FACTORS DETERMINING NUTRITIONAL STATUS OF CHILDREN IN A CHILD SURVIVAL, PROTECTION AND DEVELOPMENT (CSPD) PROGRAM AREA, SENGEREMA DISTRICT, TANZANIA.

BY

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A Thesis submitted in partial Fulfilment of the Requirements of the Degree for Master of Science in Applied Human Nutrition of the University of Nairobi.

September . 1996

DECLARATION

I, JOSEPH KATO LAURENT MUGYABUSO, hereby declare that this thesis is my original work and has not been presented for a degree in any other University.

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DEDICATION

This work is dedicated to my father 'Laurent Mugyabuso' who developed 'Senile Dementia' while I was pursuing the MSc programme; my brother in-law 'Mohamoud' who passed away while I was busy preparing a proposal for this study; and my office mate at TFNC 'Anna Kalinjuna Rwekika' who tragically passed away while I was extremely busy reporting on final chapters of this work. The work is also dedicated to my mothers 'Mary and Theonestina', my sister 'Agnes Nyamwiza' and the family of Mr Christian Katto who took the role of major care-takers to my ailing father while I was pursuing the MSc programme.

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ABBREVIATIONS AND DEFINITIONS.

ABBREVIATIONS

ACC/SCN	Administrative Committee on Coordination Subcommittee on Nutrition of the United Nations.
ANP	Applied Nutrition Programme of the University of Nairobi.
ANTHRO	Anthropometric Calculating Programme.
BMI	Body Mass Index.
CBCDE	Community Based Child Development and Education.
CSPD	Child Survival Protection and Development Programme.
CTA	Technical Centre for Agriculture and Rural Cooperation of Africa, Carribean, and Pacific under European Community Programme Convention of Lome.
CUPP	Cornell University Policy Paper.
DHS	Demographic and Health Survey.
ECSA	East, Central, and Southern Africa (Cooperation in Food and Nutrition).
ENEAD	Percentage available energy adequacy ratio from household's own production based on age weighted recommended per capita daily allowance by the World Health Organization (WHO) and the Food and Agriculture Organization of the United Nations (FAO) (i.e 2200 kcal).

ENETAD	Percentage adequacy of net energy available (considering injections and withdrawals in household's food supply) based on the FAO/WHO recommendations as explained under ENEAD above.
ENEADS	Per capita available energy adequacy from own production (ENEAD) in two categories (<80% and >80% of the recommended daily allowance (RDA).
ENETADS	Per capita daily net energy adequacy in two categories as under ENEADS above.
FAO	Food and Agriculture Organization of the United Nations.
GOK	Government of Kenya.
GRV	Growth Velocity.
HAZ	Height for Age Z-scores.
HBNM	Household Budget and Nutrition Module.
HBS	Household Budget Survey.
HHd	Household.
HNS	Health and Nutrition Survey.
HESAWA	Health Sanitation and Water Programme.
Ht/age	Height for Age.
IFPRI	International Food Policy Research Institute.
JNSP	Joint Nutrition Support Programme.
MCH	Maternal and Child Health Programme.
MOH	Ministry of Health of Tanzania.
MORLAG	Ministry of Local Governments and Regional Administration.

NCHS	National Centre for Health Statistics of United States of America.
PHC	Primary Health Care Programme.
RDA	Recommended per capita Daily energy Allowance.
SPSS	Statistical Package for Social Scientists.
TBA	Traditional Birth Attendant.
TBS	Tanzania Bureau of Statistics.
TFNC	Tanzania Food and Nutrition Centre.
Tsh	Tanzanian Shilling.
Underfives	Children under five years of age.
UNICEF	United Nations Children's Fund.
UNICEF-ESARO	United Nations Children's Fund, Eastern and Southern African Regional Office.
URT	United Republic of Tanzania.
USA	United States of America.
VHC	Village Health Committee.
VHD	Village Health Day.
VHW	Village Health Worker.
WAZ	Weight for Age Z-score.
WHZ	Weight for Height Z-Score.
WHO	World Health Organization.
Wt/age	Weight for Age.
Wt/ht	Weight for height.

DEFINITIONS

Differential factors refer to factors hypothesized to distinguish the status of households or mothers regarding nutritional status of study children.

Differentiation concept is the capacity to process a diversity of information types (Tucker & Sanjur, 1988). It also refers to a distinction or difference in status among households or mothers of study children with respect to specified factors such as income, education, and occupation.

Household refers to people living together in a compound that comprises members of a nuclear family, and other relatives who had lived in the compound for a period of at least three months prior to the survey, and all eating from the same pot/kitchen.

Household head refers to the person (male or female) who is the major decision maker on household income and expenditure patterns.

Household Income refers to household's annual cash earnings equivalent from all sources including sales, salary, value of food crops consumed by the household and remittances.

Index child in a household refers to a child aged 18 to 36 months, belonging to the study household, whose nutritional status was assessed in this study.

Maternal Behaviour refers to mother's attitudes or practices that may directly or indirectly impact on child nutritional status. These include weaning practices, birth related practices, time in contact with the child, among others.

Maternal income refers to mother's annual cash earnings from all sources, apart from those general for the household, and on which she is a major decision maker on income generation, but not necessarily the controller of realised income.

Predictor refers to determinant of child nutritional status.

Rooming index refers to living space in square metres (m^2) available per capita in all houses owned by a household.

Sanitation index refers to the sum of scores on various points derived from the assessment of household sanitation condition. Where an undesirable condition existed, on every point of assessment, a score of 0 was given, and where a bad condition did not exist, a score of 1 or 2 was given. For example, on assessment related to latrine: where the household had no latrine, 0 score was given, latrine available in bad condition and good condition, scores of 1 and 2, respectively, were given. The possible range of scores was from 0 to 15 points.

Stunting refers to an anthropometric status whereby height of a child is below -2SD Z-scores of the expected height of a reference child of the same age.

Underweight refers to an anthropometric status whereby weight of child is below -2SD Z-scores of the expected weight of a reference child of the same age.

Village Health Committee refers to a committee operating under a village administration comprising of at least six members and is responsible for coordinating and the implementation of village health relevant actions (growth monitoring, health education and advisory services to parents, among others).

Village Health Day refers to the day commemorated by a village every quarter of the year to discuss child nutritional and health status, communicate important health messages to parents, and deliberate on actions to improve nutritional and health status of the community especially children and women.

Village Government refers to the Village Executive administrative organ, headed by an executive officer and a Chairperson, and normally comprise of a total of 25 councillors. The organ formulates by-laws, organizes meetings to discuss and make deliberations on village developmental issues, and oversees implementation of deliberations made in meetings of all administrative and developmental committees in the village.

Wasting refers to an anthropometric status whereby weight of child is below -2SD Z-scores of the expected weight of a reference child of the same height.

Wealth base refers to value of all productive assets and durable goods in Tanzanian shillings (Tsh), and as specified in the study, that are owned by a household.

Weaning age refers to the age of a child in months at which breastmilk substitutes (including water, drinks such as juices, and other complementary foods) were introduced to the child.

Weight Growth Velocity refers to the rate of child's weight gain in a specified time period. In this study, it refers to the rate of child's weight gain over three months periods. The average of 3 three -monthly intervals growth velocities was taken as mean growth velocity for the child.

ACKNOWLEDGEMENTS

I wholeheartedly extend my appreciation to my employer, the Managing Director and Departmental Directors at the Tanzania Food and Nutrition Centre (TFNC), for facilitating my efforts to secure the MSc. Scholarship, granting permission to pursue the MSc. ANP, and contributing to costs for data collection and Thesis Defence and Submission.

I am most grateful to the United Nations University (UNU), for sponsoring me for the MSc. ANP. I express my sincere gratitude to the management and members of staff of the Unit of Applied Nutrition Programme (ANP) and the Department of Food Technology and Nutrition (DFTN) of the University of Nairobi, for the invaluable efforts to secure the UNU fellowship, provision of knowledge base, and an enabling environment-including use of computers beyond office hours.

I am also grateful to my Supervisors, Dr. A.M Omwega and R.K. Mwadime for constant guidance, advice and constructive criticisms at various stages of development and implementation of the study, and write up.

I owe my special thanks to Messrs Raymond Wigenge of the National Food Control Commission (NFCC) and Frank Modaha of TFNC for ensuring smooth running of my family obligations in Dar es salaam while I was pursuing the MSc Programme.

I most sincerely thank the Mwanza regional and Sengerema district CSPD coordination committees, and the district council for providing all the necessary support during planning and implementation of data collection phase. Special thanks to G.A. Nkonoki, L. Masalu and G. Bamugileki of the regional committee; and J.A.N. Sitta and A.T. Ncheye of the district committee. Gratitude goes to the principal (Ms R.S. Mattu) and members of staff of the Sengerema Folk Development College (FDC) for providing accommodation, office space and a brotherly environment during data collection phase.

I also acknowledge the enumerators from various functional managers' offices in the district who played special roles as advisors, language interpreters and key informants. These were A.T. Ncheye, R.S. Mattu, R. Muhile, N. Malyeli, B. Muzwiga, N. Majige; J.A.N. Sitta and K. Hangaiko.

I am highly indebted to all members of the Health committee and government in the study villages; and the executive officers for all the 5 wards in Sengerema division, for working hard to ensure adequate participation of eligible households in the study. Special thanks to Mr P. Nderembi, the executive officer for Buzilasoga ward who volunteered to undertake a face to face communication to all the wards and villages. Finally, I am appreciative to the respondent mothers who sacrificed a lot of their precious time during the busy paddy planting season.

ABSTRACT

This study examined household and maternal differential determinants of nutritional status of children aged 18-36 months in a Child Survival, Protection and Development programme area, Sengerema division, Tanzania. A total of 356 children and their mothers from 356 households selected by simple random sampling and systematic random sampling, respectively, were studied. The purpose was to identify potential indicators of child nutritional status in the area in order to contribute to information required in alleviation of child malnutrition. Data were collected using structured questionnaires, key informant and focus group discussions, and anthropometry.

The results indicate that about 52%, 28%, 4%, and 2% of the children are stunted, underweight, wasted, and faltering in growth, respectively. Height for age is positively determined by wealth base per capita ($p<0.005$), per capita expenditure on non-foods and maternal height ($p<0.05$). The significant positive determinants of weight for age are per capita expenditure on non-foods, frequency of child feeding, child morbidity status, and maternal height ($p<0.005$), per capita wealth base ($p<0.01$), and quality status of living house ($p<0.05$), whereas age of weaning is a negative determinant of weight for age ($p<0.005$). The significant positive determinants of weight for height are child morbidity status, age of the child, per capita expenditure on non-foods, frequency of child feeding ($p<0.005$), quality status of living house, maternal Body Mass Index and maternal

status of living house, maternal Body Mass Index and maternal marital status ($p<0.05$). The negative determinants of weight for height are age of weaning ($p<0.005$) and maternal ownership of an income activity ($p<0.05$). Weight growth velocity is positively determined by child age ($p<0.005$), whereas per capita expenditure on food, maternal ownership of an income activity and the reported time mother spends for a return journey to fetch water, are negative determinants of growth velocity. The other factors studied showed either no significant, or non-predictive, association with child nutritional status.

It is concluded that activities aimed at increasing household wealth base, reducing child morbidity, and improving water accessibility, quality of living house, maternal nutritional status and weaning practices, and family life education/services should be specific priorities for Sengerema division in order to achieve a substantial improvement in child nutritional status.

CHAPTER ONE

INTRODUCTION

1.1. Background to the Research Problem.

In the world, more than 500 million people are chronically undernourished and about 13 million children aged years under-five died in 1990 of diseases related to hunger and malnutrition (FAO & WHO, 1992). Forms of malnutrition in the United Republic of Tanzania (URT) are similar to those of other developing countries. The major nutrition problems are iron deficiency anaemia, protein energy deficiency, iodine deficiency disorders, and vitamin A deficiency which affect 32%, 28%, 25%, and 6.1% of the population, respectively (Kavishe, 1987; Kavishe & Mushi, 1993). Among children under five years of age (hereafter referred as underfives), the most prevalent form of undernutrition is protein energy deficiency (PED). The Tanzania Bureau of Statistics (TBS) reported PED to be between 40.5% to 46.7%, indicating that the problem is still of public health significance (TBS, 1993).

The causes of malnutrition in Tanzania, are a manifestation of complex and interrelated biological and social processes. These are outlined in a flexible "Conceptual Framework of Malnutrition" jointly developed by Tanzania Food and Nutrition Centre (TFNC) and UNICEF during implementation of the Joint

WHO/UNICEF Nutrition Support (JNSP) in Iringa region between 1983 and 1988 (Jonsson, 1988; Cholton & Moneti, 1989; TFNC, 1992; Kavishe & Mushi, 1993). The framework is a set of hypothesis about the direct and indirect causes of malnutrition categorized into three main levels, namely, immediate, underlying, and basic causes of malnutrition (Appendix C1 p.162). The immediate causes include inadequate dietary intake and infectious diseases, while underlying causes are related to inadequacies in household food security, care of the vulnerable groups (including under-fives), and access to essential services (health, education, water and sanitation, and housing). The important basic causes at community and household level are status of various formal and non-formal institutions and the resource base. The exact nature of the manifestation and complexity of the different causes of malnutrition are often community specific. For example, some food abundant areas unexpectedly showed higher rates of child undernutrition and deaths than food deficit ones (URT & UNICEF, 1992; Kavishe & Mushi, 1993; TFNC, 1993) and others registered improvement in nutritional status even in the face of economic decline (Mwikongi, 1994).

In view of this complexity and community specificity of causes of malnutrition, the government and UNICEF adopted and facilitated use of the "Triple A (Assessment, Analysis and Action) Cycle" which is synonymous to a learning by doing approach to planning at different administrative and social

hierarchy levels (Cholton & Moneti, 1989). The approach was used during implementation of the JNSP between 1983 to 1988 and was extended to the Child Survival, Protection and Development (CSPD) programmes. A recent review of the CSPD programmes indicated that more than 1200 village communities in 31 districts in mainland Tanzania, as a result of using the approach, had remarkably improved their capability to assess, analyze, and take appropriate actions to reduce child and maternal malnutrition and mortality (Mwikongi, 1994).

1.2. Statement of the Problem

In areas where the programmes have been newly initiated, their success has been constrained by lack of appropriate indicators to monitor the situations regarding potential causes of malnutrition, especially on the social and economic determinants (Kavishe & Mushi, 1993). Inadequacy of knowledge on social determinants of malnutrition and poor health status of young children may result into interventions that have no sustainable solutions and limited empowerment to households with malnourished children. This study intended to establish the influence of different household and maternal differential factors on the nutritional status of children.

1.3. Expected Benefits.

Findings of the study would help district coordination committees to develop guidelines on indicators for use by village and ward health committees in monitoring and assessing how the social environment influences child malnutrition. They can then implement measures that would empower households and village governments to devise appropriate interventions for improving child survival and development in new programme areas. The findings would also contribute to an information database on specific social conditions in the area that must be considered by policy makers and non-governmental organizations (NGOS) prospecting in activities related to improving child survival and development.

1.4. Justification of the Study.

The rate of stunting among under-fives in Mwanza region (where the study area belongs) was reported to be 39% with 16% being in severe condition (TBS, 1993), indicating that undernutrition is still a problem of public health significance. Though Sengerema is generally judged to be rich in food crop and domestic animals, the rate of child mortality was 192/1000, about the same as the national average of 191/1000 live births in 1985, and above those of other districts that are generally known to be food deficient (Kavishe & Mushi, 1993; TFNC, 1993). Although cotton is a major

cash crop, most households depend on food crops for cash needs and it is common for a number of households to live on one meal per day in periods between major crop harvests. This may be a reflection of food stock budgeting problems or inadequate food availability through own production, among other possible reasons. Data on food consumption in the region and the program area is very limited, though there is a general impression, based on aggregate production data, that low child feeding frequency is likely to be a factor associated with malnutrition rather than food availability (URT & UNICEF, 1992).

