing Equipment

1 Spring Balance (Aanonsen Model 102-10PBW, 25 Kg capacity, graduated in 0.1 Kg)

2 plastic (or scale) pants and 1 scale storage bag.

3.2.2 Measuring Equipment

1 Somatometre -i.e. an infantometre or length measuring instrument, calibrated in millimetres, with a length of 1 metre;

1 L-shaped wooden board for standing on. Dimensions were: horizontal base: 28 cm square, 1.2 cm thick, and vertical piece: 28 cm wide, 1 cm thick and 120 cm high;

1 Height Measuring steel tape - 2 metres long and calibrated in millimetres.

3.2.3 Miscellaneous Equipment

1 Equipment bag/shoulder bag;

1 Map of the study area (presented in appendix 2);

362 Stapled questionnaires.

3.3 Standardization of Instruments

3.3.1 Standardization of Weighing Balance

A round faced spring balance 'Aanonsen Model 102-10PBW', which can weigh up to 25 Kg and is graduated in 0.1 Kg, was used for weighing children. Standard weights of 100g, 200g and 500g were used to determine its accuracy. Before making each measurement the balance was zeroed using a screw provided. In each case the scale reading was the same as the value of the corresponding standard weight, showing that the balance was accurately calibrated.

3.3.3 Standardization of the Questionnaire

The questionnaire used in this study is shown in appendix 11. It was first written in English and then translated from English into the local language of the study population with the help of bilingual research assistants.

The questionnaire was then pretested during the pilot study in an area in the same agro-ecological zone as the study area, and where the same language was spoken. During the pretesting of the questionnaire the following were checked for: content, clarity, length and total time needed, acceptability, reliability, scorability and ease of analysis. Details of the pilot study are given in section 3.11.

3.4 Study Population and Sample Size

The study population consisted of all households in the study area with children of age 5-59 months. An initial sample of 512 underfives was selected from 299 households as described below in section 3.5.

As shown in appendix 4, the minimum sample size, determined with reference to monogamous households only, was 288 underfives. However, the number of underfives actually sampled exceeded the estimated minimum sample size, because of three main reasons. First, it was decided to include polygamous households

in the study after an analysis of data from the pilot study revealed no significant difference between the nutritional status of children from households headed by monogamists and polygamists. Secondly, the proportion of the latter type of households was high (25.3%). Lastly, an allowance had to be made for the possibility of some questionnaires being discarded due to errors in filling.

3.5 Sampling

3.5.1 Sampling Method

The sampling unit was the household. A combination of cluster sampling and systematic random sampling within a cluster was employed.

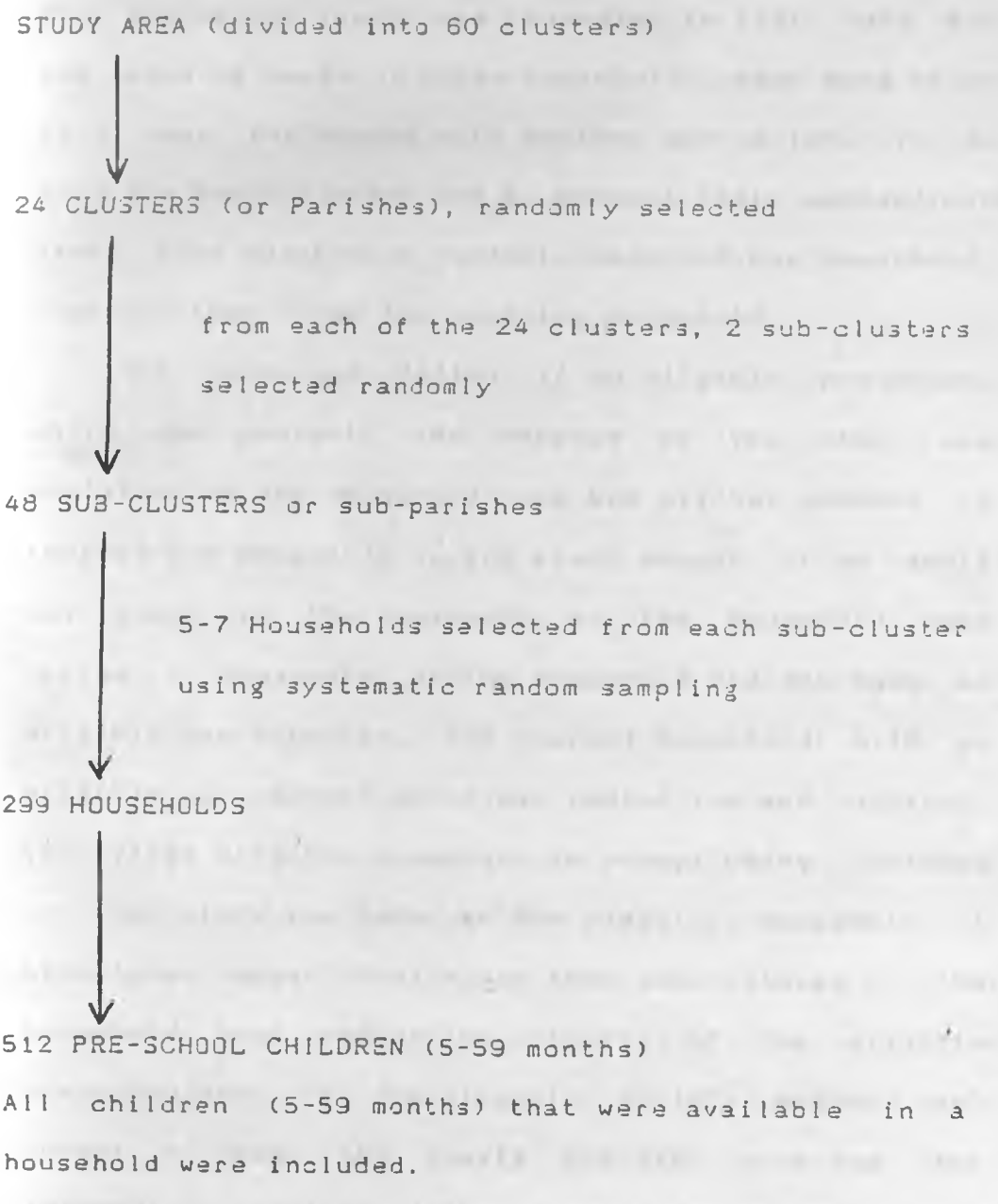
The study area was divided into 60 potential clusters, each being an administrative unit called a parish (or Muluka). A parish may have as many as 300 households.

Each cluster was given a number on a separate small piece of paper which was then folded into a tiny ball. These balls were shuffled in a basin and 24 were randomly picked, thus selecting 24 clusters. These are shown in appendix 3. To avoid bias, the selection was made by a person who did not participate in making the paper balls.

Figure 1 on page 25 gives the scheme used for

sampling. In each of the 24 parishes selected, the number of sub-parishes (representing sub-clusters) was noted using information from the parish leader (also called National Resistance Committee Chairman II). Two sub-parishes were randomly selected from each parish and 5-7 households selected from each of the two sub-parishes using systematic random sampling. A total of 239 households was obtained, providing 512 pre-school children of age 5-59 months.

Figure 1: Sampling scheme used in the study



3.5.2 Sampling Procedure

In a sub-parish, the first household to be sampled was determined from those near the boundary as follows: The sub-parish leader was requested to list down all the names of heads of those households which were on or very near the border with another sub-parish. To do this the leaders often had to consult their surbordinate staff. This researcher randomly selected one household from the list to be the starting household.

The house was visited. If an eligible pre-school child was present, the purpose of the study was explained to the household head and his/her consent to include the household in the study sought. If no adult was found in the household, or the household head failed to cooperate, or the household did not have an eligible pre-schooler, the nearest household with an eligible pre-school child was looked for and visited. The first eligible household to accept being included in the study was taken as the starting household. A structured questionnaire was then administered to the household head and/or the mother(s) of the eligible pre-schoolers. If the eligible child's mother was absent or dead, the female guardian provided the information required. Anthropometric measurements were made on all eligible children in the household. The nearest household with a pre-schooler was next consi-

dered for sampling.

A household was re-visited if on the first visit no adults were present or when all eligible pre-schoolers were away but expected to return shortly. The data from children who fell within the required age range but were physically handicapped were excluded from data analysis. This was because it was very difficult to accurately determine their lengths or heights. Nevertheless, the weights of such children were taken and recorded to avoid making them feel rejected, but were not used.