Apart from routine quarterly information, there are no studies that have attempted to statistically associate household and maternal differential factors with nutritional status of children in the programme area. Findings of this study will therefore complement those routinely gathered through village health days (VHD) activities. Since operational research is an integral component of the CSPD, the programme will need findings of the study for further review of strategies in implementing activities aimed at a sustainable improvement in child health and nutritional status.

1.5. Research Objectives.

The main objective of this study was to identify household and maternal differential determinants of nutritional status of children (18-36 months) in Sengerema Division (a Child Survival, Protection and Development (CSPD) programme area), Mwanza region, Tanzania.

The sub-objectives of this study were:

1. To determine the nutritional status of children (18-36 months) based on the internationally recognized anthropometric references values and weight growth velocity (using data on growth monitoring cards).

2. To determine the association of household and maternal differential factors with child nutritional status.

3. To identify household and maternal differential factors that are determinants of child nutritional status.

1.6. Study Question.

The study to answer the question:
What household and maternal differential factors are important determinants of child nutritional status in Sengerema Division?.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction.

A report of the International Conference on Nutrition indicate that in the world, 500 million people are chronically undernourished and 13 million under-fives died in 1990 of diseases related to hunger and malnutrition (FAO & WHO, 1992). According to the report, the most at risk population groups, are the rural and urban poor, women and children, the elderly, AIDS victims, refugees and drought prone populations, the landless, casual labourers, and members of large households. Children who are socially at risk include those in large families especially with low income, physical and mental handicap, in single parent families, those living away from home, and of deprived and minority groups (Ebrahim, 1982).

Social factors underlie the biological factors (i.e., inadequate food intake and infectious diseases), which ultimately precipitate malnutrition. This review therefore, considers the multifactorial causation of malnutrition. Aspects reviewed include the situation of protein-energy undernutrition in developing countries, efforts to alleviate the problem, and determinants of malnutrition.

2.2. Protein-Energy Undernutrition among Underfives in Tanzania and other Sub-Saharan Countries.

A review of Demographic and Health Survey (DHS) reports for the period between 1986-1993, covering children aged 3-36 months, from 16 Sub-Saharan countries, indicates that Tanzania had higher rate of stunting (40%) than most of the developing countries whose rates ranged from 23-38% (UNICEF-ESARO, 1995). Tanzania was only better than 4 of the 16 countries i.e. Madagascar, Burundi, Malawi, and Uganda whose stunting rates ranged from 44-48%. Similarly, the report indicates that Tanzania's rate of wasting was 7% which was is slightly lower than those of other 8 of the 16 countries, including Kenya and Malawi. The rate of wasting in Tanzania was only better than that of 5 of the 16 countries whose rates ranged from 8% for Ghana to 21% for Niger.

Likewise, the level of underweight among underfives in Tanzania (28.5%) was only slightly below the average rate for Sub-Saharan Africa which was reported to be 30% in 1990 (Kavishe & Mushi, 1993). The authors conclude that countries with better economic indicators like Zimbabwe and Kenya, also have better nutrition indicators, especially for stunting. The slightly better Tanzanian situation regarding the rate of underweight and wasting, when compared to the average situation of other developing countries, is presumably due to efforts of the community based programmes rather than the economic situation (TFNC, 1994; Mwikongi, 1994).

2.3. Nutritional status of under-fives reported in studies conducted in different parts of Tanzania.

The overall prevalence of protein-energy undernutrition (below -2 standard Z-scores of the NCHS reference values) in Tanzania among the under-fives, is 40.5%, 25.0% and 8.5% based on stunting, underweight and wasting, respectively (Kavishe & Mushi, 1993). A Household Budget Survey (HBS) conducted between December 1991 and April 1992, indicated that stunting, wasting, and underweight, were 31.4%, 1.7%, and 20.5%, respectively (TBS, 1992). In almost the same period, October 1991 to March 1992, Demographic and Health Surveys (DHS) reported stunting, wasting, and underweight, based on the same standards, of 46.7%, 5.6% and 28.8%, respectively (TBS, 1993).

The Household Budget Nutrition Module (HBNM) survey conducted in 1991/92 reported the rate of stunting, underweight and wasting to be 50.5%, 26%, and 9%, respectively (TFNC, 1994). The TFNC review article also reported that TFNC and Ministry Regional Administration and Local Governments (MORLAG) surveys conducted in 10 districts for the World Bank supported Nutrition and Health intervention programmes, found the rates of undernutrition to be 43%, 29%, and 6%, for stunting, underweight and wasting, respectively. The respective rates of undernutrition in Mwanza region were reported to be 39.4%, 20.7%, 4.5%, for stunting, underweight, and wasting in 1991/92 (TBS, 1993). The study also

reports severe forms of undernutrition (i.e.,<-3SD) in the regions, during the same period, to have been 15.6%, 5.2%, and 0.5%, for stunting, underweight, and wasting, respectively.

Even in food self sufficient regions of the country like Mwanza and Rukwa, high child malnutrition and mortality rates have been reported (TBS, 1988; TFNC, 1993). The year 1985 under-fives mortality rate for Mwanza and Rukwa were 192/1000 and 221/1000, respectively, which were above the national average of 191/1000 (TFNC, 1993).

There is limited detailed country-wide information on protein energy malnutrition on specific age groups among the under fives. However, it is generally accepted that undernutrition of all types (stunting, wasting, underweight) is lowest in the one year old age group, and except for stunting, rises to the peak in the 1-3 years old age group (FAO & TFNC, 1992; Kavishe & Mushi, 1993). Stunting increases progressively with age and forms the major part of protein-energy malnutrition in all other age groups.

In a study for children aged 6 to 64 months in 1989, age specific estimates of protein-energy undernutrition showed an approximate of 1:1 between stunting in ages 12-36 months and the overall underfives group (FAO & TFNC, 1992). The rate of stunting in the age range covered by the present study (i.e.18 to 36 months) could thus be estimated to be about the same as the average rate

of stunting among the underfives nationwide. Data from six districts implementing the Health and Nutrition Surveys programme (HNS), indicates that severe stunting, underweight and wasting is 18%, 10%, and 1%, respectively (TFNC, 1994). Severe stunting increased with age, ranging from 2% for children under 6 months age old to 36% in age group 48-55 months old. Total stunting rate in the six HNS districts ranged from 34% in Igunga district (central zone) to 59% in Kibondo district (Lake Tanganyika zone), with overall severe stunting ranging from 12% to 28% in the respective districts. These were however based on MCH data that generally has selection bias.

The nationally representative DHS conducted in 1992 indicated stunting to range from 12% for children less than 6 months old to 59.5% for children between 36-47 months old (TBS, 1993). The corresponding rates of severe stunting ranged from 1% to 21.9% in the above mentioned age groups. Stunting rates in the age range 12-23 and 24-35 months were, respectively, 49.5% and 57.2%. The two age ranges closely match the age range for children covered by the present study (18-36 months). The highest rates of wasting and underweight were observed in age group 12-23 months. These were 9.8%, 1.4%, 36.7%, and 10.9%, for total wasting, severe wasting, total underweight, and severe underweight, respectively.

2.4. Programmes Aimed at Alleviating Health and Nutrition Problems.

Intervention programmes are of varying nature. They can be grouped into four main categories on the basis of approaches used to tackle the problem. These are curative/rehabilitative, promotive, preventive, and facilitative, approaches. The ideal programme would attempt to have a balanced combination of the different approaches. Curative or rehabilitative interventions are usually hospital or centre based like the nutrition rehabilitation units in referral hospitals (TFNC & UNICEF, 1988; Van-Roosemalen-Wiebenga et al, 1987) or the Family Life Training Centres in Kenya (GOK & UNICEF, 1992). These have little empowerment to households and community as they meet the short term objectives of curing severe malnutrition but do not meet the long term objectives of preventing recurrence of malnutrition especially in other siblings. This is because the hospital or centre environment is often different from that in the community and at home. These programmes, however have a promotive role as participating mothers are also educated on good child feeding behaviours.

Community-based programmes that are mainly promotive include the Applied Nutrition Education programme of the Dominican Republic (Pelletier, 1990). However, education in isolation from other interventions has proved to be less effective. Likewise, use of prepackaged education materials and messages tended to limit

problem oriented actions. Examples of community based intervention programmes include the Primary Health Care (PHC) (Taylor & Jolly, 1988; Maneno & Mwanzia, 1991), integrated Maternal and Child Health Programme (MCH) like the Tamir Nadu Integrated Nutrition programme in India, child-care and on-site feeding programme in Columbia (Pelletier, 1990), and the CSPD programme in Tanzania (Cholton & Moneti, 1989; Mwikongi, 1994). These programmes combine the different intervention approaches to varying degrees. The programmes encourage community participation in alleviating health and nutrition problems.

The major weaknesses of most of these programmes is the institutionalized separation of policy formulation and planning from implementation. This results in overly ambitious and complex plans that fail to take into account the needs of the client, and client response to government initiatives (Pelletier, 1990). The unique feature of CSPD programmes in Tanzania, is their emphasis on capacity building and training at all levels, decentralization of decision making process with effective use of bottom-top approach, and strong integration of programme activities with government technical and administrative hierarchy, and multi-sectoral collaboration (URT & UNICEF, 1992; Kavishe & Mushi, 1993).

2.4.1. Government Efforts to Alleviate Malnutrition in Tanzania.

The Tanzanian government's concern for the social well-being, especially on children and women dates back to the era of the Arusha Declaration of 1967 (TANU, 1967) and the Directive of the then ruling party-Tanganyika African National Union (TANU) of 1973 (TANU, 1973). These actions were based on policy of "Socialism and self reliance" and emphasized on people based rather than material-based development. They gave priority to rural development, water, health and education free of user charges.

One of the most important nutrition relevant commitments was the legal establishment of the Tanzania Food and Nutrition Centre (TFNC) in 1973 (TFNC, 1993). The main aim of the TFNC was to catalyze nutrition relevant actions and harmonize development and implementation of policies aimed at alleviating food and nutrition problems in the country. Recent concerns include:

(i) ratification of the Convention for the Child and official designation of June 16th as "African Child Day" (URT, 1991),

(ii) endorsement of the World Declaration on Child Survival, Protection and Development (FAO & UNICEF, 1992),

(iii) inclusion of the Priority Social Action Plan (PSAP) in the extended Economic Recovery Programme (ERP) of 1989/92 (URT, 1989),

(iv) formation of a ministry of Community Development, Women Affairs and Children (CDWAC) in 1990 (URT & UNICEF, 1990),

(v) and the declaration of a National Food and Nutrition Policy in 1992 (URT, 1992).

The present study aimed at contributing to the knowledge base on area specific policy priorities towards alleviating child undernutrition.

2.4.1.1. The CSPD Programme.

CSPD is generally a community based program whose main strategy is to empower communities to assess, analyze, and take appropriate actions on developmental issues especially those pertinent to health and nutrition situation of children and women. CSPD programmes are mainly replications of the WHO/UNICEF Joint Nutritional Support Program (JNSP), that started in 1983/84 in Iringa region (located in southern highlands of Tanzania). The programme has successfully expanded to cover other areas and aspects over time.

The programme has greatly empowered communities to handle food and nutrition/health problems (Jonsson, 1988; Kavishe & Mushi, 1993). This is partly reflected by a significant reduction in child undernutrition, especially severe underweight in areas implementing the CSPD (Cholton & Moneti, 1989; Kavishe & Mushi, 1993; TFNC, 1994). Data on nutrition trends available in CSPD

programmes for nine regions (provinces), covering between 3 to 9 years, from 1984 to 1992 indicate a substantial reduction in both severe and total underweight with the highest rate of reduction being in severe malnutrition. The reduction rate in the overall malnutrition ranged from only 8% in Singida region between 1990 and 1992 to 62.5% between 1987 to 1992 in Kilimanjaro region (TFNC, 1994). The respective reduction rates in severe malnutrition ranged from 57% to 91% for Shinyanga and Kilimanjaro regions, in the respective periods stated above.

CSPD activities concentrate on maternal and child health, water and environmental sanitation, household food security, child care and development, income generating activities, research, and management and staff development (Cholton & Moneti, 1989; URT & UNICEF, 1992; Kavishe & Mushi,1993; Mwikongi, 1994). Communities in more than 1200 villages in 31 districts of mainland Tanzania were reported to have improved their own capacity to assess and analyze problems affecting children and women and had taken appropriate actions to improve their nutritional status even in the face of economic decline (Mwikongi, 1994). The critical factors in the success of the Iringa JNSP were the conceptual framework, the Triple A Cycle and social mobilization (Cholton & Moneti, 1989). These elements have always been part of any effort in establishing and expanding the CSPD programme to other areas in the country.

In Mwanza region, piloting of the CSPD was undertaken in two of its 6 districts - Sengerema and Geita. The programme started in January 1993 in 3 divisions in Geita district constituting a total of 71 villages, and one division in Sengerema district comprising of 29 villages (TFNC, 1993). It was decided to start the program in the two districts because though having good resource base and food situation, they had high rates of child malnutrition and deaths (URT & UNICEF, 1992; TFNC, 1993). Each district is expected to make use of experiences from these initial programme divisions to expand the programme to other areas.

A mid year review of village health days activities in Sengerema and Geita districts indicated that a number of village and ward health committees had not come up with guidelines of indicators that could help in monitoring and assessing social environment in households having severely malnourished children (Mugyabuso, 1993). The present study was conducted in Sengerema CSPD programme area and is partly aimed at contributing to knowledge base on how and to which extent different household factors affect child nutritional status in the area.

2.5. Importance of Growth Monitoring.

Growth monitoring and promotion (GMP) is an operational strategy for enabling mothers to visualize growth or lack of growth, and receive specific guidance in a way in which she (her family and her community) can act to ensure health and continued regular growth in her child (Mason et al, 1984). It involves following changes in child physical development, by regular measurement of weight and sometimes length. It can therefore provide for earlier detection of the need for intervention than one time screening measurements.

The advantages of growth monitoring include early detection of nutrition and health problems in growing children (Van Lerberghe, 1988; Beaton et al, 1990), and recording responses to interventions (Beaton et al, 1990). It also provides a basis for communicating with mothers and health workers concerning child health and nutrition, and stimulation of thinking about causes of poor growth and malnutrition (Mason et al, 1984; Beaton et al, 1990). In the CSPD programme, GMP is mainly used as a strategy for community mobilization rather than nutrition impact monitoring (Jonsson, 1988; Kavishe & Mushi, 1993).

Target growth rates (road to health) are generally based on the WHO/NCHS reference values which are practically similar to local references when the references are developed from non-poor, healthy children (Gibson, 1990; Beaton et al, 1990). The concern

is mainly whether a child's pattern of growth is along the same centile band as age increases, rather than the actual weight at any given time. Thus the child's longitudinal record presents its own control and the reference curves mainly help to illustrate expected patterns of growth.

2.6. Indicators of Nutritional Status.

Relevant indicators for the present study are stunting, underweight, and wasting, and weight growth velocity.

2.6.1. Anthropometric Indicators.

Assessment of nutritional status based on height for age (stunting), weight for height (wasting) and weight for age (underweight) is widely documented (Gibson, 1990; Beaton et al, 1990; Waterlow et al, 1992; Kavishe & Mushi, 1993). These three indices reflect different but interrelated aspects of protein-energy malnutrition (PEM). Height for age (Ht/age) reflects the degree of stunting and is thus a measure of chronic malnutrition. Ht/age indicates height of a child as a proportion the height of NCHS reference child of the same age. Weight for height (Wt/ht) indicates the degree of wasting and is thus used to estimate acute malnutrition and the need for immediate action. It is defined as weight of a child expressed as a proportion of the weight of NCHS reference child of the same height. Weight for age

(Wt/age) is defined as of weight a child expressed as a proportion of weight of NCHS reference child of the same age. It is a reflection of both stunting and wasting and thus a useful measure of nutritional progress in a community of mixed child age composition.