3.6 Interviewing Procedure

The interview was given when the head of a prospective household to be sampled accepted to let his household be included in the study.

Before administering the questionnaire to the household head, the research assistants established rapport with the respondent. In the absence of the male head of household, the mother or female guardian of the child provided all the responses, except those related to the amount of land available to the household. The latter issue always required the presence of the household head.

3.7 Indices of Nutritional Status

The following indices of nutritional status and their respective cut-off points using the Harvard standard were employed:

3.7.1 Weight-for-Age

Well nourished: Weight-for-age ⩾ 80%

Mild-moderate malnutrition: Weight-for-age 60% - < 80%;

Severe malnutrition: Weight-for-age < 60% ;

Weight-for-age was used to measure acute or chronic malnutrition.

3.7.2 Height-for-Age

Well nourished: ⩾ 90%

Mild-moderate malnutrition: Height-for-age 80 - < 90%

Severe malnutrition: Height-for-age < 80%.

Height-for-age was used as a measure of chronic malnutrition (or stunting).

3.7.3 Weight-for-Height

Well nourished: ⩾ 80%

Wasted: < 80% . Weight-for-height was used as a measure of acute malnutrition (or wasting).

3.8 Selection and Training of Research Assistants

Eight secondary school leavers in Kapunyasi parish were identified with the assistance of the parish leader. Five had stopped in form four and the rest in form five or six. They were all males and could speak Lugwere - the main local language spoken throughout the study area. Three of the selected school leavers were parents and one happened to have two pre-school children of ages 7 months and 51 months.

The training of the research assistants lasted eighteen days. During the first day the objectives of the study were outlined to the trainees by the principal researcher. For six days, working only in the afternoons, the school leavers were individually and collectively trained to take accurate weight, length and height measurements of the two young children of their colleague. The methods for determining these measurements are described in section 3.9.

Emphasis was put on the need to adjust the reading on the weighing scale to zero before each weighing was done, and to view the reading scale at right angle to avoid parallax. It was pointed out that heights would be determined only for those children of age 24-59 months using a steel length measuring tape. For children 5-23 months of age, recumbent length was to be determined using the somatometre. Collectively, the

principal researcher, his assistants and a few village elders constructed a local calender of events for the last six years only. For each parish, a local calender of events was made by modifying the main calender.

The research assistants practiced using the local calenders of events by role playing using the method described in a United Nations publication: "How to Weigh and Measure Children" (Shorr, 1986).

In using a local calender of events, an assistant asked the mother or female guardian if the child was born before or after a named event shown in the calender. First, the birthdate was located between two special annual events. Next, the birthdate was located between two repeated annual events until the exact month of birth was determined.

The remaining parts of the questionnaire were discussed by the research team. The assistants were also taught proper filling of the various forms. Finally, they were requested to conduct themselves politely in the field, and to respect other people's views and property.

3.9 Determination of Age, Weight and Height of Children

3.9.1 Determination of Age of a Child

Parents were helped to remember the dates of birth of their pre-school children by using a local calender of events. Then the ages were calculated from the dates of birth, and given to the nearest month.

3.9.2 Determination of Weight of a Child

The weight of a child was measured using a round faced spring balance 'Aanonsen Model 102-10 PBW' which can weigh up to 25 Kg. The balance was hung onto a fixed support above the ground or held above the ground by one of the research assistants while standing. The balance was then zeroed using a zeroing screw provided on it.

The child was undressed completely or had a minimum of clothing (shorts only for boys, light dress for girls). Footwear, if present, was removed. The child was then put into the plastic shorts fitted with straps which were then fastened to the weighing balance in such a way that the child hung freely from the scales. The child's weight was read to the nearest 0.1 Kg by an assistant and recorded. The balance was viewed at right angle to avoid parallax. The child was removed and the balance zeroed again. A second assistant took

the weight measurements of the same child in a similar manner. If the difference between the two readings was more than 0.1 Kg, the measurements were repeated.

3.9.3 Determination of Height of a Child

3.9.3.1 Measuring Lengths of Children aged 5-23 months

The recumbent lengths (crown-heel lengths) of children of age 5-23 months were determined using a somatometre. This is a steel length measuring device of 1 metre length. The device has a movable footpiece and an immovable head piece, both of which are perpendicular to the measurement surface calibrated in millimetres. Two people took the length measurement. The child was laid with no footwear on the length measuring device with the crown of the head against the immovable headpiece. The head faced directly up so that the line of sight was perpendicular to the measuring board.

The assistant applied gentle traction to ensure that the child's head was firmly against the headpiece. He held the child's knees together and pushed them down against the horizontal surface with one hand or forearm, thus fully extending the child's legs. The other hand gently held down the child's head. Another assistant- the measurer- slid the movable footpiece to the child's feet until the heels of both feet touched the footpiece. The child's feet were then immediately

removed from contact with the foot-piece with the measurer's one hand (to prevent the child from kicking and moving the footpiece) while the footpiece is held securely in place with the other hand. If the child proved uncooperative, a third person held the child's hands and pressed the chest gently down.

The reading was taken to the nearest 0.1 cm. The measurement was repeated until two readings agreed within 0.5 cm. Both readings were recorded. The above procedure was repeated for the next eligible child.

3.9.3.2 Measuring Heights of Children 24-59 months of age

The heights of eligible children aged 24-59 months were measured using a height measuring steel tape. The tape was held vertically and pressed firmly along the middle of the vertical rectangular surface of the L-shaped wooden board. Three people were required to measure the height.

The positioning of the child for measurement is shown in appendix 5. If the child's hair had been braided, it was unbraided. A wooden rectangular headboard was lowered onto the child's head until it firmly touched the crown of the head, and the scale at the same time. The stature was read to the nearest 0.1 cm and recorded. Another person took the second measure-

When the difference between the two readings was more than 0.5 cm, the measurements were repeated.

3.10 Morbidity

The history of diarrhoeal disease and measles among preschool children was obtained by the recall method. In the case of diarrhoea, which was defined as more than three loose watery stools in a day, a seven-day recall period was used.

3.11 The Pilot Study

A pilot study was done in an area called Kamuge. This borders the study area and has a similar ecological setting. People in the village chosen speak mainly Lugwere, as do those in the study area. Thirty households with pre-school children were identified with the help of the village chief.

A draft questionnaire was administered to each head of household. Some of the questions were addressed to the child's mother or female caretaker. Anthropometric measurements were taken for all eligible children in the household as described in section 3.9 .

The questionnaire was pre-tested for the following:

a) Content

identifiers and questions related to selected indicators of risk of malnutrition were checked.

b) Clarity

Language, readability, and comprehension both by the research assistants and the respondents were checked

c) Length

The average time taken to administer a single questionnaire was noted.

d) Acceptability

Questions were checked to see if they were invasive or not, and to avoid cultural taboos.

e) Reliability

Two research assistants administered two similar questionnaires to the same respondent and their results checked for consistency so as to get an idea of the size of inter-observer error. To assess the size of intra-observer error, one research assistant was made to administer a questionnaire twice to the same respondent. In each case, the number of questions for which answers were not consistent was taken as a direct measure of the size of error.

f) Scorability

Responses were examined to see if they fitted into the pre-set scaling and scoring system.

g) Ease of Analysis

This was determined by carrying out a preliminary analysis using an IBM personal computer; frequency distributions of a few variables like age, sex and

weight-for-height of children were obtained.

The results of the pilot study were reviewed by the principal researcher and team, and appropriate adjustments made. One major change in the questionnaire was the omission of a question to elicit the presence or absence of pitting oedema in eligible pre-school children, due to much uncertainty and variation among the research assistants in determining this condition.

3.12 Method of Data Cleaning, Processing and Analysis

The questionnaires completed each day were collected together by a research assistant and examined to ensure that each questionnaire was still intact. The researcher checked for completeness of data, consistency of answers given, and for proper filling of the forms. Relevant corrections were made by the researcher and his assistants.

Altogether, 299 questionnaires were filled, one per household, and 512 eligible pre-schoolers sampled. But three questionnaires were discarded due to errors in filling or lack of information. This resulted in four otherwise eligible children being excluded from subsequent analysis. A further two children were excluded because their weights, lengths or heights were so inconsistent as to be practically impossible and were almost certainly due to recording errors. Therefore,

296 households had satisfactorily completed questionnaires and these provided 506 eligible preschool children that were studied.

For each of the 506 children the weight-for-age, weight-for-height or length, and height-(or length)-for-age were determined using the Harvard Standard. The weight and height or length of a child of a certain age were each expressed as a percentage of the median weight and median height or length of Harvard children of the same age. Similarly, the weight of a child of a certain height was compared with the median weight of Harvard children of the same height.

The data was entered into a micro-computer by using KEDIT programme. A system file and programme file were made, and the data accessed for analysis using the SPSS/PC programme. The following statistical analyses were made: Frequency distributions; Chi-square tests, and correlations.

CHAPTER 4

THE STUDY SETTING AND RESEARCH IMPLEMENTATION

4.1 Description of the Study Setting

The study area, Bugwere, is located in the North Western part of Tororo district in the Eastern region of Uganda. The area covers approximately 1,295 square kilometres (500 square miles) and comprises three counties, viz. Budaka, Kibuku and Butebo. A map of the study area and its location are given in appendices 1 and 2.

According to the 1980 national census, the population for Tororo district numbered 668,334 , with a growth rate of 2.3 percent. The current (1987) projected population, taking the annual growth rate of 2.3 %, is approximately 783,652. The study area has, therefore, a population of about 200,000 - about one quarter of the people in the district. The population is fairly dense: 150-199 people per square km (Uganda Population Census, 1980).

The climate is tropical, with moderate temperatures and an annual rainfall of about 1250 mm. The area has a bimodal rainfall pattern, with the long rains falling from August to November. December, January, June and July are usually dry months. The vegetation is Savannah.

The area is occupied by mainly one tribe: the Gwere (or Bagwere), belonging to the Bantu ethnic group. The Gwere live mainly by small scale farming. For food they cultivate millet, cassava, sweet potatoes, bananas, rice, maize, groundnuts and green vegetables. Beans and peas are grown on a relatively small scale. The main cash crop is cotton.

The small scale farmers fall into two basic categories: those who cultivate and have no cattle (but may have other livestock), and those who cultivate and keep some cattle. Other livestock are mainly goats, sheep and poultry. Pigs are rarely kept.

The residential pattern of the Gwere in the rural areas is patri- or neolocal: sons marry and settle on the land of their fathers or acquire land elsewhere to start on their own. Daughters after marriage leave home and follow their husbands.

The common residential situations are: land being occupied by one man and his wife or wives, land divided between a father and his sons or, after the father's death, between his sons. Single or separated women may live with their parents or their brothers. Widows live independently or with the relatives of their deceased husband. When land is shared between a father and his sons, it is usual for the sons to build houses next to that of their father. The result is an extended family

living on one compound, although households remain independent in that each tends to have its own kitchen and cultivate its own part of the land. However, it is also usual for the sons to establish their own separate compounds on the land.

The study area (Bugwere) has several health facilities. One government dispensary and six sub dispensaries exist. There are also about ten private health clinics each run by a Medical Assistant and/or Doctor.

Three main murram roads traverse the area and run almost parallel to each other as indicated in the same map. These are connected by numerous smaller roads. Elsewhere are complex networks of village paths. There is no tarmac road. Public service vehicles such as buses and several smaller vehicles are used for road transport. Bicycles are also used. However, travel on foot is the most common means of transport.

4.2 Research Implementation

Implementation of the research was done in five major phases, viz. preparatory, pilot, data collection, data processing and analysis, and write up of the thesis. Initially, a proposal for the research was drafted in 1986 as part of the requirements of a course unit called "Project Development". The proposal was successfully presented during two seminars. The Inter-

national Development Research Centre (IDRC) agreed to fund the research.

In the period between July and November 1987, preparatory arrangements were made. The equipment to be used in the survey was acquired mainly through purchase. Some of it was borrowed from the department of Food Technology and Nutrition. Then a short visit was made by the researcher to the study area, and on return to Nairobi, a questionnaire was drafted with the guidance of several supervisors. An application was made to the National Research Council of Uganda for permission to conduct research in the proposed area of study .
In the same period of time, a second visit was made to the study area to prepare for the stay in the area and for pilot testing. The pilot study was done in November and December 1986.

Data collection was delayed due to a delay in obtaining research permission. Together with the proposal, the original draft questionnaire had been handed to the National Research Council. The council was of the view that non-medical personnel with little training were likely to make very unreliable observation of pitting oedema. Similary, the council also suggested the ommission of questions to elicit whether a child had lately suffered from fever, cough and eye illness. The researcher made the changes required. On

19th January, 1987, research permission was granted. Data was collected until the middle of May 1987.

The data were cleaned and processed. A method of entering and analysing data using a personal computer was decided after the researcher consulted his supervisors and a statistician. KEDIT programme was used for entering data. Data analysis was started in July 1987 using the SPSS/PC programme.

The write up of the thesis was began in September 1987 and by the end of December the first draft was ready. This was presented in a seminar held on the 13th of January 1988. The final copy of the thesis was submitted to the University of Nairobi in June 1988.

CHAPTER 5

RESULTS

5.1 General Characteristics of the Study Population.

A total of 502 preschool children selected from 296 households were studied. The total population of the households studied was 2,111, constituting about 1% of the entire population of the study area.

Eighteen percent of the households possessed iron-roofed houses while 82% had grass-thatched ones.

Forty percent of the mothers or female guardians had no formal education as compared to 29 percent of the male heads of households.

Of the 296 households sampled, 27.7% were headed by polygamists and 69 % by monogamists. Approximately 61% of the preschool children had mothers or female guardians that were in monogamous marriage, 35% had mothers in polygamous marriage, while the rest (4%) belonged to single, widowed, or divorced mothers. The major occupation of 259 (87.5%) households was subsistence farming. Only 26 (8.8%) of the heads of households were salaried. The rest were either small traders or did other non-salaried jobs.

Of the study households, 96% obtained water mainly from a spring or well, 2.4% from a stream , 1% from a bore-hole, and 0.6% from a tap. Most of the springs and

wells were unprotected. For 80% of the households, the main source of water was located beyond a distance of 1 km. In addition, most of the households (83%) were situated four to eight kilometres from the nearest health facility.

Diarrhoeal disease and measles were quite common among underfives in the population. Approximately 15% of the 502 children studied had suffered from diarrhoea within 7 days preceeding the study; 71% had suffered from measles. With respect to sanitation, about one quarter of the sample households did not have latrines.

5.2 Distribution of children by age and sex (n=502)

5.2.1 Distribution by age

Table 5.1 presents the distribution of children by age. About one tenth of the children were less than one year old while four tenth were aged between three and five years. The mean and median ages of the children were 33 and 32 months respectively.

5.2.2 Distribution of children by sex

The male to female sex ratio of the children was approximately 1:1 with slightly more females (0.96:1).

Table 5.1: Distribution of children by age (N=502)

Age* (months)	Percent	Cumulated per cent
05-11	7.0	7.0
12-23	23.3	30.3
24-35	24.1	54.4
36-47	27.7	82.1
48-59	17.9	100.0
Total	100.0	.

Mean age = 33 months, Median age = 32 months.

* Expressed to the nearest month.

5.3 Prevalence of Protein-energy malnutrition (PEM)

5.3.1 Weight-for-age, weight-for-height, height-for-age

The results of prevalence of PEM in the underfives are presented in Tables 5.3.1 to 5.3.3 below.

Of the 502 children, 27.1 per cent had weight-for-age below 80% of the Harvard median; 20.9 percent were stunted i.e. had a height-for-age below 90% of the Harvard median, and 13 per cent were wasted, having weight-for-age below 90% of the standard. Few (0.6 %) were marasmic. Table 5.3.2 gives the distribution of weight-for-age using Gomez classification.

Table 5.3.1: Weight-for-age prevalence using Harvard standards

Weight-for-age	n	Percent
≥ 80%	366	72.9
60-< 80%	133	26.5
< 60%	3	0.6
Total	502	100.0

Table 5.3.2: Distribution of weight-for-age (W/A) using Gomez classification (N = 502)

W/A	Class	Percent
≥ 90 %	(well nourished)	36.9
75-<90%	(first degree PEM)	51.8
< 75 %	(2nd and 3rd degree PEM)	11.4
Total		100.0

Table 5.3.3: Weight-for-height (W/H) and height-for-age (H/A) Prevalences (using Harvard standards)

Index of nutritional status	Prevalence					
	≥ 90%		80-<90%		< 80%	
	n	%	n	%	n	%
Height-for-age	397	79.1	103	20.5	2	0.4
Weight-for-height	437	87.1	59	11.8	6	1.2

N = 502

5.3.2 Comparative classification of nutritional status

Tables 5.3.4 and 5.3.5 indicate the comparative classification of nutritional status using the three indices: Weight-for-age (W/A), weight-for-height (W/H), and height-for-age (H/A) using the Harvard standards. The distribution of children by weight-for-height and height-for-age showed no significant difference at 5% level.