For comparability of information from different studies, it is often advisable to report data as Z-scores from the NCHS reference values rather than percentage of reference median or percentiles (Beaton et al, 1990; Gibson, 1990). Z-scores have the advantage of having the same meaning across different ages and indicators (Beaton et al, 1990). Generally a Z-score greater than -2SD is considered as adequate nutrition, less than -2SD -as undernutrition, and below -3SD -as severe protein energy undernutrition.

2.6.2. Growth Velocity.

The use of growth velocity in assessment of child nutritional status over time is widely documented (Marshall, 1971; Roch et al, 1989; Hijaz et al, 1989; Gibson, 1990 Van Lerberghe, 1990; Waterlow et al, 1992). Growth velocity is defined as the rate of change of anthropometric variables with child's age (Gibson, 1990). It is calculated using the following formula:

$$(X_2 - X_1)/(t_2 - t_1)$$

where X_1 and X_2 are values of the measurements on two occasions t_1 and t_2. A child's growth rate over three months of fastest

growth is most frequently 2-3 times of the slowest growth rate, so that a satisfactory assessment of a child's growth cannot bemade over less than one year (Marshall, 1971). This therefore, limits use of growth velocity as a measure of health status. Velocity data basis of the NCHS reference are available up to the age of 3 years (Roche, et al, 1989). The data points for infants and young children are in intervals of three months or longer. Increments measured over six months are the minimum interval which can be used to provide reliable data (Gibson, 1990). This minimizes effects of seasonal variation.

Growth velocities of over short periods such as a month are so variable that it is extremely difficult to organize the information in a way that is useful (Waterlow et al, 1992). The coefficients of variation of gains over four weeks are of the order 20-30 percent (Fomon et al, 1971). The variability tends to be even greater for third world children who are subjected to a wider range of environmental stresses (Harrison & Schmitt, 1989). This high variability makes it difficult to predict impending malnutrition from velocity data.

Growth velocity curves are derived from longitudinal studies. They can be used to establish the timing of adolescent growth spurt, to detect abnormal changes in growth, and to evaluate individuals (rather than populations) in terms of changes in rates of growth and/or poor response to therapy (Gibson, 1990). Growth increments during infancy need to be evaluated in relation to gestational age, body size and weight for length at birth.

Premature and small- for- gestational age infants tend to havelarger increments than term infants (Gibson, 1990). Also incremental growth during pubescence should preferably be interpreted in relation to data on maturity levels. For example, skeletal age influences timing of pubescent growth spurt (Baumgartner, 1986; Gibson, 1990). Natural variation in body weight over short periods due to minor and normal changes in hydration status or after meal, may present a practical difficulty in assessing growth rates and complicate interpretation of anthropometric data (Beaton et al, 1990).

Faltering, on the basis of growth velocity has been defined as gains of less than 0.5kg per month for a child aged between 0-4 months, three horizontal or falling monthly values for ages 6-15 months, even within the road to health area (usually from -2SD to median); three horizontal or falling monthly values, below the road to health area, or any loss of weight greater than 1kg in a month, or any value greater than 2kg below the road to health area, for ages 16-60 months (Steveny, 1982). Faltering has more recently been defined as gain in weight below -2SD of the expected standard gain (Hijaz et al, 1989). This definition is however very insensitive as the standard deviation (SD) is so large. In this study, growth velocity of less than or equal to zero was defined as faltering growth, while any growth greater than zero was judged as growing.

An important use of velocity measurements is to help in identifying causal factors, for example responsiveness of gains in weight and length over seasonal influences (Waterlow et al, 1992). However, studies in Bangladesh that were adjusted for seasons, showed no advantages of weight and height velocities over the standard indicators for periods over a year (Bairag et al, 1985). Weight velocity was found to be a good predictor of short term (two months) mortality. The Kasongo study in Zaire, indicated significantly lower height velocities for young children who died than their age counterpart survivors in the months before death (Van Lerberghe, 1990).

Thus the most appropriate and commonly used measures of nutritional status are the standard anthropometric indicators - weight for age, weight for height and height for age Z-scores from the NCHS reference standards. However, the cut-off points, being one time point measurements, as is the case for cross sectional studies cannot help to determine whether the child has been growing well or fluctuating or faltering. Growth velocity measurements using carefully selected time interval (data points) and period for measurements, have the advantage of describing child's development in nutritional status, thus reflecting the environment the child is exposed to.

Since most determinants of malnutrition especially the underlying causes, impact on nutritional status over time, use of both the anthropometric indicators and growth velocity would complement

and health status. In the present study, weight growth velocity was studied in relation to potential household and maternal differential determinants.

2.7. Determinants of Malnutrition.

This section reviews the determinants of malnutrition and is organized on the basis of the conceptual framework of malnutrition (Jonsson, 1988; Kavishe & Mushi, 1993). These are grouped into immediate or biological factors and social factors (underlying and basic causes of malnutrition). The biological factors are related to food intake and infectious diseases. The social factors are related to inadequacies in accessibility to food, care of children, essential services (education, health, water and sanitation, housing), resource base, and cultural beliefs and customs.

2.7.1. Immediate Determinants.

These are conceptually related to child food intake and morbidity.

2.7.1.1. Food Intake.

A number of studies have indicated that adequate food intake is paramount for good child nutritional status (Jellife & Jellife, 1979; Greiner, 1988; Mosha & Lorri, 1988; Zumrawi, 1991; Kennedy & Peters, 1992; John & Gopaldas, 1993). A preferable approach is

to help mothers to enrich energy density of foods fed to young children. For example, high energy low bulk foods were demonstrated to be better child growth promoters in terms of weight for age and growth velocity than high energy high bulk foods (John & Gopaldas, 1993). The present study establishes the effect of daily feeding frequency on child nutritional status.

2.7.1.2. Child Morbidity Status.

Most studies have reported infectious diseases especially malaria, diarrhoea and lower respiratory tract infections to have negative impact on child nutritional status. For example, a study conducted in low income urban areas of Tanzania showed that malaria and diarrhoea were significant negative predictors of Wt/age and Wt/ht, respectively (Mbago & Namfua, 1992). Likewise, a study conducted in West Africa, diarrhoea and respiratory tract infections had negative impact on children aged less than 2 years (Rowland et al, 1988). However, diarrhoea had a significant negative effect on growth of exclusively breast feeding children, while growth was normal in second year of life besides continual of infections.

Likewise, a study conducted in Uganda indicated that skin infections and diarrhoea, within a two-week period, were negative determinants of weight for height (Vella et al, 1992). Infectious diseases were also found to affect weight gains for infants from 3-6 months of age (Zumrawi, 1991). The major child infectious diseases in Tanzania are: malaria, upperrespiratory tract

infections (URTI), and diarrhoea (TFNC, 1994). The respective prevalence of these diseases changed from 20-35%, 15-11%, and 8-7% between 1984 to 1991, for malaria, URTI, and diarrhoea. The present study intended to establish the effect of infectious diseases on child nutritional status.

2.7.2. Social Determinants of Child Malnutrition.

A child's social environment refers to a combination of factors underlying the availability and effectiveness of services and interpersonal relations within the household or immediate community (Ebrahim, 1982). A study conducted in Panama, indicated that maternal and household differentiation were important in determining child dietary intake, haemoglobin status and the prevalence of parasitic infections (Tucker,1989).

2.7.2.1. Food Accessibility.

This may be considered in terms of physical, financial and social accessibility to food.

2.7.2.1.1. Physical Food Accessibility.

A number of studies indicate that household physical food accessibility (availability) is positively associated with child nutritional status (Onchere, 1984; Mosley, 1985; Lindjorn et al, 1993). For example, in drought-prone areas of Ethiopia, child nutritional status was positively associated with food availability especially from animal sources and cereals (Lindjorn et al, 1993). However, household food accessibility is a necessary but not a sufficient condition for good health and nutritional status. Other important factors are care and health services (Bryceson, 1990; Jonsson & Toole, 1991a; Jonsson & Toole, 1991b). This was demonstrated in a study on food security in Tanzania where no clear relationship existed between child malnutrition/mortality and food availability (Kavishe & Mushi, 1993). The study also indicates that availability of food does not guarantee its accessibility due to social and/or economic constraints.

Data on nutrition trends in Tanzania, indicate that from 1984/85 to 1993/94, with an exception of year 1985/86, food production was generally below that needed to meet the per capita energy requirements (TFNC, 1994). Major problems include unreliable rains, low use of fertilizers, incidence of crop pests and diseases and post harvest handling problems. The estimated food shortage gap in the country for year 1993/94 was 992551 metric tons, that was equivalent to 33% of the requirements (URT & FAO, 1994; TFNC, 1994). This implies that a number of households had

inadequate accessibility to food to meet requirements for an active health life. The present study establishes the effect of per capita energy availability from household's own crop production on child nutritional status.

2.7.2.1.2. **Income, Expenditure and Occupation.**

It is widely documented in literature that household income is positively associated with child nutritional status (Bairagi, 1980; Onchore, 1984; Mosley, 1985; Mahadaven *et al*, 1986; Martorell & Habitch, 1986; Thomas *et al*, 1987; Gopaldas *et al*, 1988; Tucker, 1989; Braun & Pandya-Lorch, 1991; Esrey & Sommerfelt, 1991; Zumrawi, 1991; Zhao, 1992). A household that uses almost all its human or economic resources to achieve food security, is highly vulnerable or at risk of becoming food insecure compared to one that uses a small proportion of its resources to achieve the same goal (Jonsson & Toole, 1991b; Kavishe & Mushi, 1993).

This implies that poor households who depend on food crop sales for their income are at a greater risk of food insecurity and malnutrition than those with alternative sources of income. This is evidenced by the fact that the prevalence of malnutrition of 40% in rural areas of Tanzania is the same as the proportion of households generating their income from sales of food crops (41%) and about the same as the percentage of food deficit population (40%) (URT, 1989; Kavishe & Mushi, 1993).

Although income generation activities have long term nutritional benefits, higher child malnutrition and mortality levels have been observed in areas where cash crop economy was imposed (Kennedy, 1989). The author argues that decisions made by income controllers at household level on using the increased income on non-foods relative to food may be more important than the actual amount of extra income. This may also be due to pressure for the use of limited time generated by cash incentives at the expense of time spent on food crop production and for care and feeding of the child (Kavishe & Mushi, 1993). In a study previously conducted in Bangladesh, normal household expenditure on non-foods was positively associated with child nutritional status (Bhuiya et al, 1986). This reflects the importance of overall child care in determining nutritional status rather than food security alone.

Income generation activities must therefore be integrated with other activities that also address child survival in order to achieve the intended effects.

Moreover, there are studies that have reported stability or improvement in anthropometric nutritional status in the face of economic deterioration (Gross et al, 1987; Mwikongi, 1994). One of the reasons attributed to this observation was effective community mobilization to undertake actions relevant to improvement of nutritional condition.

Many studies have reported a positive effect of both maternal and paternal occupation or income on child nutritional status. For example, it was observed in Uganda that fathers who were alcohol distributors had higher child mortality than tobacco farmers or business men (Vella et al, 1992). Maternal employment and income are key factors to child nutrition (Greiner, 1988; Tucker & Sanjur, 1988; Zhao, 1992). The income differential factor was consistently and positively related to dietary and anthropometric outcomes (Tucker & Sanjur, 1988). The author also concluded that maternal time in home production decreases with her employment but total household time does not due to inputs of other household members. It is also concluded that when women control cash income, they generally spend more on food (Katona-Apte, 1983). This is likely to positively contribute to child nutritional status.

However, mother's wage increases through employment is positively associated with decline in duration and extent of breastfeeding (Popkin, 1978). This may negatively impact on child nutritional status. This study aimed at establishing the effect of household and maternal income, occupation, and per capita expenditure on both foods and non-foods, on child nutritional status.

2.7.2.2. Household Size.

There are contradicting views about the influence of household size on child nutritional status in literature. Most studies report a negative association of household size with either child food intake and/or nutritional status (Sembajwe, 1981; Onchere, 1984; Mrisho, 1987; Braun & Pandya-Lorch, 1991; Esrey & Sommerfelt, 1991; Mbago & Namfua, 1992). Among the reasons given for the negative relationship are that a smaller family allows for mothers to spend more time interacting, stimulating, teaching, and disciplining children (Frank, 1991). Conversely, it also implies that the per capita food available diminishes with increasing household.size (Onchere, 1984).

But there are studies that have indicated either no association or even a positive association between household size and child nutritional status (Kwered, 1988; Betrand et al, 1989). The positive effect of household size on child nutritional status is postulated to be due to contribution, by the many economically active household members, to labour for household tasks and agricultural work (Betrand et al, 1989) and to child care (Kavishe & Mushi, 1993).

The present study establishes the influence of household size on child nutritional status.

2.7.2.3. Child-Care Practices.

These are mainly related to maternal behaviour in relation to feeding practices, time in contact with the child, and birth related practices.

2.7.2.3.1. Breastfeeding.

The joint WHO/UNICEF statement reports several advantages of proper breastfeeding (WHO & UNICEF, 1989). These include anti-infective properties of breastmilk, improving maternal child bond and child spacing. It is recommended to breastfeed exclusively for 4 to 6 months and introduce least cost weaning foods, preferably based on locally available weaning foods (Jellife & Jellife, 1979; WHO & UNICEF; 1989). It is also advisable to initiate breastfeeding within a half-hour of birth (WHO & UNICEF, 1989; TBS, 1993).

There is a significant positive association of proper breastfeeding and supplementary feeding with child nutritional status (Elisa *et al*, 1990; Shoff *et al*, 1991; FAO & TFNC, 1992; Kennedy & Peters, 1992; John & Gopaldas, 1993). Formula fed infants followed between birth to six months were observed to have a significantly higher reduction in growth velocity than breastfed ones (Elisa *et al*, 1990). Similarly, children breastfed up to 18 months of age were observed to be better nourished than their age counterparts who were breastfeeding for shorter periods (FAO & TFNC, 1992). In a study previously conducted in Morogoro

township in Tanzania, short breastfeeding duration was associated with poor child nutritional status and increased susceptibility to diseases especially diarrhoea and measles (Karegero, 1989).

In Tanzania, about 98% of children are breastfed but only 44% fulfil the universal recommendation of initiating breastfeeding within one hour of birth (TBS, 1993). The study also reports that the median duration of breastfeeding, exclusive breastfeeding, and full breastfeeding to be 21.6, 0.6, and 2.3 months, respectively. It also reveals that by the end of 3 months of birth, only 23.5%, of infants are still exclusively breastfeeding, 28.7% are given plain water on top of breastfeeding, and 47% are already under supplementary feeding.

However, about 95% of children in the country continue to breastfeed to between 12-15 months of age (TFNC, 1993; TBS, 1993). The major reasons for stopping breastfeeding in rural areas of Tanzania include: another pregnancy, the child is old enough, child refused, the milk is insufficient for the child, or the milk has gone bad (TFNC, 1989; Kavishe & Mushi, 1993). In the present study, the influence of breastfeeding practices on child nutritional status is assessed.

2.7.3.3.2. Supplementary Feeding.

Supplementary feeding is vital for improving weight gain in infants from 3-6 months of age (Zumrawi, 1991). However, high energy low bulk foods are better child growth promoters in terms of weight for age and growth velocity than high energy, high bulk foods (John & Gopaldas, 1993). Likewise, many studies have proposed high nutrient density weaning foods from germinated grains in order to improve child food/nutrient intake even in situations of heavy mother's workload (Mosha & Lorri, 1987; Karegero & Kurwijila, 1988; Greiner, 1988).

Child feeding frequencies in Tanzania are low, on average two or three times per day (Kavishe & Mushi, 1993). Similarly, the national DHS of 1991/92, found that 96% of Children aged 6-59 months were being fed less than 4 times per day (TBS, 1993). The lower feeding frequencies are significantly associated with poor child nutritional status (Kavishe et al, 1985; Mbago & Namfua, 1992). Small stomachs for young children, unlike in adults, imply that children need to eat more frequently in order to meet their energy requirements. The present study establishes the influence of feeding frequency on child nutritional status.

2.7.2.3.3. Maternal Time in Contact with Child.

Economically constrained mothers are faced with a difficult choice between using the time for economically productive work or child care and domestic activities (Nabarro, 1981). A number of studies have shown that the time mother has for child care is positively associated with the quality of care and by implication, with child nutritional status (Nabarro, 1981; Mosley, 1985, Gopaldas et al, 1988; Lukmanji; 1992; Kavishe & Mushi, 1993). However, a recent study conducted in Tanzania found that there was no relationship between women's workload and the children's nutritional status (Lukmanji et al, 1993). These authors argued that the relationship was likely to have been modified by the contribution of men to household work.

The positive contribution to child care by other household members in extended family structures may outweigh the negative influence of mother's workload on child nutritional status. The influence of mother's time in contact with her child on nutritional status of the child is therefore dependent on household composition-i.e. the availability of alternative care givers to the child. In the present study, the influence of mother's day time in contact with the child on the child's nutritional status, is assessed.

2.7.2.3.4. Maternal Birth-related Behaviour.

Factors relevant to the present study are: parity and number of living children, birth order of the index child, and mother's age at first birth.

2.7.2.3.4.1. Maternal Age at First Birth.

The age at which child bearing begins has important demographic consequences and also nutritional consequences for the mother and child. Young teenage mothers are more likely to bear low birth weight babies (Miller, 1984; Konner & Shotak, 1986; Maso et al, 1988; Zuravin, 1988). This outcome is due to an inadequate accumulation of fat stores and/or an excessive mobilization of fat during gestation (Maso et al, 1988). Likewise, adolescent pregnancy is socially disadvantageous as young teenage mothers have impaired educational, economic and marital status compared to older mothers (Konner & Shotak, 1986). These authors also report that adolescent mothers are 1.3 times more likely to suffer from non-fatal anaemia (11%) and toxaemia (9%) as a result of pregnancy than women aged 20-24 years in which the respective prevalences were 8.8% and 6.9%. The authors also reported that maternal death rate is 60% higher for women who become pregnant before age 15 and the rate for 15-19 years old is 13% greater, than for mothers in their early twenties.

However, in Zuravin's (1988) study, age at first birth was not significantly associated with child nutritional status when other fertility variables were controlled. The report of the Tanzania national DHS of 1991/92, indicate that the Median age at first birth ranges from 18-19 years with older mothers reporting lower age at first birth than younger ones (TBS, 1993). The report also indicates that 29% of teenage girls aged 15-19 years had already begun child bearing.

2.7.2.3.4.2. Parity and Number of Living Children.

Parity and number of living children which by implication increasing number of dependants, is negatively associated with child nutritional status (Zuravin, 1988; Kavishe & Mushi, 1993). This is however modified by composition of household members and the family structure. Extended family system and many economically active children in the household may contribute positively to child care and thus nutritional status (Tucker & Sanjur, 1988; Kavishe & Mushi, 1993). The present study establishes the influence of parity and number of living children on child nutritional status.

2.7.2.3.4.3. Birth Order of Child.

Birth order has implication on pregnancy outcome and child nutritional status. A study conducted in Philippines indicated that first born had the least favourable birth outcomes of all infants (Miller, 1991). The author also reported a strong interaction between birth order and inter-pregnancy intervals. Infants at a birth order of 5 or greater and short birth interval were at a decided disadvantage compared with those with a wider interval, while those of birth order 2-4 had the same relative outcome regardless of birth interval.

However, in a study previously conducted in Bangladesh, a significantly higher proportion of well nourished children was found among pregnancy orders greater than or equal to 5 and among those who had previously experienced two or more foetal or child deaths (Swenson, 1984). The author concluded that the experience a mother gains in child care may tend to diminish any potential adverse biological effects that have been attributed to higher pregnancy orders in infancy. The influence of child's birth order on nutritional status is modified by factors like inter-pregnancy interval and mother,s experience on child care. The present study also aimed at establishing the influence of child's birth order on his/her nutritional status.

2.7.2.3.5. Maternal Age.

There are contradicting views about the influence of mother's age on child nutritional status. Most authors report a positive association of mother's age and child nutritional status (Miller, 1984; Grummer-strawn, 1991; Mbago & Namfua, 1992). However, in a study conducted in Bangladesh, it was shown that women of over 29 years had the highest proportion of severely malnourished children when compared to other maternal age groups of less than 19 years and 19-28 years (Swenson, 1984). A higher proportion of well nourished children were among mothers with age 19-28 years. However, mother's age alone or in combination with other demographic variables does not explain a higher proportion of variance in child abuse or neglect (Miller, 1984). The present study also aimed at establishing the influence of mother's age on child nutritional status.

2.7.2.3.6. Maternal Nutritional Status.

Among the indicators of maternal undernutrition are height below 145 cm and BMI of less than 20 (Gibson, 1990, Kavishe & Mushi, 1993; TBS, 1993). Maternal height is generally used to predict the risk of difficult delivery since a short stature is correlated with a small pelvis (Yomeyama et al, 1988; Gibson, 1990; TBS, 1993). The mean height for women in Tanzania is 155.9 cm and only about 1% are below 145 cm (TBS, 1993). This indicates

that most women have adequate height. A number of studies indicate that maternal nutritional status is positively associated with child birth outcomes, including nutritional status (Thomas et al, 1987; Zumrawi, 1991; Materu et al, 1993). Maternal anthropometric measures are good predictors of both birth outcomes and child nutritional status up to the age of 2 years (Materu et al, 1993). Mother's nutritional status therefore seems to influence the nutritional condition of foetus and of the child especially during lactation where child nutrition requirements is substantially dependent on mother's body nutrient reserve. Mother's nutritional status may also reflect the quality of care in the household, and by implication child nutritional status. The present study aimed at establishing the influence of mother's nutritional status on child nutritional status.

2.7.2.3.7. Maternal Marital Status.

The mechanism by which marital status affects infants and child health and nutritional status, remains uncertain. However, children of single parents are at higher risk of poor care as compared to their counterparts whose father and mother are united by marriage (Ebrahim, 1982). There is also evidence that mothers who marry before birth, whether before or after conception, are significantly less likely to have a low birth weight baby and more likely to breast feed than are mothers who are unwed at the time of the birth (Winges et al, 1985). Therefore children of married mothers are more likely to be well nourished than those

of unmarried counterparts. The present study also aimed at assessing the influence of maternal marital status on child nutritional status.

2.7.2.4. Essential Services.

These include health, education, water and sanitation, and housing.

2.7.2.4.1. Access to Health Services.

Proximity to health facility and the quality of heath services offered are important for community health and by implication child nutritional status (Martorell, 1980; Yusufu, 1989). Health services availability though significantly associated with child's Ht/age showed a weak correlation (Yusufu, 1989). In Tanzania, 72% of the population lived within 5 km of a health facility and 93% within 10 km by 1989 (MOH, 1989). Health facilities, particularly at primary level are being utilized as reflected by high attendance rates and coverage of specific programmes (Kavishe, 1990). The study also indicates that about 85% of women country-wide received antenatal care and 55% of deliveries took place at a health institution. Furthermore, nationally 53% of deliveries take place in health facilities and 75% of households have child growth charts (TBS, 1993). Vaccination coverage was reported to be 83% by 1986 which was above the global goal of 80% by 1990 (MOH, 1989).

Vaccination helps to prevent or improve immunity against child killer diseases, and by implication child nutritional status. This was demonstrated in a study in the coast region of Tanzania where child immunization status was positively associated with child wt/age and wt/ht (Fundikira, 1988). However, Fundikira's study did not demonstrate a significant association between immunization status and Ht/age.

It is important to integrate the services of traditional health carers with formal health ones in order to improve on the effectiveness of health care delivery. This is consistent with the Primary Health Care (PHC) Initiative. For example, experience gained through training traditional birth attendants (TBAs) in Kwazulu South Africa, suggested that when carefully selected, such personnel can be a valuable asset to rural obstetric services in the area of health education, the provision of rudimentary inter-partum care, and obstetric case finding (Larsen et al, 1988). It can therefore be concluded that accessibility to health services is important for good child nutritional status. The present study aimed at establishing the influence of accessibility to health services on child nutritional status.

2.7.2.4.2. Education.

Many studies indicate that parental education influences child nutritional status. Most of them report mother's education as a positive determinant of child nutritional status (Popkin, 1978; Manoff, 1984, Bhuiya et al, 1986; Gopaldas et al, 1988; Yoneyama et al, 1988; Karim & Chowdhury, 1990; Esrey & Sommerfelt, 1991; Shoff et al, 1991; Mbago & Namfua, 1992; TBS, 1993). In Indonesia, intervention through nutrition education alone with carefully pretested methods, showed a substantial improvement in nutritional status of children as compared to controls (Manoff, 1984). Similarly, in rural Bangladesh, maternal and care-takers' education were associated with improved feeding practices especially feeding frequency and hygienic measures, which by implication would positively contribute to nutritional status (Gulden et al, 1993).

The Tanzania DHS of 1991/92 also showed a positive association between mother's education and child nutritional status (TBS, 1993). For example, the study report indicates that the proportion of stunting among children whose mothers had completed primary or higher education levels was between 10-17% against 23% for children whose mothers had no education or did not complete p rimary school education. Some studies also indicate that father's education (Bhuiya et al, 1986; Yoneyama et al, 1988) and level of education of the most educated household member (Bhuiya et al, 1986) was positively associated with child nutritional status.

Likewise, a previous study in Bangladesh, demonstrated a high interaction between family income and mother's education, indicating that children of literate mothers are likely to benefit more in terms of nutritional status than those of illiterate ones (Bairagi, 1980). However, other studies observed no association between maternal or father's education and child nutritional status (Rawson, 1976; Yusufu, 1989). It can generally be concluded that parental education is associated with child nutritional status through interaction with other factors like income. The present study also aimed at assessing the influence of maternal and household head's education level on child nutritional status.

2.7.2.4.3. Water and Sanitation.

Water supply is a critical factor in household hygiene and health status of its members. Improvement in water supply and sanitation leads to reduction in morbidity and mortality, savings in maternal time and improved food production (Isley, 1983; URT & UNICEF, 1985). These may, by implication contribute positively to child nutritional status. A study conducted in Sri-Lanka indicated that access to piped water close to home improves nutritional status to a greater extent than public water supply (Esrey & Sommerfelt, 1991). The authors explained the negative effects of public water supply on child nutritional status as a reflection of supply problems. A similar observation was reported by Zumrawi (1991) whereby water availability had a significant positive effect on weight gain in infants 3-6 months age old.

In a review of 43 studies, Hughes (1980) concluded that projects which emphasized on quantity of water were more frequently able to demonstrate improvement in morbidity than those that emphasized on water quality. A similar observation was reported by Bhuiya et al (1986) who showed that measures of sanitation, including source of water and quality of latrine were not significantly associated with child nutritional status. The acceptable minimum per capita requirement of water per day necessary for health benefits is estimated to be 20-30 litres (Hughes, 1980). Ownership of sanitary toilet facilities and sanitation level in general were positively associated with child nutritional status (Golpadas et al, 1988; Esrey & Sommerfelt, 1991; Zumrawi, 1991).

It can therefore be concluded that adequate water supply and sanitation are important for good child nutritional status.
The present study also aimed at demonstrating the influence of accessibility to water and sanitation condition on child nutritional status.

The effect of resource base at household level on child nutritional status also depends on the nature of decision making on resource use. Insufficient or lack of control over resources and decision making power by women may have a negative impact on child nutritional status (Mosley, 1985; Lukmanji, 1992; Kavishe & Mushi, 1993). Therefore, the influence of resource base on child nutritional status depends on both the availability of resources and decision made regarding use of the resources. One of the objectives of the present study was to examine the effect of household's wealth base per capita on child nutritional status.