Of the 502 children, 306 (61%) were classified as malnourished by at least one of the indicators of nutritional status. Considering all the children, 77 (15.2%) were classified as malnourished by both W/A and H/A indices, 61 (12.2%) by W/A and W/H indices and 12 (2.4%) by W/H and H/A indices.

Figure 2 illustrates the distribution of the 306 malnourished children by the three indices. Only 8 (2.6%) of the children were classified as malnourished by all the three indicators.

Table 5.3.4: A comparison of H/A and W/A (N=502)*

H/A	W/A ⩾ 80%	W/A < 80%	Total
⩾ 90%	338 [67.3]	59 [11.8]	397 [79.1]
< 90%	28 [5.6]	77 [15.3]	105 [20.9]
Total	366 [72.9]	136 [27.1]	502 [100.0]

X^2 = 144, df = 1, p <0.00001

* Figures in square brackets are percentages of 502

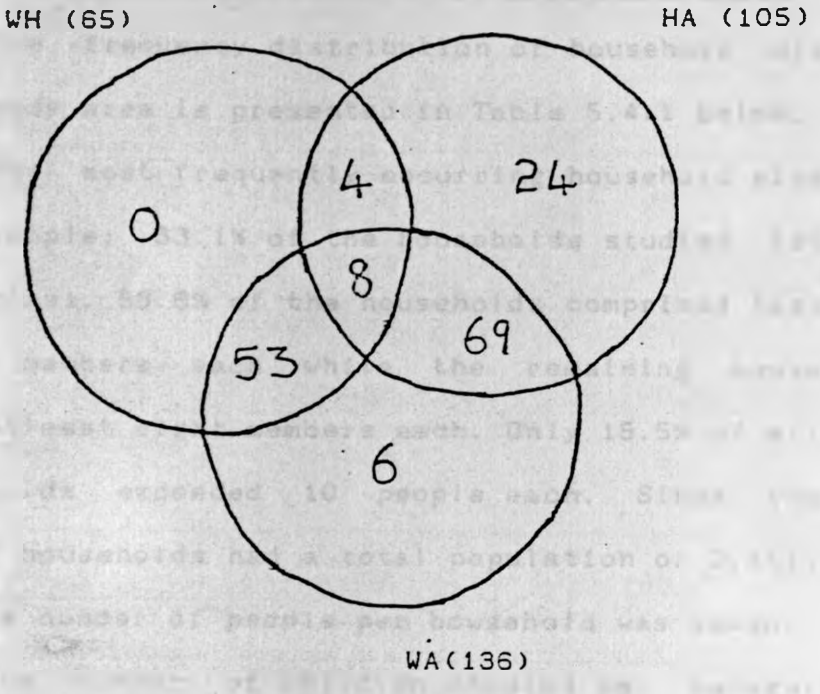
Table 5.3.5: A comparison of W/H and W/A (N=502)*

W/H	W/A ⩾ 80%	W/A < 80%	Total
⩾ 90%	362 [72.1]	75 [14.9]	437 [87.1]
< 90%	4 [0.8]	61 [12.2]	65 [12.9]
Total	366 [72.9]	136 [27.1]	502 [100.0]

X^2 = 168, df = 1, p < 0.00001

* Figures in square brackets are percentages of 502

Figure 2: Venn diagram to show the number of children malnourished according to W/H, H/A, and W/A



N = 306 malnourished children

n(W/H) = 65

n(H/A) = 105

n(W/A) = 136

n(W/H ∩ * H/A) = 12

n(H/A ∩ W/A) = 77

n(W/H ∩ W/A) = 61

n(W/H ∩ W/A ∩ H/A) =8

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* ∩ denotes intersection of sets.

5.4.1 Frequency distribution of household size

The frequency distribution of household size in the study area is presented in Table 5.4.1 below.

The most frequently occurring household size was 5-7 people; 33.1% of the households studied fell in this class, 58.8% of the households comprised less than eight members each while the remaining households had atleast eight members each. Only 15.5% of all the households exceeded 10 people each. Since the 296 sample households had a total population of 2,111, the average number of people per household was seven.

The number of children studied per category of household size are presented in Table 5.4.2. About one half (50.3%) of the children came from households with less than eight people, the rest (49.8%) came from larger households. About one quarter (24.3%) of the children came from households exceeding ten members.

Table 5.4.1: Distribution of household size

Household size	Number of households	Percent of households
2-4	76	25.7
5-7	98	33.1
8-10	76	25.7
11-13	28	9.5
14+	18	6.1
Total	296	100.0

Table 5.4.2: Distribution of children by household size

Household size	Number of children	Percent of children
2-4	199	19.7
5-7	153	30.5
8-10	128	25.5
11-13	69	13.7
14+	53	10.6
Total	502	100.0

5.5 Household size and child nutritional status

The relationship between household size and child nutritional status is illustrated in Tables 5.11 and 5.12 on pages 57 and 58. Child weight-for-age and the total number of people in the household were not significantly ($p > 0.05$) associated. There was also no statistically significant ($p > 0.05$) association between the size of household and the prevalence of stunting and wasting among the preschool children .

5.6 Household Dependency Ratio

Table 5.6 below presents the distribution of household dependency ratio.

The least dependency ratio was 0.25, and the maximum 5.00. Of the 296 households 43.3% had a dependency ratio not exceeding 1.00, as compared to 81.0% not exceeding 2.00. Thus, only 18.9% of the households had a dependency ratio exceeding 2.00.

5.7 Household dependency ratio and child nutritional status

The relationship between household dependency ratio and child nutritional status is presented in Tables 5.11 and 5.12. None of the three anthropometric indices was significantly associated with household dependency ratio.

Table 5.6: Household Dependency Ratio* (N = 296)

Dependency ratio	Frequency	Percent	Cumulative percent
0.25-1.00	128	43.3	43.2
1.01-2.00	112	37.8	81.0
2.01-3.00	48	16.3	97.3
3.01-4.00	6	2.0	99.3
4.01-5.00	2	0.7	100.0
Total	296	100.0	.

* Dedendency Ratio = Sum of children under 15 years and adults aged over 64 years in a household divided by the sum of adults with ages 15 to 64 years living in the household.

5.8 Relationship between number of females aged 8-64 in a household and child nutritional status

The relationship between the number of females of age 8-64 years in a household and child nutritional status is shown in Tables 5.11 and 5.12 on pages 57 and 58. The association between the number of females in the above age range in a household and weight-for-age, height-for-age and weight-for-height of a child was not statistically significant ($P>0.05$).

5.9 Amount of land available to households (N =296)

The amount of land available to the study households is presented in Table 5.9.1 below. A few households (12.2%) did not have more than 0.80 hectares (2.0 acres) of land each. Only 4.4% of the households had access to over 4.00 hectares (10 acres) of land. About half of the households had total landholding between one and two hectares (2.5-5.0 acres).

5.10 Child nutritional status and the amount of land available to a household

The results of the Chi-square and correlation tests for the amount of land available to a household and the nutritional status of pre-school children are presented in Tables 5.11 and 5.12. None of the tests was statistically significant .

Table 5.9.1: Amount of land available to households

Land size category (Ha)*	No. of households	Percentage
< 0.8	36	12.2
0.8 - 2.0	161	54.4
2.1 - 4.0	86	29.0
> 4.0	13	4.4
Total	296	100.0

* 1 Hectare (Ha) is equivalent to 2.5 acres.

5.11 A Summary Table of Results of Chi-Square tests

Table 5.11: Association between child nutritional status and specific socio-economic factors

N=502

Variable name	Index of Nutritional status	X^2	P
1. Household size	Weight-for-age	0.002	>0.05
	Weight-for-height	0.370	>0.05
	Height-for-age	1.040	>0.05
2. Number of Females* in the Household	Weight-for-age	0.003	>0.05
	Weight-for-height	0.093	>0.05
	Height-for-age	0.955	>0.05
3. Dependency ratio of Household	Weight-for-age	1.350	>0.05
	Weight-for-height	0.950	>0.05
	Height-for-age	1.390	>0.05
4. Total Household landholdings (ha)	Weight-for-age	0.300	>0.05
	Weight-for-height	1.124	>0.05
	Height-for-age	0.073	>0.05
5. Marital status of household head **	Weight-for-age	1.410	>0.05
	Weight-for-height	0.482	>0.05
	Height-for-age	1.177	>0.05

* Age 8-64 years.