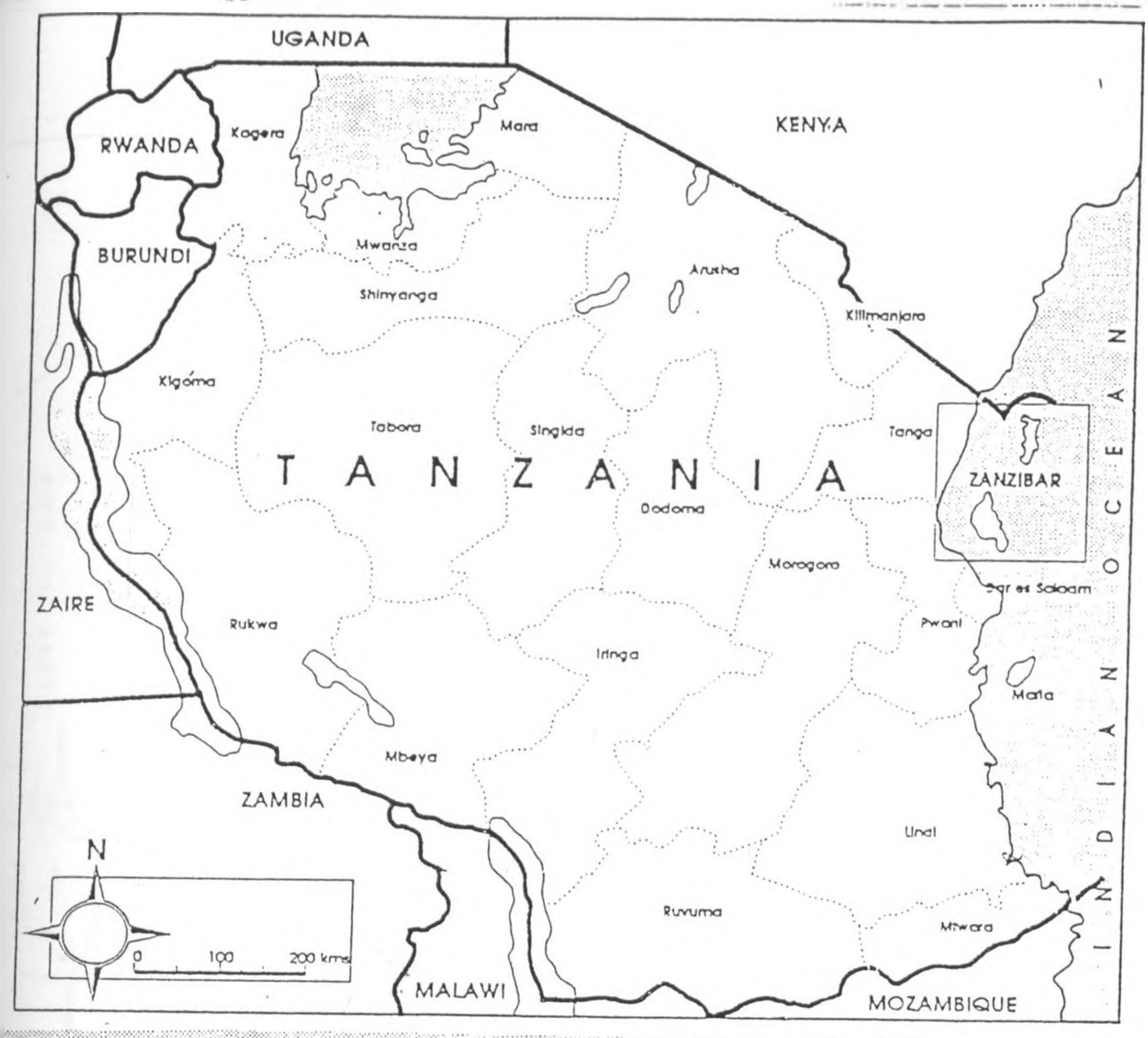
CHAPTER THREE

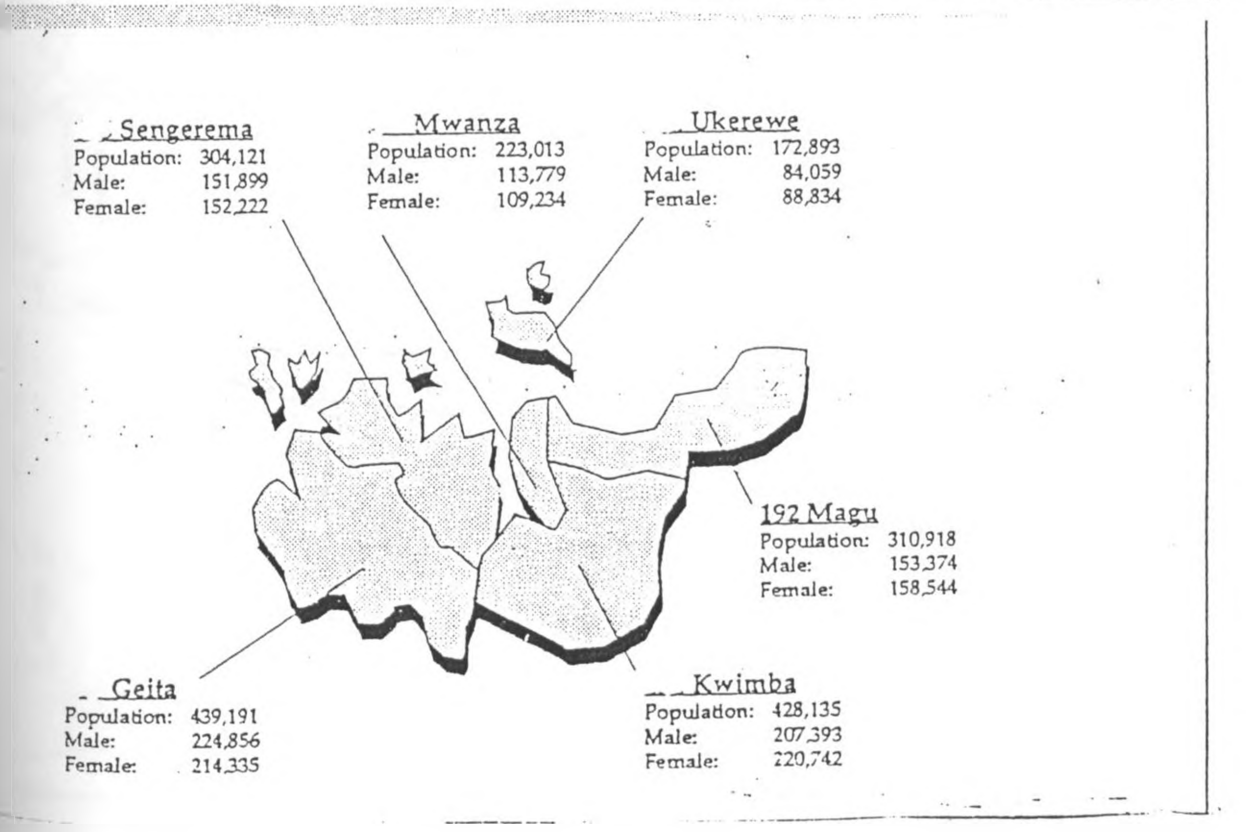
STUDY SETTING

3.1. The Study area.

Sengerema is one of the six districts in Mwanza region, Lake Victoria zone of Tanzania (Map1). The district occupies an area of 8817 sq.km but most of it (62%) is the water mass of Lake Victoria. The district is divided administratively into 5 divisions, 25 wards and about 120 villages. This study was conducted in the South-Eastern part of the district, Sengerema division. Of the five divisions, only Sengerema has implemented the CSPD programme, and of recent (1995), it has expanded to the North-Western part (see Map 2).

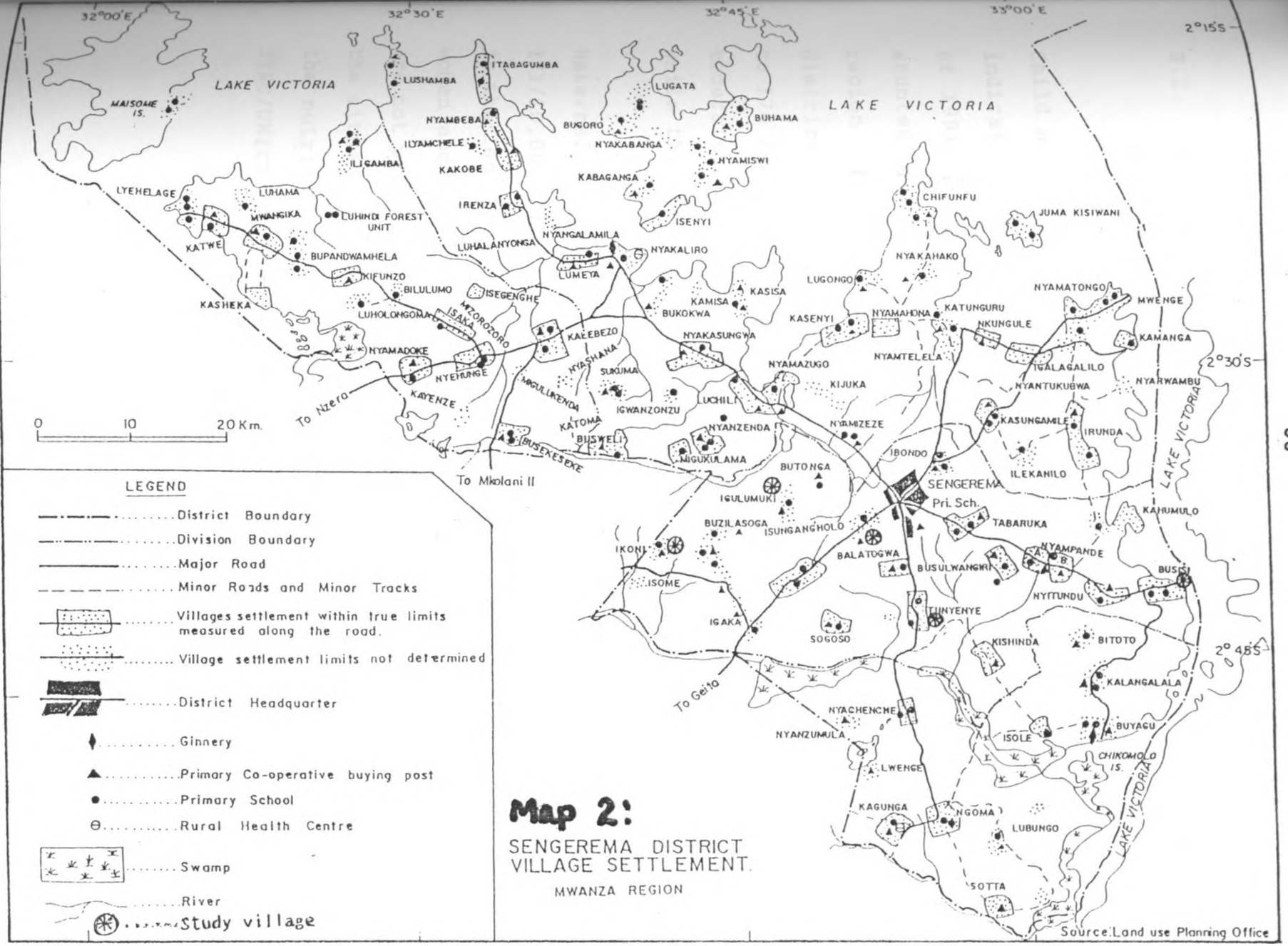
The CSPD started in 1993 in the study area and was expected to cover a projected population of 84215 by 1995. Of this population, 16843 (20%) is less than 5 years old (underfives) and 5053 children (30% of underfives) are 18-36 months old. The latter age group constituted the population frame for the study. The major ethnic groups in the area are the "Sukuma" and "Zinza".





Map 1: Tazania Regional Boundaries and Selected 1988 Census Data for Districts in Mwanza Region.

Source: Adapted from Kayishe & Mushi (1993) and TBS (1989).



Map 2:

SENGEREMA DISTRICT
VILLAGE SETTLEMENT.

MWANZA REGION

Source: Land use Planning Office

3.2. Manifestations of the Problems of Children and Women in Sengerema District.

Child nutritional status and mortality rate are the most useful indicators of the situation of children. The national DHS data of 1991/92 indicate that about 15% of children are severely stunted and 10% of mothers are chronically wasted, in Mwanza region (TBS, 1993). In CSPD areas of Sengerema and Geita districts, underfives mortality declined from 233/1,000 in 1992 to 174 /1,000 in 1994 (Bamugileki, 1995). The rate of severe and moderate underweight was 4.7% and 21.4%, respectively, in 1992 while the respective rates declined to 1.5% and 17.5% in 1994.

Maternal mortality rate decreased from 228/10,000 of 1992 to 171/10,000 in 1994. The prevalence of low birth weight (<2.5kg) in the region is about 12%. The trend of improvement in the rates women and child health problems may reverse if the root causes are not properly addressed. This background therefore highlights the situation in the study area regarding the possible causes of the nutritional and health problems according to the flexible TFNC/UNICEF conceptual framework of malnutrition (Appendix C1).

3.3. Causes of Child and Maternal Malnutrition and Deaths.

3.3.1. Immediate Causes.

3.3.1.1. Adequacy of Food intake.

Like in many parts of the country, feeding frequency is low, averaging 2-3 times per day. It is common for a number of families to live on one meal per day especially in periods shortly before major staple crop harvests. Likewise, it is common for young children to feed on porridge composed of only cassava flour for as low as 2-3 times per day. However, there are limited quantitative data on food consumption in the area.

3.3.1.2. Infectious Diseases.

Malaria, diarrhoea, and acute respiratory infections account for 50% of all attendances at the out patient clinics in Mwanza region (URT & UNICEF, 1992). The major diseases for underfives are malaria, diarrhoea, respiratory tract infections, anaemia and measles. The regional MCH report indicates that the most common causes of maternal deaths are: bleeding, uterine infections, anaemia, ruptured uterus, and retained placenta. The commonest type of anaemia is the nutritional anaemia. Vaccination coverage was unsatisfactory before implementation of the CSPD. Only 54% of infants

received the third dose of polio vaccine in 1991/92 (URT & UNICEF, 1992). However, current data in the village reports indicate that only about 3% of children have incomplete immunization for their age.

3.3.2. Underlying and Basic Causes of Child and Maternal Deaths and Malnutrition.

These include inadequacies in food security, maternal and child care, essential services (health, education, sanitation and water, housing) and resource base.

3.3.2.1. Food Security and Access.

About 95% of households in the district derive their economic livelihood from small scale food and cash crop production. This relies mainly on hand hoe technology and rainfall.

The district comprises two agro-ecological zones. The first, Northern zone, gets enough rainfall (>900 mm per annum) and is famous for production of cotton, maize, rice, cassava fruits and vegetables. Of the 5 wards in Sengerema division, only Buzilasoga falls in this zone. The second, Southern zone, experiences unreliable rainfall (800-900 mm per annum), often inadequate for maize cultivation. The zone covers most of the areas in the study division. Crops suitable for cultivation in this zone are cotton, sorghum, millet, cassava, sweet potato and legumes.

The major cash crop in this district is cotton. However, its production has been declining due to low productivity per acre as compared to food crops like rice. For example, aggregate cotton production in Mwanza region declined from 192,830 tonnes in 1970/71 to only 112,743 tonnes in 1988 (URT & UNICEF, 1992). The population of cattle, goats and other livestock is relatively high and there is also a reliable supply of fish from Lake Victoria. Fish production in the region increased from an annual average of 40,500 tonnes in 1978 to 107,900 tonnes in 1988.

Data from the regional agricultural extension office (URT & UNICEF, 1992) and the national Household Budget Survey (TBS, 1992), suggest that people in the region generally produce enough food to satisfy the basic requirements. The regional food balance sheet for 1988/89 indicate that the percentage adequacy of food and energy available from own food production in Mwanza region were 134% and 100%, respectively, of the recommended per capita requirements (TFNC, 1991). Moreover, Sengerema ranks among the best two districts in terms of crop production and domestic animal wealth in the region (TFNC & UNICEF, 1992).

There are however, pockets of food deficit households in the district. In recent years, imminent food shortage has been reported in the district (Daily News, 1993). This is partly caused by poor timing of rains and preference of cultivation of maize instead of drought resistant crops which are recommended by experts, use of poor quality seeds, and low rate of use of fertilizers/manures.

3.3.2.2. Maternal and Child Care Patterns.

Care refers to provision in the household and the community, of time, and support to meet the physical, mental and social needs of the growing child and other family members (Gillespie & Mason, 1991).

3.3.2.2.1. Maternal Care Patterns.

Like in other parts of the country, many nutrition relevant decisions made by women are not implemented because they do not control the necessary resources. Women participation in decision making is minimal and almost all use of household income has to be approved by their husbands. They also do not have access to institutional support for economic development as land allocation and crop sales in cooperative unions are all registered under household heads who are generally men. By the end of 1991, the district had registered only 11 women groups, equivalent to only 8.1% of groups in the region. The most popular informal income generation group activities in the district are: sewing/knitting, small shops, handicrafts, agricultural projects and street food vending.

Women take the triple role of producers, reproducers, and major offerers of care (Kisanga, 1990; Kavishe & Mushi, 1993). They bear a disproportionate share of agricultural workload. They also have the responsibility for food processing and preparation, and

other domestic chores as fetching water and fire wood. Most women bear children the man wants regardless of the possible health consequences. This is a major constraint to family planning whose acceptance is estimated at only 25% in the study region (URT & UNICEF, 1992).

participation of mothers in village health days (VHDs) and MCH services in the programme area increased from an average of 80% in 1992 to 88% in 1994 (Bamugileki, 1995). Country reports also indicate that antenatal care coverage of pregnant mothers was about 95% in the country by 1984 (MOH, 1989). Medical care is constrained by inadequate drug supplies and lack of transport system for referrals. However, the quality of care has been improved by availability of VHW with essential drugs kit and equipment in CSPD villages. This is also enhanced by establishment of a village "Health Fund" which is mainly dependent on household contributions.

3.3.2.2.2. Child Care Patterns.

The caring capacity for children is influenced by the time available for the mother and other household members for child care. Extended family system in the district, offers means for alternative care givers. Care of young children is mainly left to older siblings or grand parents when parents are away for economic activities. Children who are still breastfeeding, mostly accompany their mothers during farm work. The district had only 6 day care centres in 1992 (10% of the regional centres) but

these were not community based. Organization of community based day care centres is constrained by lack of trained attendants. In some villages, acceptance of day care arrangements is also constrained by belief in witchcraft. People fear to mix their children with those from households believed to practice witchcraft.

In a few villages that deliberated on starting the centres, they have been operating only when households have enough food in stock to contribute to running them. Moreover, the centres operate for only two days in a week in order to give time to members of the VHC to participate in their own farm work and undertake household demonstrations. However, household demonstrations were minimal in surveyed villages partly because of lack of consistent compensation for the time spent by members of the VHC, by village governments. Nevertheless, use of child growth monitoring for community mobilization has facilitated child care from both paternal and maternal parents.

Most children (99%) in the region are breastfed. The median duration of breast feeding and exclusive breastfeeding in Mwanza region are 20.6 and 1.4 months, respectively (TBS, 1993). However, there is a high prevalence of mothers who are expressing colostrum out of breasts with a belief that it is dirty and may cause health problems to the baby. This practice is also accompanied with high rate of use of prelacteals.

3.3.2.3. Essential Services.

These include: health, education, water and sanitation, and housing.

3.3.2.3.1. Health Services and Environment.

Health services in Sengerema district are provided both through the formal and informal system. The formal health system is provided through 38 dispensaries, 6 health centres, and one hospital. This is approximately 9,600, 60,700, and 364,000 people per dispensary, health centre, and hospital, respectively, by 1995. Health centre accessibility is better than those for the region (Mwanza) and the national averages which are estimated at 91,000 per health centre.

Hospital accessibility is lower than the national and regional average of 175,300 people per hospital. Moreover, the only available hospital is owned by the Catholic Church, and medical services are not user free. In terms of dispensary availability, the situation is similar to the regional and national average of about 9,500 people per facility. Each dispensary serves an average of 4 villages.

The informal health system is very extensive in Sengerema district. It comprises traditional healers, traditional birth attendants (TBAs) and sorcerers. The number of TBAs in the district is likely to be higher than the national average of 4 TBAs per village. Efforts have been made to integrate the services of TBAs in the programme. In every village implementing the CSPD, there is at least one trained TBA to assist a female VHW in village level obstetric services. Belief in witchcraft is one of the major obstacles to development of good health behaviours in the area. However, progressive integration of the traditional system in the programme may bring improvement in behaviour and even in general development.

Each village implementing the CSPD programme has two trained VHW, one female, another male. These are responsible for health education and first aid services to households, and coordinating activities of the village health committee (VHC). Vaccination is also integrated into the VHDs activities. This approach and the normal out-reach services have greatly empowered communities to control immunizable child killer diseases. Recent developments in a number of villages include establishment of a village health fund to help in replenishing the stock of essential drugs kit that is quarterly donated by UNICEF, pay monthly allowance to VHWs, and meeting allowances to members of the VHC. The funds are dependent on household contributions and fines charged to village members who break some health norms or village by-laws.

Health management and information system in the CSPD is closely integrated with planning and implementation of programme activities. In every CSPD village there are four types of registers.

The first is a "Village members" register organized according to village sections, ten-cell leadership units, and household heads. Information specific for underfives in the register, include: age in months, sex, immunization status, whether they have growth charts (Form No.1), and nutritional status in every quarter of the year.

The second, Form No.2, summarizes information on nutritional and health status of underfives in every ten-cell leadership unit so that follow up of children with health problems can be made even at such grass-root levels. The form is similar to the main village register on child-specific information.

Form No.3 summarizes quarterly village child nutritional and health status information. The information include: coverage in assessment of registered children, number and percent of children in different nutritional status (Wt/age percentiles) categories. It also includes information on immunization status for age, and child deaths and their causes.

All the forms are updated at least once before the end of the quarter to include new births and immigrants, and remove the deceased and migrants. Statistics summarized by the VHC are discussed and communicated to households during celebrations for village health days (VHDs). Measures to alleviate the problems are discussed and deliberations are made before the statistics are sent to higher levels of programme implementation and coordination (ward, district and region). Copies of village meeting minutes are sent together with the statistics to the higher levels. A similar communication procedure is done between ward to district and district to region. Higher levels are supposed to make follow up to lower levels to facilitate implementation and timely information preparation.

Traditional drama, choirs and other community specific demonstrations are used to communicate important health messages to villagers. Every severely malnourished child is discussed individually and the possible causes are evaluated in order to decide on corrective measures. There is also a regional CSPD newsletter called 'Mtoto wa Mwanza" in which coordinators and implementors of the programme at different levels exchange information and views on events relevant to the CSPD programme components and developmental goals in different areas of the region.

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3.3.2.3.2. Education.

Primary school education in the district is unfavourably affected by shortage of teaching materials and high drop out rates. School attendance in the district ranges between 50-70% and there were no children enrolment (i.e., 0%) to primary standard one at the age of 7 years (Sengerema-CSPD, 1992). The reasons for poor attendance are: child labour in fishing and agricultural work, participation in traditional drama groups and weekly crop and livestock open markets, and pregnancy. Similarly, regional statistics indicate that the proportion of drop outs among children enrolled for primary standard one and who completed standard seven level in 1990, was more than 40% in the district (URT & UNICEF, 1992).

The situation is worse than the national average rate of 25% school drop outs (Kavishe & Mushi, 1993). Illiteracy rate among women in Mwanza region is about 37%, slightly higher than the national average of 34% (TBS, 1993). However, the district has a medical assistant school, nursing training centre, and a folk development centre which can be used for training various cadres in the programme on health relevant aspects.

3.3.2.3.3. Water and Sanitation.

Majority of households in the district obtain water from unprotected sources. These include seasonal ponds/wells and Lake Victoria. The Health, Sanitation and Water programme (HESAWA), jointly supported by the government (URT) and the Swedish International Development Agency (SIDA) was launched in the three Lake Victoria zone regions (Mwanza, Mara, Kagera) (see Map 1) in 1984. Community participation approach is used in formulation of water and sanitation schemes. A few protected modern wells, equipped with a hand pump, are available in Sengerema town and some villages. However, most of them get dry during dry season. Skin rashes (mainly scabies) are common among children in the area, mainly due to shortage of water needed for body hygiene.

The rate of accessibility to safe water is lower than the national average of 42% of households. Environmental sanitation is poor among households with many domestic animals. It is also not uncommon to find animals, especially calves and goats in the house where people sleep. Like in many parts of the country, there has been an increase on the number of households with latrine presumably through interventions of PHC and CSPD programmes, and successes in the universal primary education (UPE). Most village governments have come up with by-laws to ensure that hygienic and sanitation measures are adhered to, by households. Most houses in the villages are mud and grass-thatched, and poorly ventilated. This is common even among households owning hundreds of domestic animals.

3.3.2.4. Economy of the District.

The economy of the district is mainly dependent on agricultural produce. All roads are non-tarmac and the major ones connecting the district headquarters to the regional headquarters, and rural areas become non-passable during heavy rains of February to April. The district/divisional town has no electricity and telephone services are poor.

3.4. Achievements and Constraints of the CSPD Programme.

The critical factor in the successes of CSPD programmes are; the flexible conceptual framework of malnutrition, the Triple A cycle, and social mobilization. The capacity of a number of communities to assess, analyze, and take appropriate actions to alleviate child/women health and nutritional problems has increased in the course of implementation of the programme. This is evidenced by a significant reduction in rates of severe underweight, child morbidity and mortality, as well as maternal deaths.

Sustainability of these successes is however constrained by lack of in-depth knowledge on area specific social indicators of the risk of child malnutrition in a household. In new programmes, actions deliberated by implementation committees rely much on the conceptual theoretical knowledge rather than the actual social environment that has caused malnutrition. Knowledge on the area-

CHAPTER FOUR

RESEARCH METHODOLOGY

4.1. Research Design.

A cross sectional survey of both descriptive and analytical nature was carried out in the pilot area (Sengerema division) of Sengerema district Child Survival, Protection and Development (CSPD) programme area, from January to March, 1995. The design was applied in a modified context to enable determination of child growth velocity by collecting secondary serial weight and age data for the study children (from growth cards and village registers), covering four three-monthly periods of year 1994.

Methods of data collection included a child specific questionnaire administered to the mothers of randomly selected children (18 to 36 months) from systematic-randomly selected households. Key informant interviews and focus group discussions were used to collect qualitative data relevant to child health and nutritional status and implementation of the CSPD programme in the study area. Measurement included weight and height of children and mothers while secondary data on child weight and age was collected from growth cards and village registers.

4.1.1. Inclusion Criteria:

Three hundred and fifty six (356) households (ie. with children 18-36 months), selected by systematic random sampling from a list of eligible households (prepared from village registers), were included in the study. Where more than one child (18-36 months) existed in an eligible household, the child for inclusion in the study was selected by simple random sampling. Each respondent mother from eligible households had to have resided in Sengerema division (the study area) at least for the past three (3) years. Each eligible child was staying with his or her mother.

4.1.2. Sample size.

A minimum sample of 342 households with children aged (18-36 months) was required. This was determined using the following formula (Fisher *et al*, 1991) and underlying practical considerations.

$$n = \frac{Z^2.p.q}{d^2}$$

where n = desired sample size

Z = standard normal deviate (i.e. 1.96 for 95% Confidence Interval).

p = proportion of children, 18 to 36 months of age estimated to be stunted, that is below -2SD of reference standards (i.e. 39.4%=0.394, proportion of stunted children in Mwanza region (TBS, 1993), assumed to be same as that of study children.

q = 1-p = proportion of children who are well nourished (i.e.have normal height for age=0.606)

d = degree of accuracy desired = 0.05

This sample size calculation formula assumes a 50% power. It is however, normally desired to report data from high powered samples, like 80% power, especially when having more variables to relate. However, this would necessitate having large samples that are difficult to manage because of limited time and financial resources. In view of these constraints, this low powered formula was adopted.

The proportion of stunted children in age 12 to 36 months showed a 1:1 ratio with that of overall average stunting among the underfives in Usangu basin, Mbeya region (FAO & TFNC, 1992). A similar relationship is assumed in the CSPD program area. Thus, the rate of stunting among study children (18-36 months) was estimated to be equal to 39.4% (the overall rate of stunting among underfives in Mwanza region). Therefore, the desired sample size (n) was given by:

$$n = \frac{(1.96)^2 \times (0.394)(0.606)}{(0.05)^2} = 367 \text{ children.}$$

However, this formula is applicable in descriptive studies when the study population is above 10,000. The population of underfives in Sengerema division, the CSPD program piloting

area, was estimated at 16843 by the middle of year 1995 of whom only about 5053 children belong to age 18 to 36 months. Therefore, children eligible for the study in the area were less than 10,000. The following formula was therefore used to adjust for the sample size requirements (Fisher et al, 1991).

$$n_f = n/(1+n/N)$$

where n_f = desired sample size when the study population (<10000).

n = desired sample when the study population $\geq$ 10,000.

N = estimated population frame of study subjects in the program area

Therefore, $n_f = 367/(1+367/5053) = 342$

However, a higher sample size of 356 households and index children was covered.

4.1.3. Sampling Method.

The study was conducted in Sengerema division - the only area that has been implementing the CSPD programme in Sengerema district. All the 5 wards , with a total of 31 villages, in the division were represented. One village from each of the 5 wards was randomly selected. These 5 villages, constituted about 16% of villages in the division. The sampling procedure is outlined in Figure 1.

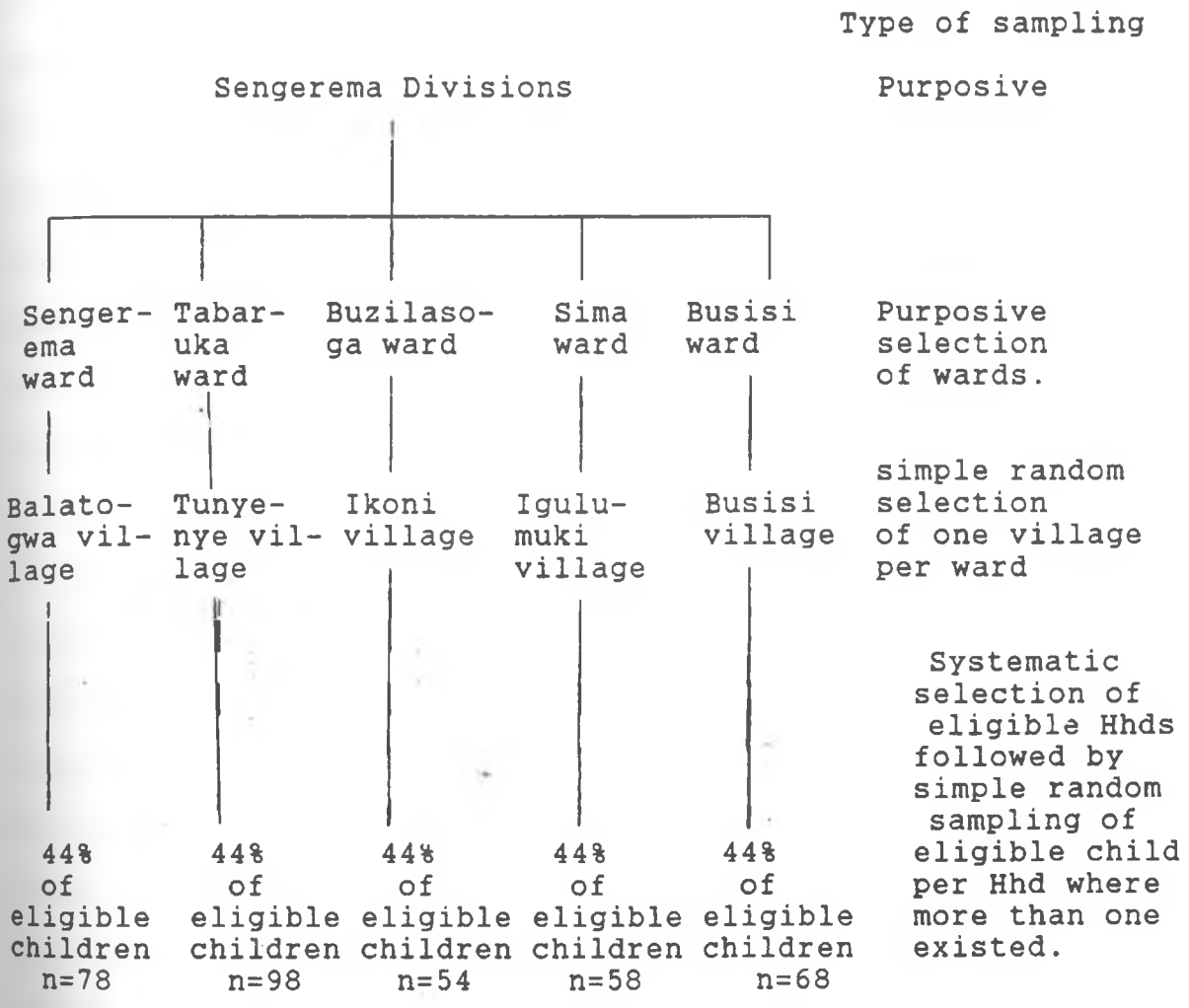

Figure 1: Sampling Plan

Using village registers and growth monitoring forms (containing anthropometric and health records of all underfives in each ten-cell leadership unit), a list of households with children in the desired age range (18-36 months) in each sampled village was prepared. The exact number of children drawn from each sampled village was proportional to village population frames. Villages thus acted as stratification factors. Eligible households (i.e., with children aged 18-36 months) were selected by systematic

random sampling. The k-value in systematic sampling of subjects was 44%, that is, the percentage of all eligible children in each of the sampled villages. To avoid household bias, one child was selected from each of the sampled households. In households with more than one eligible child, the index child was selected by simple random sampling (Figure 1). This minimized chances of having the sample biased by either younger or older eligible children.

To minimize problems of missing sampled respondents, that was experienced during pretesting stage of the study, all mothers with children under five years were invited for normal MCH and free first aid services were given with assistance of village health workers (VHW) and two nurses who were also enumerators. First aid drug kits were donated by programme authorities. The free and quick weighing, advice and first aid offered during the survey, pooled crowds of mothers and made it possible to get the sampled subjects. Homesteads of interviewed mothers were later visited in order to fill the questionnaire on sanitation and housing which needed observation.

4.2. Data Collection.

Data collection was undertaken using a structured, pretested (and modified) questionnaire, key informant interviews, and focus group discussions using checklists. Measurements included weight and height/length using weight scales and height/length boards,

respectively. Interviews were conducted by trained enumerators to mothers of the randomly selected eligible children.

4.2.1. Structured Questionnaire

The questionnaire was organized into five sections (see Appendix D), each consisting of a series of structured questions. These were:

1. Demography.
2. Food availability and child weaning practices.
3. Information on child bearing, access to health services and child morbidity status.
4. Water, sanitation and housing.
5. Household income, mother's income and household wealth base.
6. Anthropometry and growth monitoring data.