** Monogamous and polygamous cases only.

5.12 Results of Pearson Correlation Tests

Table 5.12: Correlation coefficients of child anthropometric measurents with specific socio-economic variables

N=502

Variable name	Index of Nutritional Status		
	Weight/age	Weight/height	Height/age
1. Household size	-0.0129	-0.0130	-0.0172
2. Dependency ratio of household	0.0319	-0.0200	0.0142
3. No. of Females# in the household	-0.0070	0.0064	-0.0129
4. Total landholding for the household	0.0254	0.0001	0.0114
5. Landholding per strong adult (ha)	0.0539	0.0152	0.0986*
6. Sex of child	-0.0616	-0.0396	-0.0613
7. Age of child	0.0769	0.1301**	-0.0807

aged 8-64 years

1-tailed significance : ** $p < 0.01$, * $p < 0.05$

5.13 Correlation of household size with dependency ratio, number of females, and landholding

Table 5.13: Correlation coefficients for household size and stated socio-economic variables

Variable name	Household size
Dependency ratio of household	0.2748 **
Number of Females in household#	0.8315 **
Total household landholding(Ha)	0.3663 **

females aged 8-64 years.

1-tailed significance ** = $p < 0.001$.

5.14 Percent natural population increase

The sample households had a total population of 2,111. In the previous period of one year, there were 120 births and 28 deaths. Based on this data, the crude death rate for the community was 13.3 per 1000 while the crude birth rate was 56.8 per 1000. This gives a natural population increase of 4.35 per cent per annum.

CHAPTER 6

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

6.1 Discussion

6.1.1 Prevalence of protein-energy malnutrition

The prevalences of low weight-for-age, weight-for-height and height-for-age in the present study were higher than those reported for communities in North-eastern Uganda (Kakitahi et al., 1985). The prevalence of first degree malnutrition was in the range estimated for the entire country in the 1960's (Rutishauser, 1971). However the level of wasting was much lower than that obtained by Alnwick (1981) for the slum areas in Kampala city, and by Herbert (1983). The differences in the levels of wasting could possibly be due to differences in sanitation, diarrhoeal disease prevalence, and food availability. Weight-for-height was considered to be the most accurate index because it was not subject to errors in age assessment, since it is age-independent. All the children classified as malnourished by this index were also classified as malnourished by the other two indices. However, the weight-for-height index has one main limitation: a severely stunted child who is also under-weight may have a normal weight-for-height.

6.1.2 Age and child nutritional status

Age was positively correlated with child weight-for-age ($r = 0.077$) and weight-for-height ($r = 0.130$). In the latter instance, the correlation was statistically significant ($p < 0.01$). To explain the effect of age, two hypotheses are advanced.

First, the level of maternal malnutrition might be high - leading to a high prevalence of low birth-weights. In this case, given adequate child health care, a child's nutritional status may progressively improve with age.

Secondly, there seems to be a high prevalence of infectious diseases. Fifteen percent of the sample children had suffered from diarrhoeal disease in the week preceeding the study, and 73% had suffered from measles. The prevalence of diarrhoea was highest between the age of 5 and 24 months and declined in the succeeding months, as can be seen in appendix 7. Therefore after the second year of age, one would expect a child's weight-for-height and weight-for-age to improve progressively with age. The correlation between age and height-for-age was negative, but not significant. The negative effect may be due to the fact that a smaller proportion of the children below one year of age is stunted as compared to older children. This, perhaps, is because of the positive impact of breastfeeding as

most mothers were observed to be still breastfeeding during the child's late infancy.

6.1.3 Child's sex and nutritional status

Although the female children had a slightly better nutritional status, sex of the child was not significantly ($p > 0.05$) associated with nutritional status. This suggests a lack of sex preference, contrary to what has been reported from some parts of Africa and Asia (Kennedy et al., 1987; Wray and Aguirre, 1969; Buiya et al, 1985). Results similar to those of this study have been reported by Lazarus et al. (1984) in South Africa, and Martorell et al. (1984) in Nepal.

6.1.4 Household size and nutritional status

Household size showed a negative trend with children's weight-for-age and weight-for-height. This finding is similar to that reported for Siaya, Kenya, by Kaseje et al. (1976). With respect to weight-for-height the results are similar to those obtained in the same region by Kennedy et al. (1987). However, the negative influence of household size on nutritional status observed in this study is less significant than that found in several other studies (Wolfe and Behrman, 1982; Gupta and Srivastava, 1977; Christian, Mora and Herrera, 1975; and Buiya et al., 1985).

6.1.5 Nutritional status and household dependency ratio

Households in the study community generally had high dependency ratios. However, dependency ratio was not significantly ($p>0.05$) correlated with nutritional status, but was correlated significantly ($p<0.001$) with household size. Since household size was negatively correlated with child nutritional status, dependency ratio in this community is important in so far as it influences household size.

6.1.6 Number of females in household and child nutritional status

The number of females in a household aged 8-64 years was negatively, though not significantly, associated with child weight-for-age. This may be because the number of females tended to increase with household size. Thus any possible positive influence of the number of females on child weight-for-age might be over-shadowed by the negative effect of household size.

The number of females in a household had, however, a weak positive ($p<0.05$) influence on weight-for-height. Thus, many females in the household probably, in some way, have a beneficial effect on child growth. The weak strength of relationship can perhaps be accounted for by the following reasons. Not all the females aged 8-64 years in a household can be available most of the time;

some go to school, for instance. Therefore, the total time effectively spent on child care by each female may be quite small. Also, it is possible that the level of co-operation in child care among all adult females in a household may not always be high.

6.1.7 Size of landholding and child nutritional status

The total amount of land available to a household was not significantly ($p > 0.05$) associated with child nutritional status. But the average amount of land that was potentially available per strong adult (i.e. a person aged 15 to 64 years) in the household was significantly ($p < .05$) correlated with height-for-age, but not with weight-for-height and weight-for-age. The correlation of the last two indices with landholding, though positive, was weak ($p > 0.05$). The following explanation is advanced. There appears to be no acute shortage of farmland in this population presently, as can be inferred from the significantly ($p < 0.01$) positive correlation of the total amount of land available to the household with household size. Thus, given enough land per household, the amount of food crops produced may not be directly proportional to total household land area. Food production will be much influenced by the number of people actively involved in household agricultural production, and, of course, the mode of production.

The results suggest that when total household landholdings are averaged over the number of strong adults in the household, the quotient is a stronger correlate of preschool child nutritional status. This is plausible since the quotient, rather than the total household land area, gives a more accurate indication of household land sufficiency.

The present findings on the association between household landholdings and nutritional status are similar to those obtained by Rawson et al. (1976) in Costa Rica, Victora et al. (1986) in Brazil, and Kaseje et al. (1983) in Kenya. However, several investigators have reported stronger associations between household landholding and child nutritional status. These include Valverde (1976) in Guatemala, F.A.O (1984) in Machakos, Kenya, and Nabarro (1981) in Nepal. In these studies a considerable proportion of households had very small areas of land.

It would thus appear that in those communities where acute land shortage is common, the relationship between household landholding and child nutritional status is likely to be significantly positive.

5.1.8 Percent natural population increase

The percent natural population increase of 4.35 for the study community is higher than the national rate

of 3.2 (World Bank, 1985). The crude death rate (CDR) and crude birth rate (CBR) for Uganda are 18 per 1000 and 50 per 1000, (ibid). For this community, the CDR is lower and the CBR higher than the corresponding national rates. The high percent natural population increase suggests a possible growing increase in the demands put on resources in the area, such as food and cultivable land.

6.2. Conclusions and Recommendations

From the fore-going, several conclusions are drawn. First, the prevalence of protein-energy malnutrition in Bugwere, particularly the mild and moderate forms, is low. The percentage of preschool children with weight-for-age below 80% of the expected value does not exceed 30%. Secondly, the influence of several socio-economic factors on preschool child nutritional status in the study community is varied. The negative influence of household size on child nutritional status, though not significant currently, is likely to increase rapidly, given the high rate of population growth. With increase in population, there is likely to follow increase in land pressure, and a subsequent fall in food production. Most (67%) of the households had access to less than 2 hectares of land. Although total household landholding seems to have no significant influence on

the nutritional status of underfives, there is a significant ($p < 0.05$) positive correlation between average household landholding per adult and height-for-age of the children.

Except with respect to weight-for-height, the number of females of age 8-64 years in the household appears to have no significant positive influence on the nutritional status of preschool children. Also, sex of a child does not appear to affect its nutritional status significantly, nor does the household dependency ratio.

Environmental sanitation in Bugwere area is generally inadequate, and most households obtain water from unprotected sources. Diarrhoeal disease and measles seem to be common in the community.

With respect to recommendations, from the foregoing, it would be appropriate to encourage construction of pit latrines, protection of more water sources, and oral rehydration therapy, as well as increasing family planning and immunization activities in the area.

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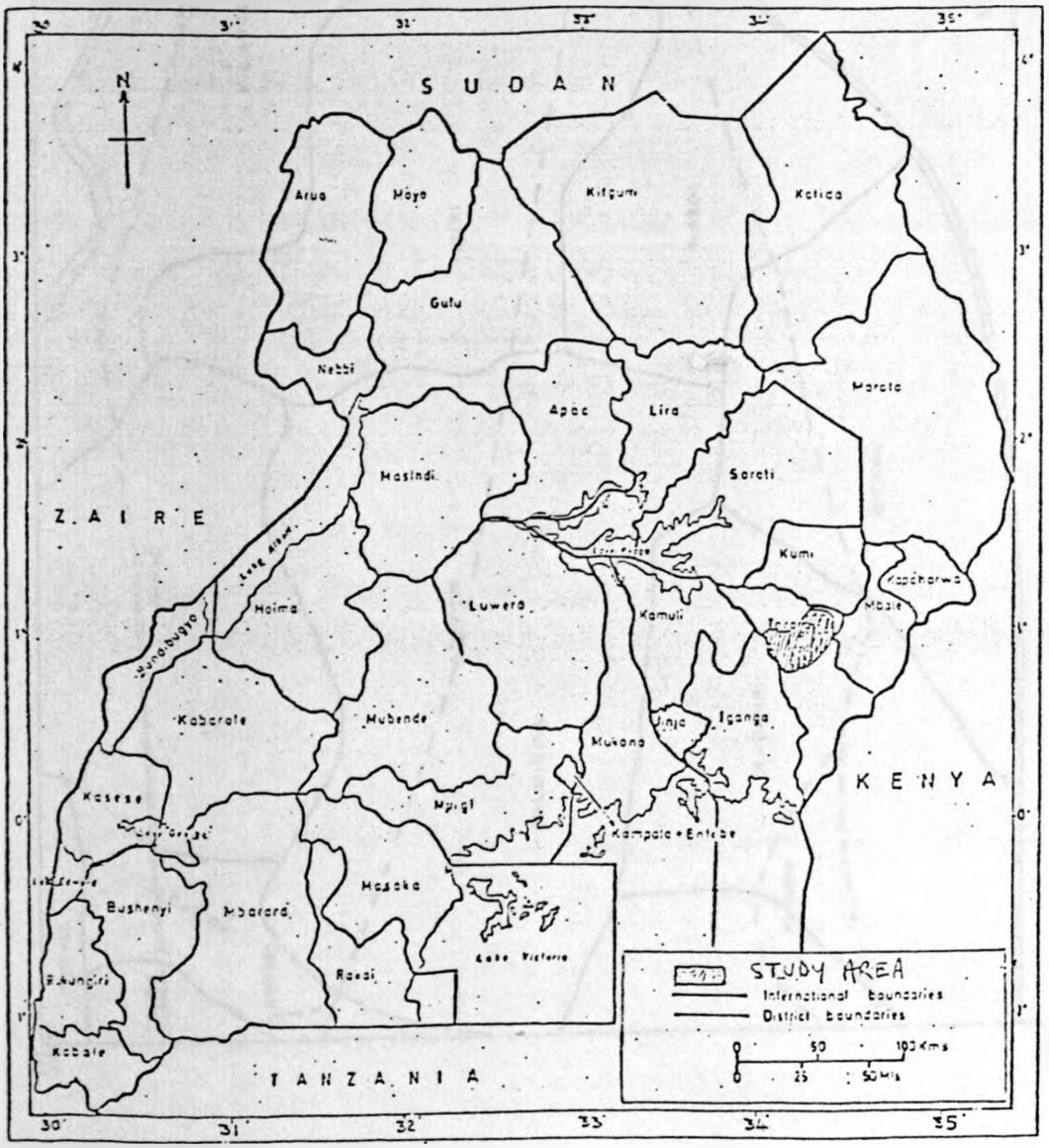
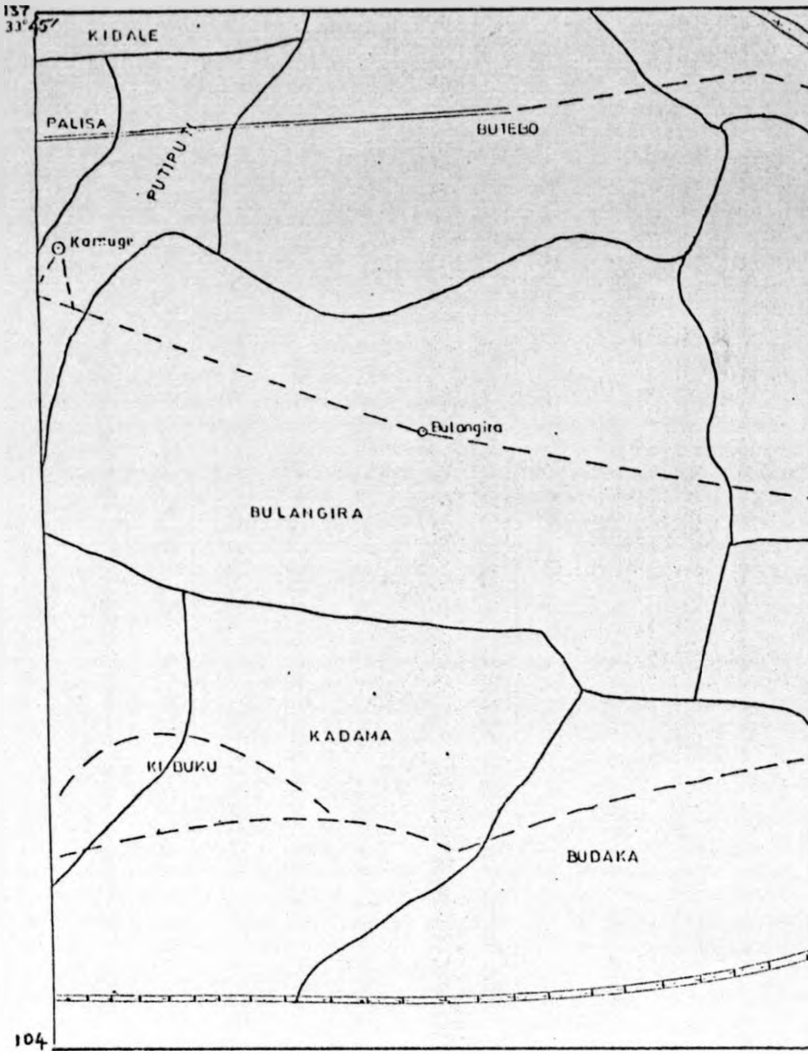
APPENDIX 1