4.2.1.1. Nutritional Status.

The Protein-Energy undenutrition of children and their mothers was assessed by taking weight and height measurements. Child weight was measured using "Salter Scales" which where calibrated using a 5kg stone, every morning at Sengerema Folk Development College (FDC). Weights were taken to the tenth of a kilogram. Two measurements were taken for each case and the average calculated. Children were weighed with minimum clothing (vest and pant). Some of the children (25%) were in vest/dress only

without pant. All scales were zeroed with a weighing pant prior to taking measurements. All weights were later adjusted by subtracting 100 gm. This weight was arrived at, after measuring 24 vests and pants, randomly picked from the study villages and also adjusting for proportion of children who had no pants. Weights of mothers were taken using bathroom scales. Shoes and any extra clothing were avoided during weighing.

The principal investigator participated in all height measurements and ensured all precautions on measurement techniques as recommended in the United Nations Manual on how to measure and weigh children (United Nations, 1986) were strictly adhered to. A standard height board, suitable for child length and height for both children and adults, was used. The measuring board was a product of SHORR Productions, Irwin .J. Shorr, 467 Prospect Street, Woonsocket Rhode Island, 02895 USA. Height or length was read to the nearest 0.1 cm.

Growth cards and village registers were used to record child's exact date of birth as well as weight, age in months, and nutritional status category (good, moderate or severe) based on weight for age percentile, during each of the four assessment quarters (village health days) for the year, 1994.

4.2.2. Key Informant Interviews and Focus group Discussion.

The purpose of key informant interviews and focus group discussions was to obtain general qualitative information on major child health problems and measures usually undertaken, and the social environment related to the problems. The check list for qualitative information is shown in Appendix E. Key informants included members of regional and district CSPD task force, village health committees and village governments. Since it was a busy paddy cropping season in the district, it was difficult to organise focus group discussions in most of the villages except Tunyenye village. The village accommodates a health centre.

Members of staff at the health centre who were also members of village health committee, managed to convince mothers to spare extra time for discussions after an interview (on 3rd February, 1995). One group was composed of mothers having between one and three parities, and second group composed older mothers having more than 3 parities. Members in the first group were between 16 to 26 years, and in the second group were between 29-45 years. Members in the two groups were all born and lived in the study area. The principal investigator guided the discussion while a field assistant recorded minutes of the discussion. The results of key informant interviews and focus groups discussions are integrated in relevant sections in this thesis.

4.3. Research Activities.

The field exercises were undertaken in three phases, the preliminary phase, the pretesting phase and the actual research phase.

4.3.1. Preliminary Phase.

A preliminary visit was undertaken in January, 1995. The purpose was to organize for permit to undertake the study, from regional authorities, to explain study objectives to regional and district authorities and to plan with district authorities on the logistics of study implementation. Some ward executive officers were also met and assisted in alerting other ward officers and village authorities on the study. The experience of the principal investigator on the programme as a nutrition desk officer from the national centre (TFNC) and further information obtained during the visit, ascertained need for research.

4.3.2. Pretesting Phase.

This phase was undertaken in late January, 1995, shortly after the preliminary phase. The English questionnaire was translated into Kiswahili at TFNC Dar es salaam even before a preliminary visit to the study area. The questionnaire was first discussed with members of Sengerema district CSPD task force, followed by

another discussion and role playing with a team of selected and trained enumerators. The enumerators were trained by the principal investigator on interview techniques, clarifying the different questions in the questionnaire, meaning of the various codes on the questionnaire, weight and height measurements on children and adults. The questionnaire was pretested in the actual field situation in Nyampulukano village in the outskirts of Sengerema township. The experience of pretesting phase was used to modify the questionnaire after discussing results of the phase with the enumerators. A final modified questionnaire was then produced in January, 1995.

4.3.3. The Definitive Study.

The actual study was undertaken between early February to mid March, 1995. At the end of work for each day, the survey forms were checked for recording errors and completeness. Any erroneous questionnaire was corrected after making thorough check-backs and in some instances incomplete questionnaires were re-administered the following day. Finalized survey forms were taken to the ANP University of Nairobi for data entry and analysis.

4.4. Data Analysis.

Data analysis was done in the Applied Nutrition Programme (ANP), University of Nairobi. Data was entered and cleaned using dbase III+ computer programme. SPSS/PC+ version 4 was used for data analysis. ANTHRO Programme was used to calculate weight for age (WAZ), height for age (HAZ) and Weight for height (WHZ) nutritional status indices based on NCHS reference standards.

4.4.1. Nutritional Status and Growth Velocity.

Protein Energy nutritional status for index children was assessed using anthropometric indices -height for age (HAZ), weight for height (WHZ), and weight for age (WAZ). Height for age (HAZ) expressed height of the child as a proportion of the expected height of a reference child of the same age. Weight for height (WHZ) expressed the weight of the child as a proportion of the expected weight for a reference child of the same height. Weight for age expresses the weight of the child as a proportion of the expected weight for a reference child of the same age. These indices are based on NCHS reference standards (Section 2.6.1).

Growth velocity reference data used in this study, were based on the third centile for girls in a reference health population (Gibson, 1990). This is the lowest band of a growth development card commonly used in MCH Clinics (Appendix C2). The expected

growth rate between 3 months, 6 months, and 9 months time intervals for children of ages ranging from 6 to 24 months was derived from the centile. The choice of initial reference child age emanated from the fact that children who were 18-36 months between January and March, 1995 (during the survey), were aged between 6 to 24 months in March, 1994 (initial point of studied growth data). Both expected and observed growth velocities were calculated as change in weight per three months period. An average of velocities for three 3-monthly intervals was used as the observed growth velocity. This was then changed into percent growth adequacy based on expected age-specific growth velocity as per reference values derived from the lowest band on the child growth card.

Nutritional status of mothers was assessed using Body Mass Index (BMI). BMI was arrived at by dividing mother's weight (kg) by the square of mother's height (m^2). Pregnant mothers were excluded in analysis involving associations of BMI with child nutritional status variables.

4.4.2. Food Availability.

Household food availability was assessed by summing together the undermentioned:-

(a) Net energy from grainy crops: Amounts of grainy crops were reported in local measures such as bags, tins, and bowls whose weight equivalents were established during the survey. The net food available for every crop shown under section D of the

questionnaire (Appendix D) was determined by subtracting amounts sold and donated out from the sum of amounts available in storage at the beginning of the harvest season, amount harvested, amount received as donations, and amount purchased. The net food available for each crop was converted into its energy equivalent using food composition tables (CTA & ECSA, 1987) (Appendix C3). The net energy equivalents from all sources were summed up to obtain net energy available in a household.

(b) A similar procedure was used to estimate net energy available from non-grainy food sources, that are normally harvested in piece meal for immediate consumption. Average yield per hectare for cassava and sweet potato, as stipulated in the Ministry of Agriculture basic data (URT, 1993) was multiplied by cultivated area in acres in order to estimate potential harvest from land cultivated under the two root crops. Information was collected on estimated size of land in acres under which each of these crops were cultivated. Customarily, 70 by 70 walking steps for an adult person is a good estimate for one acre where actual metric measurements are not available. Adjustments were made to ensure that calculations were based on edible fractions of the foods. Food composition tables (CTA & ECSA), 1987) were then used to estimate energy that could potentially be derived from estimated yields of the root crops.

Energy contributions of grainy and root crops were summed up to obtain estimate of net energy availability from crop sources. This was further divided by household size to obtain the net per capita energy availability from crop sources. The same approach was used to estimate energy available per capita per day from household's own food production.

Although this approach ignores food losses in the field and during handling and storage, these could not be easily estimated from interview and, were generally not presented as problems during qualitative discussions. For non-grainy crops, estimates of food exchanges were ignored as these are normally harvested in piece meal for immediate food use. A small portion of root crops is dried (mainly cassava chips) and sold during weekly market days.

4.4.3. Income, Expenditure, and Wealth Base.

In a situation where a respondent could only recall daily weekly or monthly incomes, further probing was made to estimate the total period in the past year for which the activity was undertaken. The annual income in such a situation, was obtained by summing up short period incomes. Annual income from all the activities as well as mother's annual cash income and the value of staple and leguminous foods consumed by the household were summed up to obtain total annual household income. The total income was divided by household size to obtain an estimate of annual household income per capita. Also mother's annual income

estimate from various activities (see Q.43 of the questionnaire) was summed up to obtain an estimate of mother's total annual income. Usual weekly expenditure pattern on food and non-food items was multiplied by 52 (i.e. number of weeks per year) to obtain an estimate of annual expenditure on the items.

Data on Wealth base involved interview on different productive assets and durable goods (see Q.46 of questionnaire) owned by the households, number of each of property articles and value estimated based on market prices for the items in Tanzanian shillings (Tsh). During pretesting and in the course of data collection, values of different articles were established for different localities in the study area. This exercise took into consideration the size (eg. of animals), model (eg. of bicycle or radio), variety/breed and whether the article was new or old. The total sum of values of property articles owned by the household was an estimate of its wealth base in Tsh. This was then divided by household size to obtain an estimate of wealth base per capita in the household.

4.4.4. Sanitation and Quality of Living House.

Sanitation index was created from scores on the ten assessment points on sanitation condition (see questionnaire (Appendix D) questions 53, 54 and 55d). Where a bad condition existed, the household scored 0 or 1, and where it did not exist, a score of 1 or 2 was given (depending on assessment point). For example, where a latrine existed but in bad condition, a score of 1 was given, while a score of 2 was given on each point where a latrine was judged to be in a good condition. Where a latrine did not exist, a 0 score was given on each assessment point concerning latrine. Scores were summed from all points of assessment for each household to obtain sanitation index. The possible range of scores was from 0 to 15 points.

The quality or status of house in which mother and child slept was judged on the basis of materials for roof, wall, and floor, whether there were openable and closable windows or not, and whether the size of windows were satisfactory. Windows of sizes less than 45cm x 45cm were judged unsatisfactory. Where better construction materials or satisfactory window size were observed, a score of 1 or 2 was given, and 0 score for a poor condition on each assessment point. The possible minimum and maximum scores were 0 to 6 points.

4.4.5. Rooming Index.

Rooming index refers to the living space available per capita in the household. The average room size was $8m^2$ and that of huts (round non-partitioned houses) was $5m^2$. The living space for a household was estimated by multiplying the number of rooms and huts by $8m^2$ and $5m^2$, respectively, and summing up the two products. The total living space was divided by household size to establish the rooming index in m^2 per capita.

4.4.6. Statistical Analysis.

Descriptive statistics was used to describe the distribution of variables such as education, income, occupation, and nutritional status categories. Chi-square was used to determine the association of categorical independent variables such as education, and occupation with nutritional status categories based on the three anthropometric indicators (HAZ, WAZ and WHZ). Pearson correlation of independent variables with specific nutritional status indicators as dependent variables was undertaken using SPSS/PC+. This aimed at analyzing factors which are associated with child nutritional status. Multiple regression analysis with dummy variables was used to identify the differential factors which are determinants of child nutritional status.

CHAPTER FIVE

RESULTS

This chapter presents both descriptive and analytical results. The descriptive section is presented in tables and graphs (Appendix: Tables A1-A11 and Figures A1-A21). The analytical results are in associations (chi-square and correlations) and Multiple regression analysis.

5.1. General Characteristics of the Study Population.

It is apparent from Table 1 that 356 households (44% of households in the study villages) with 2733 persons were interviewed in the 6 study villages. The average household size was 7.7 persons (SD=3.7). The adjusted mean household size after removal of outliers (>14 persons) was 6.9 persons (SD=2.4). Households with less than 5, 5-8 and greater than or equal to 9 persons were 16%, 53% and 31%, respectively. The observed sizes ranged from 2 to 21 persons per household.

The population of under fives was 23% and the dependency ratio was 1:1.13 indicating a larger proportion of dependants compared to the economically active population. Extended family system in the community is apparent from the fact that, on the average, 30%

Table 1. General Characteristics of the study population.

Characteristic	Status in the Population
# HHds in the study	356 (44)[a]
Population size	2733
Household size	
Mean size	7.7 (SD=3.4)
Adjusted mean size[b]	6.9 (SD=2.4)
% <5 persons	16
% 5-8 persons	53
% 9+	31
Age of Population (years)	
Mean age	17.2 (SD=15.9)
% <5	23
% 5-14	29
% 15-44	40
% 45-64	7
% 65+	1
Dependency Ratio[c]	1.13
% Non-nuclear relatives[d]	30
% Mothers with no education[e]	36
% HHd heads with no education	24
% All married mothers	82
% Mothers in Polygamous marriage	18
% Mothers, mainly Farmers	85
% HHd heads mainly Farmers	78
% HHds, water from protected sources[f].	3
% HHds owning Latrines	85

a. Percent of households studied among households in sampled villages.
b. Mean household size after removal of outliers (>14 persons).
c. Dependency ratio = # Persons <15 Years and >64 Years / # Persons 15-64 Years in the same Population.
d. Percent of relatives to index child in household who are not members of nuclear family e.g uncles, aunts, grand parents based on number of all people staying with the child.
e. Formal education, also including adult education.
f. Households obtaining water from protected sources (piped or, wells).

of household members were non-nuclear family relatives to the index child. These included relatives like grand parents, step parents, uncles, aunts and nephews. In terms of formal education, illiteracy rate was 36% and 24% among mothers and household heads, respectively. Most mothers (82%) were married

and 18% were in polygamous marriage. Farming was the major occupation for 85% and 78% of mothers and household heads, respectively. Most households get water from unprotected sources like traditional wells, ponds and Lake Victoria, with only 3% having access to piped or protected wells' water. Most households (85%) had latrines, those few without latrines defecated in the bush. Sharing latrines among households is constrained by long distances between household premises.

5.2. Nutritional Status of Children (18-36 months).

The nutritional status of the children based on anthropometric standards and growth velocity are shown in Table 2.

Table 2: Nutritional Status of Children (18-36 months) based on Anthropometric standards and Growth Velocity[a] in Sengerema Division

Indicator	Status in the population # Children	% Total[b]
Stunting (Ht/Age)		
Below -2SD	187	52
Below -3SD	66	18
Underweight (wt/Age)		
Below -2SD	101	28
Below -3SD	14	4
Wasting (wt/ht)		
Below -2SD	15	4
Below -3SD	1	0.3
Faltering growth[c] (GRV)	7	2

a. The mean values of HAZ, WAZ, WHZ, GRV were -2.02 (SD=1.26), -1.36 (SD=1.25), -0.27 (SD=1.09), and 132.6%, respectively, of the standards used
b. Percentage based on total valid number of children assessed.
c. Faltering growth velocity (GRV) refers to zero or negative average weight change over 3 months periods.

It is apparent from the table that 52%, 28%, 4% and 2% of children in the age group studied were stunted, underweight, wasted, and faltering in growth, respectively. The extent of severe undernutrition was 18%, 4% and less than 1% for stunting, underweight and wasting, respectively.

5.3. Association of Household and Maternal Factors with Child Nutritional Status.

The factors considered under this section include household size, income, wealth base, child weekly morbidity status, food availability, weaning practices, water accessibility, sanitation condition, access to health services, occupation, marital status, education, and mother's age. Exact child age in months was included as a control variable.

5.3.1. Household Differential Factors.

These are shown in Table 3 and the description of the nature of association of the factors with child nutritional status is presented below. The proportions of undernourished children in different categories of households based on the factors studied are shown in the Appendix (Figures A1-A18).

Table 3: Child Nutritional Status by Household Differential Factors.