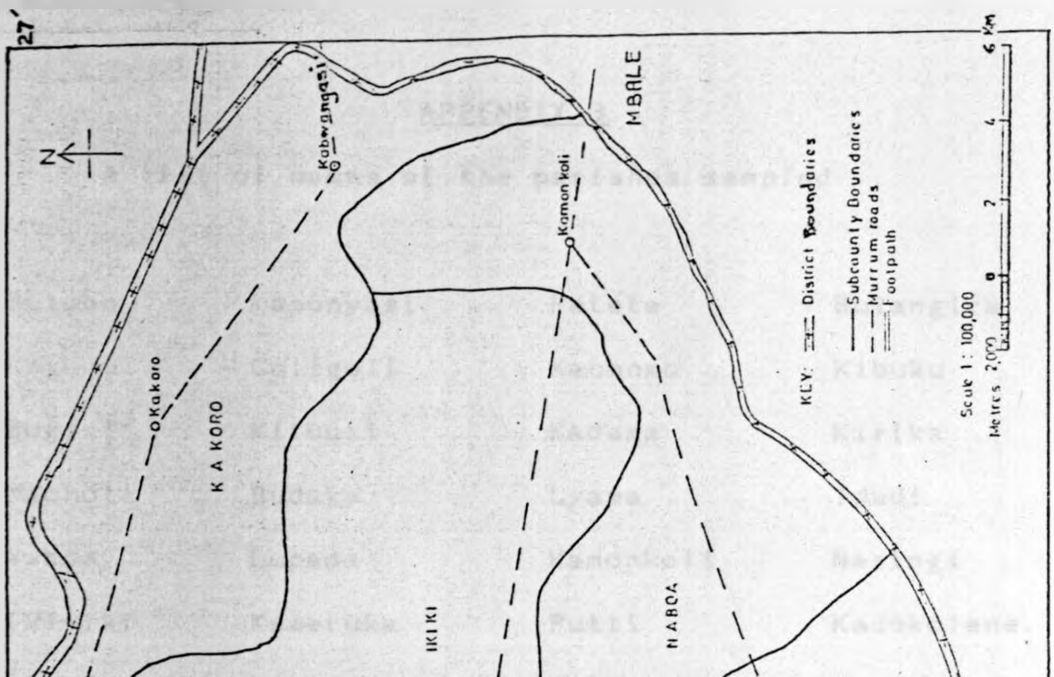
Map of Uganda showing the location of the study area




137
33°45'
KIDALE
PALISA
PUTIPUTI
BUTEBO
Kamuge
Bulangira
BULANGIRA
KADAMA
KIBUKU
BUDAKA
104

APPENDIX 2

Map of the study area (Bugwere)



APPENDIX 3

A list of names of the parishes sampled

Butebo	Kapunyasi	Petete	Bulangira
Kagumu	Goligoli	Kachomo	Kibuku
Bugiri	Kituuti	Kadama	Kirika
Macholi	Budaka	Lyama	Idudi
Naboa	Lupada	Kamonkoli	Nasingi
Iki-Iki	Kameruka	Putti	Kadokolene.

APPENDIX 4

Determination of minimum sample size

The following formula was used to determine the minimum sample size:

$$n = \frac{z^2(p.q)}{r^2}$$

where:

n = Sample size (Number of underfives)

p = The approximate proportion of children with PEM in the study area. From a review of the literature (Kakitahi, 1983), p was taken to be 25%.

q = 1-p. The approximate proportion of children who are not malnourished.

z = The desired confidence limit in estimating P. In this case, the confidence limit was 95%. This corresponds to a z-value of 1.96.

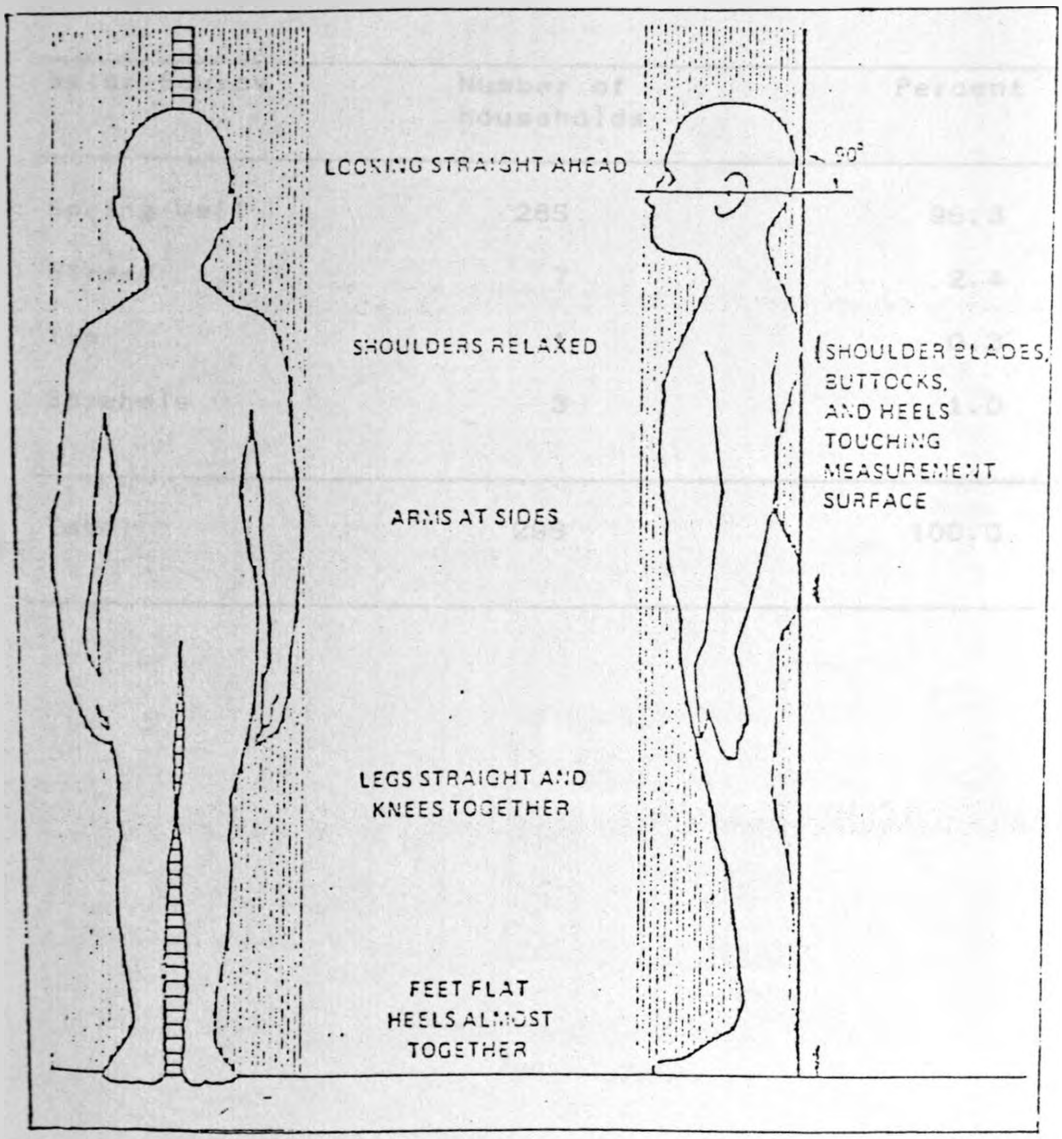
r = Precision, or risk of error in estimating the prevalence of PEM. This was set at 5%.

Using the formula above,

$$n = \frac{1.96 \times 1.96 \times 0.25 (1 - 0.25)}{0.05 \times 0.05} = \underline{288}$$

APPENDIX 5

Position of the child when measuring height



Source: Simko, M.D., Cowell, C., Gilbride, A.J. (1984). A comprehensive guide for planning intervention. Aspen Systems Corporation, Rockville, Maryland, U.S.A., p. 77.

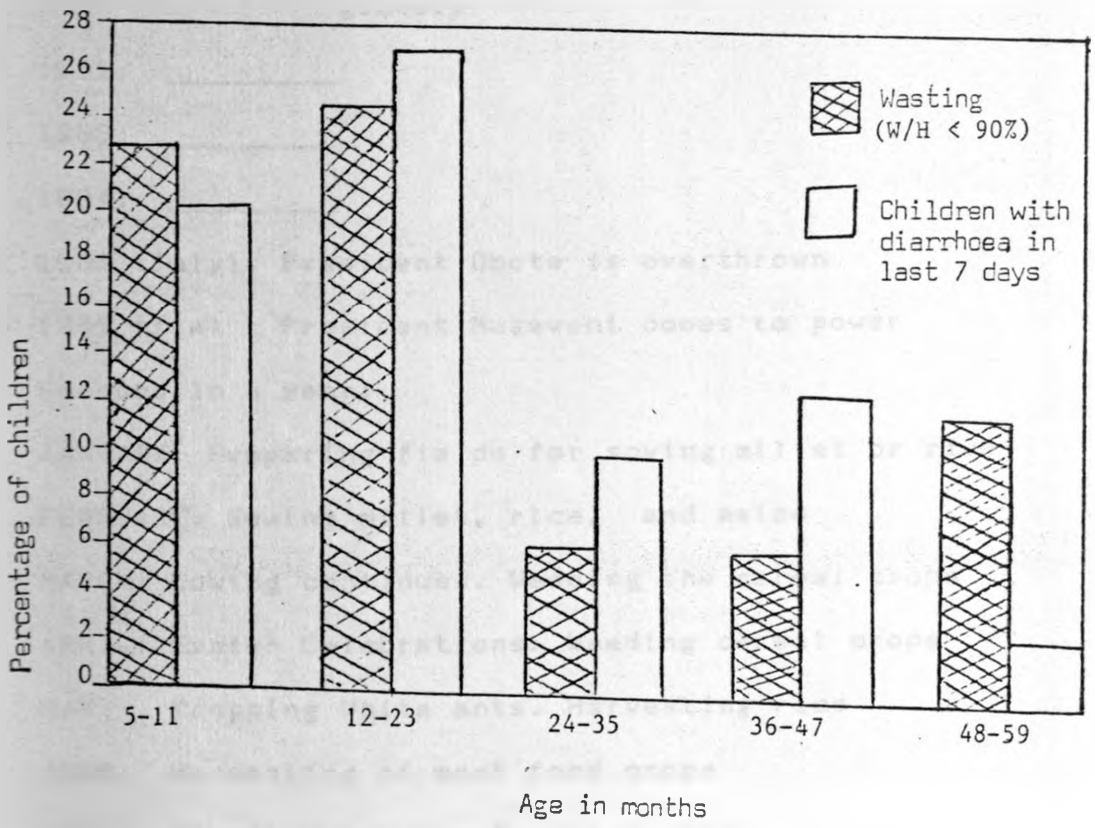
APPENDIX 6

Distribution of households by type main water source

Water Source	Number of households	Percent
Spring/Well	285	96.3
Stream	7	2.4
Tap	1	0.3
Borehole	3	1.0
Total	296	100.0

APPENDIX 7

Distribution of children reported to have had diarrhoea in the last 7 days by age and prevalence of wasting (weight/height <90% using harvard standards)



APPENDIX 8

A local calender of events

1980 (Jan - December): Famine in Bugwere area

1980 (December): National general elections

1981 (March): Buffalo kills a person near Bulangira ginnery

1982: _____

1983: _____

1984: _____

1985 (July): President Obote is overthrown

1986 (Jan) : President Museveni comes to power

Seasons in a year:

JANUARY: Preparing fields for sowing millet or rice

FEBRUARY: Sowing millet, rice, and maize

MARCH: Sowing continues. Weeding the cereal crops

APRIL: Easter Celebrations. Weeding cereal crops

MAY: Trapping White ants. Harvesting rice

JUNE: Harvesting of most food crops

JULY: Planting cotton. Sowing cowpeas

AUGUST: Sowing cow peas. Weeding Cotton

SEPTEMBER: Trapping 'Naka' White ants. Weeding cotton

OCTOBER: Harvesting cowpeas. Trapping white ants

NOVEMBER: Picking Cotton

DECEMBER: Preparing for and celebrating christmas.

APPENDIX 9

Distribution of sample children by household size

Household size	Number of children	Percentage of children
2 - 4	199	19.7
5 - 7	153	30.5
8 -10	128	25.5
11-13	69	13.7
> 13	53	10.6
Total	502	100.0

APPENDIX 10

Regression of selected variables with child anthropometric measurements (expressed as percentages) (n = 502)

INDEPENDENT VARIABLES	DEPENDANT VARIABLES (W/A, W/H and H/A): Weight/age b	Weight/age t	Weight/height b	Weight/height t	Height/age b	Height/age t
Sex of child	-0.060	-1.37	-0.074	-1.20	-0.056	-1.21
Age of child	0.095	2.67[b]	0.107	3.30[b]	-0.050	-1.12
HH* size	-0.063	-1.30	-0.014	-0.21	-0.017	-0.34
Dependency ratio of HH	0.012	0.27	-0.025	-0.39	0.021	0.46
No. Females in the HH	-0.042	-0.87	0.031	0.49	-0.064	-1.30
Total HH Land	0.033	0.70	0.008	0.13	-0.081	-1.46
Land/Adult	0.053	1.19	0.083	1.35	0.458	2.13[c]
Socio-economic Status of HH	2.418	2.59[b]	0.002	0.03	1.072	2.72[b]
Measles	-0.014	-0.33	-2.936	-2.72[b]	-0.041	-0.92
Diarrhoea	-5.587	-3.58[a]	-3.972	-2.64[b]	-1.579	-2.44[c]

Significance : a = $p < 0.001$, b = $p < 0.01$, c = $p < 0.05$

* HH stands for Household.

Diarrhoea = occurrence of diarrhoea in children within 7 days preceeding the study (0 = No, 1= Yes)

Measles: 0 = child has not suffered, 1 = Has suffered.

APPENDIX 11

A copy of the questionnaire used during the survey

PART 1: DEMOGRAPHY FORM

Form 1. Date:_____8_, (dd/mm/y). Household No:____

District: Tororo. County:_____. Subcounty:_____

Parish:_____. Village:_____. Sub-village:_____

Name of Household head:_____. Religion:_____

Interviewer' name:_____

A: Household Census

ID. No.	Name	Sex	Age		Marit. Status	Rel to HH head	Educ yrs.	Occup
			Years	Mths				
01_								
02_								
03_								
04_								
05_								
06_								
07_								
08_								
09_								
10_								
11_								
12_								

Key:

Marit status = Marital status: s= single, m =monogamous marriage, p=polygamous marriage, d = divorced or separated, w = widowed , o = other.

Sex : 1 = male 2 = female

Religion: 1 = Christian 2 = Moslem 3 = other

Rel to HH head = relationship to head of household:
1= head of household, 2 = wife ,3 = son, 4 = daughter
5= grandchild, 6 = brother, 7 = sister , 8 = other

sub-county: 01 = Butebo 02 = Kakoro 03= Kabwangasi
04 = Kibale 05 = Kibuku 06= Kadama
07 = Buseta 08 = Bulangira 09=Kaderuna
10 = Budaka 11 = Lyama 12= Naboa
13 = Iki-iki 14 = Kamonkoli

Education: Number of years of schooling

Occupation:01 = None 02 = Cultivates 03 = Looks after livestock 04 = Mixed farming
05 = Looks after young children
06 = Farms and Looks after children
07 = Trader, 08 = Trader/Farmer
09 = Has salaried job
10 = Has a non-salaried job
77 = Response refused, 88 = Other
99 = Missing data.

B : Vital Statistics

1. Within last year (1986) did any BIRTHS occur in this household ? If NO , put 0 in this space____ If YES, how many births ? _____ If the child/children is/are still alive are they listed among the persons above? _____

2. Within last year (1986) did any death occur in this household ? NO/YES. If yes, how many deaths occured ? _____

PART 2:INDIVIDUAL CHILD FORM

FORM 2. Date of Interview_____8__(dd/mm/y). HH No.____

County: _____ Village_____ sub-village_____

Head of HH._____ Interviewer's name _____

Child's Name:_____ ID in Household: _____

Mother's/female guardian's Id : _____

Child's Age: _____ months. Sex: 1 = Male, 2 = Female

ANTHROPOMETRY	A	B	C
Weight (Kg.1) (+/- 0.1 Kg)	___ __.___	___ __.___	___ ___.___
Height (Cm.1) (+/- 0.5 Cm)	___ __.___	___ ___.___	___ ___.___

MORBIDITY: (Measles and Diarrhoea)

1. Has this child suffered from measles before ?

   0 = No 1 = Yes 2 = Don't know _____

2. Has this child suffered from diarrhoea within the last 7 days ? 0 =No, 1 = Yes, 2 = Don't know._____

PART 3: AMOUNT OF LAND AVAILABLE TO HOUSEHOLD

FORM 3. Date_____8__(dd/mm/yy). Household No._____

County: _____ Village_____ sub-village_____

Head of HH._____ Interviewer's name _____

_____

Name of respondent:_____

1. How much land do you own ? _____ acres
2. How much land do you rent from other people ?

   _____acres
3. Amount of land cultivated: _____ acres
4. Could you please take us through your land, including the one you rent ?

Notes:

_____

_____

F. COMPOUND OBSERVATIONS

1. Type of roof of main house _____

   1= grass-thatched 2 = Flat tins 3 = corrugated iron

2. Material used for the floor ? _____

   1 = Dirt 2 = Dung smeared mud 3 = Cement

3. How many rooms does the main house contain ? _____

4. Do you have any latrine ? _____

   No = 0 , Yes = 1

5. What is the normal source of water ? _____

   1 = Tap, 2 = Stream, 3 = Well, 4 = Borehole

6. How far is the nearest health facility from the home ? _____

   1 = < 1 Km, 2 = 1 - <4, 3 = 4-8, 4 = > 8 Km.