Factor	Association with Child Nutritional Status. HAZ	WAZ	WHZ	TestA[a]	GRV	TestG[b]
HHd Size (persons)	2.64[c]	3.02	1.99	X^{2d}	0.10	Pcr[e]
HHd Head's Education	1.40	0.11	0.08	X^2	-0.08	Pcr
HHd Head's Occupation	0.09	0.05	0.37	X^2	-0.09	Pcr
Time to Health Facility (min.)	-0.07	0.06	0.04	Pcr	-0.03	Pcr
Child Immunization	1.00	0.07	0.55	X^2	0.08	Pcr
Child Morbidity	1.49	9.49**	0.25	X^2	0.11*	Pcr
Water Adequacy in Dry season	3.62	1.88	0.00	X^2	-0.11	Pcr
Time get water (min)	-0.04	-0.05	-0.03	Pcr	0.12*	Pcr
Water Source[f]	-0.07	-0.07	-0.06	Pcr	-0.06	Pcr
Latrine Ownership	3.43	4.29*	2.80	X^2	-0.18	Pcr
Sanitation Index	0.77	0.10	-0.12*	Pcr	-0.15*	Pcr
Room Index (m^2/cap.)	0.00	0.02	0.02	Pcr	0.03	Pcr
House status score	0.06	0.04	-0.01	Pcr	-0.15	Pcr
Food Availability						
HHEAD[g]	0.12*	0.16**	0.07	Pcr	0.15*	Pcr
HHETAD[h]	0.17**	0.20*	0.11*	Pcr	0.17	Pcr
Acres of Root crops	0.19*	0.23**	0.14*	Pcr	0.10	Pcr
Tins of Cereal crops	0.06	0.06	0.34	Pcr	0.05	Pcr
Wealth Base/cap (Tsh)	0.22**	0.22**	0.14*	Pcr	0.24	Pcr
Income/cap & Yr.(Tsh)	0.08	0.15*	0.12	Pcr	0.01	Pcr
Expenditure/cap. & Yr						
Overall expen. (Tsh)	0.06	0.14**	0.18**	Pcr	-0.01	Pcr
Exp. on Food (Tsh)	0.03	0.10	0.14*	Pcr	-0.02	Pcr
Exp. non-foods (Tsh)	0.08	0.14*	0.14*	Pcr	-0.06	Pcr

a. Statistical test/analytical method used on association of the factors with anthropometric variables
b. Statistical test/method of analysis used on association of the factors with growth velocity.
c. Value of a test static (e.g. 2.64 is the chi-square value).
d. X^2 = Chi-square.
e. Pcr = Pearson correlation.
f. Water sources categorized into two: Good sources=1 (piped, and protected wells), and Poor source=0 (unprotected wells, lake water, etc.).
g. Percentage per capita energy adequacy from Hhd's own production based on age weighted per capita RDA by WHO/FAO (2200 kcal/day).
h. Percentage per capita net available energy adequacy based on the WHO/FAO RDA. This considers withdrawals and injections in household's food supply.
*. Significant at $p<0.05$
**. Significant at $p<0.01$

5.3.1.1. Child Morbidity Status.

Mother's weekly recall indicated that about 59% of children studied had experienced an illness during the week prior to the survey. The most prevalent diseases were cough, malaria, diarrhoea, skin rashes and eye diseases (conjunctivitis), which showed a weekly prevalence of 51, 34, 12, 7.3, and 6 cases per 100 children in the age group (18-36 months) studied (Appendix, Table A7). Child morbidity status was significantly ($p<0.05$) and positively associated with wt/age and GRV. That is, there was a significantly higher proportion of undernutrition in households with children who were reported ill than in those who were well. A significant association was however not demonstrated between child morbidity and Ht/age or Wt/ht.

5.3.1.2. Household Size.

The mean household size was 6.9 (SD=2.4), which is above the national and Mwanza regional (provincial) values of 5.2 and 6.4, respectively (TBS, 1989). The range of household sizes was from 2 to 21. The relationship between household size and child nutritional status is described in Figure A1 in which no definite pattern was observed. It is apparent from Table 3 that household size was not significantly associated with any of the child nutritional status variables studied.

5.3.1.3. Household Head's Education Level.

About 24% of household heads had not been exposed to any formal education (even adult education). The majority (70%) had attended part or all classes of primary school, and only 3% attended secondary school or college education. The relationship of household head's education on child nutritional status is described in Figures A4 and A5. There was generally a slightly higher proportion of wasted and underweight children among the uneducated household heads than the educated ones. However, Table 3 shows that household head's education was not significantly associated with any of the child nutritional status variables.

5.3.1.4. Household Head's Occupation.

About 78% of household heads had farming as their major occupation in the year preceding the survey, the remaining 22% were mainly occupied with other activities such as petty business, construction work, casual and formal employment.
Figure A8 describes the relationship between household head's occupation and child nutritional status (HAZ, WAZ, WHZ). There was generally a lower proportion of severely undernourished children among households whose major occupation was farming than in those with other major occupations. However, there was no significant association between the occupation category of household head and any of the child nutritional status variables.

5.3.1.5. Wealth Base, Income and Expenditure.

Results on Table 3 indicate that each of these factors was associated with at least one of the nutritional status variables studied.

5.3.1.5.1. Wealth Base.

The mean value of wealth base per capita was about Tsh 20,659 (SD=24,318), indicating a high variance in distribution of wealth in the community. Table 3 indicates that wealth base was significantly (i.e., using Pearson Correlation test) and positively associated with all the four nutritional status variables studied, i.e., Ht/age ($p<0.01$), Wt/age ($p<0.01$), Wt/ht ($p<0.05$), and GRV ($p<0.05$).

5.3.1.5.2. Household Income.

The mean annual household income per capita was estimated at Tsh. 43,303 (SD=19,951). Income showed a significant ($p<0.05$) positive association with Wt/age, but not the other three nutritional status variables.

5.3.1.5.3. Expenditure.

The mean annual per capita overall expenditure, expenditure on food, and expenditure on non-foods, were estimated at Tsh. 11688

(SD=6,732), 7,213 (SD=4,648), and 4,192 (SD=2,555), respectively (Appendix Table A11). It is apparent from Table 3 that overall per capita annual expenditure showed a highly positive significant ($p<0.01$) association with both Wt/age and Wt/ht, but not with the measures of chronic undernutrition (Ht/age and GRV). Expenditure on food was only significantly ($p<0.05$) and

positively associated with Wt/ht (WHZ), but not with the other three nutritional status variables. Expenditure on non-foods showed a positive significant ($p<0.05$) association with both Wt/age and Wt/ht, but not Ht/age nor GRV.

5.3.1.6. Food availability.

Food availability was assessed based on estimated energy adequacy from household's own production, and the net energy, acres of root crops cultivated, and net amount of cereal crops in the previous year. The acres of root crops (cassava and sweet potato) cultivated by the household in the previous year showed a significant positive association with Wt/age and ht/age ($p<0.01$) and with Wt/ht ($p<0.05$), but not GRV. However, there was no significant association between reported amount of cereal crops and any of the child nutritional status variables.

The mean per capita energy adequacy from own production and the net energy were 94.3% (SD=54.34) and 87.5% (SD=50.7) of the FAO/WHO recommended daily allowance (RDA), which were above the

minimum recommendation (80% of FAO/WHO RDA) for a healthy active life (Braun & Pandya-Lorch, 1991). Before removal of outliers and extremes, the mean values were 107% (SD=81) and 104% (SD=95) for adequacy ratio from own production and the net energy, respectively. Also Energy adequacy categories (1=≥80% of RDA, 0=<80% RDA) from both own crop production and the net energy werepositively associated ($p<0.05$) with HAZ, but not the other three nutritional status variables (Figures A17 & A18).

5.3.1.7. Access to Health Services.

Access to health services was assessed only on the basis of time mother spends to reach the nearest health facility, use of formal health facility during delivery of the index child, and child immunization status. The mean time to nearest health facility (one way) was 68.2 minutes (SD=38.5) (Table A6) and only 49% of mothers delivered the index child at a formal health facility (Appendix, Figure A19). The rest were either assisted by traditional birth attendants (TBAs) or by relatives at home. Also about 97% of the children had completed immunization (Appendix, Figure A12).

The proportion of stunting was higher among children with incomplete immunization than in fully immunized counterparts. However, underweight and wasting rates were higher among the fully immunized children than the counterparts with incomplete immunization. However, all the health accessibility variables

were not significantly associated with any of the child nutritional status variables.

5.3.1.8. Water, Sanitation and Housing.

About 97% of households in the study area got water from unprotected sources, and only 46% had adequate water during dry season (Appendix, Table A8 and Figure A14). About 85% of households owned latrines. The mean overall sanitation index was 9.2 (SD=2.2) on a 15 possible maximum score scale. It was however surprising to note a significantly higher proportion of underweight children ($p<0.01$) among households with latrines (30.5%) than in those without latrines (16.7%) (Figure A15). Table 3 surprisingly indicate a positive correlative association ($p<0.05$) between time to fetch water and growth velocity (GRV). Significant negative associations were observed between ownership of latrine with Wt/age and GRV ($p<0.05$), sanitation score (index) with W/ht and GRV ($p<0.05$), and house status score with GRV ($p<0.05$). The mean rooming index was 4.8 sq.metres per capita (SD=1.4). There was no significant association between rooming index with any of the nutritional status variables. Overall, there was no significant association between the three household factors with child Ht/age.

5.3.2. Maternal Differential Factors.

Maternal factors studied, include education, occupation, nutritional status (height, BMI), ownership of an income activity, income, age, marital status, and behaviour in relation to weaning practices and pregnancy or birth history.

Table 4: Child Nutritional Status by Maternal Differential Factors.

Factor	Association with Nutritional Status					
	HAZ	WAZ	WHZ	Test A[a]	GRV	Test G[b]
Maternal Education	1.93	0.36	1.34	X^{2d}	-0.01	Pcr[e]
Maternal Employment						
Occupation	1.43	0.56	0.36	X^2	-0.10	Pcr
Income Activity	1.96	6.19*	0.07	X^2	-0.04	Pcr
Annual income (Tsh)	0.02	-0.02	-0.06	Pcr	-0.04	Pcr
Income RHHd (%)[f]	0.07	0.01	-0.06	Pcr	0.09	Pcr
Marital Status	4.36	0.17	0.11	X^2	-0.02	Pcr
Maternal Age (yrs)	0.13*	0.04	-0.04	Pcr	0.02	Pcr
Maternal Height (cm)	0.24**	0.27**	0.21**	Pcr	0.11**	Pcr
Maternal BMI(kg/m^2)	0.00	0.08	0.13*	Pcr	0.01	Pcr
Maternal Behaviour						
Weaning Age (month)	-0.03	-0.03	-0.02	Pcr	-0.12*	Pcr
Delivery at Health Facility[g]	0.16	0.02	0.07	X^2	0.01	Pcr
Breast feeding duration (month)	0.10	0.13*	0.12*	Pcr	0.03	Pcr
Giving colostrum	0.52	4.48	0.33	X^2	-0.11	Pcr
Feeding frequency	0.09	0.06	-0.02	X^2	-0.03	Pcr
Age at First Birth (yr)	0.05	0.04	-0.01	Pcr	0.04	Pcr
Birth order of child	7.07	0.49	0.52	X^2	-0.03	Pcr
# Parities	2.03	0.00	0.68	X^2	0.01	Pcr
# Living children	1.83	0.01	2.20	X^2	-0.01	Pcr
Time with child (hr)	-0.05	-0.08	-0.08	Pcr	-0.01	Pcr

a. Statistical test/analytical technique used in association of maternal factors with anthropometric variables.
b. Statistical test/analytical technique used in association of maternal factors with growth velocity.
c. Value of a test static (e.g. 1.93 is a chi-square value)
d. X^2 = Chi-square.
e. Pcr = Pearson correlation.
f. Mother's income relative to total household income.
g. Place of delivery of index child (1=formal health facility, 0=others (home, TBAs etc.).

It is apparent from Table 4 that the factors which showed a positive significant ($p<0.05$) association with at least one of the four child nutritional status variables (HAZ, WAZ, WHZ, GRV) were ownership of income activity, maternal age, maternal nutritional status (height or BMI), and breastfeeding duration. Age of weaning was, significantly ($p<0.05$), but negatively associated with growth velocity (GVR). Child feeding frequency was not significantly associated with any of the child nutritional status variables. Maternal height was strongly positively associated ($p<0.01$), with all the four nutritional status variables studied.

5.3.2.1. Maternal Education.

About 36% of mothers had no exposure to any formal education, and only 1% had achieved above primary school education level (Appendix, Figure A2 and A3). However, maternal education was not significantly associated with any of the child nutritional status variables.

5.3.2.2. Maternal Employment.

This factor was subdivided into occupation, ownership of income activity, and income. About 85% of mothers were mainly occupied by farming and 57% had no income generation activity apart from those general to the household (Figure A16). The mean mother's annual income, and income relative to total household income,

were Tsh. 7207 (SD=19,950) and 1.8% (SD=3.6), respectively (Table A11). Among the four maternal employment factors studied, only ownership of an income activity was significantly ($p<0.05$) and negatively associated with child nutritional status (Wt/age).

5.3.2.3. Maternal Marital Status.

About 82% of mothers were married, 18% of whom were in polygamous marriage. Figure A6 indicates that there was generally a higher proportion of undernourished children (Ht/age, Wt/age and Wt/ht) among unmarried mothers than the married ones. Marital status was however not significantly associated with the child nutritional status variables.

5.3.2.4. Maternal Age.

The mean maternal age was 27.7 years (SD = 6.4). The variable was positively and significantly ($p<0.05$) associated only with Ht/age among the four nutritional status variables studied.

5.3.2.5. Maternal Nutritional Status.

This was assessed in terms of mother's height and BMI. The mean maternal height was 157.8cm (SD=5.7). Only 1% of mothers had height below 145cm (the at risk during delivery and poor birth outcomes). Mother's height was significantly ($p<0.01$) and positively associated with all the four child nutritional status

variables. The mean maternal BMI was 21.2 (SD=2.5). About 32% of mothers were wasted with 11% in severe condition (Figure A20). BMI showed a significant ($p<0.05$) negative association with child Wt/ht. There was however, no significant association between BMI and the other three child nutritional status variables (Table 5.4. & Figure A21).

5.3.2.6. Maternal Behaviour.

Factors considered under maternal behaviour included time in contact with child, weaning practice, and fertility related behaviour. Table 4 indicates that among the studied factors, age of weaning was significantly ($p<0.05$) and negatively correlated with child growth velocity (GRV) whereas breastfeeding duration was significantly ($p<0.05$) and positively correlated with both child Wt/age and W/ht. Other factors did not show a significant correlation with any of the child nutritional status variables.

5.3.2.6.1. Time in Contact with the Child.

The mean usual day time mothers reported to have had contact with their children was 4.6 hours (SD=1.7). However, there was no significant association between the contact time and child nutritional status.

5.3.2.6.2. Fertility-Related Variables.

The values of these variables in the study population are shown in the appendix (Table A6). The mean age at first pregnancy was 17.4 years (SD=2.0), and a median of 18 years (Range=12 years). 6About 83% of mothers had experienced teenage pregnancy. The mean birth order of index child was 4.2 (SD=2.8) with a range of 14 birth orders. The mean number of parities and that of living children were 4.8 (SD=2.9) and 3.9 (SD=2.4), respectively.

However, these factors were not significantly ($p<0.05$) associated with any of the child nutritional status variables.

5.3.2.6.3. Weaning Practices.

Factors studied include age of introducing weaning foods, breastfeeding duration, whether colostrum was given to the index child, and child frequency of feeding.

5.3.2.6.3.1. Use of Colostrum and Age of Weaning.

The mean age of weaning was 1.9 months (SD=2.7) with a median of 0 month and a range of 12 months (Table A5). The prevalence of late weaning (beyond 6 months of birth) was 4.5 per 100 children. About 67% and 58% of mothers expressed out colostrum and gave prelacteals to index children, respectively. This is contrary to the universally recommended exclusive breastfeeding for at least

four months of birth (Cameroon & Hofvander, 1976; Jellife & Jellife, 1979; WHO & UNICEF, 1989). Also 44% of mothers (69% of those who expressed out colostrum) judged colostrum to be unsuitable for babies, and only 40% of all mothers initiated breastfeeding within one hour of birth. The rate of proper breastfeeding (i.e. introducing weaning foods between fifth and sixth month of birth) among the households studied, was only 12%. Age of weaning showed a significant ($p<0.05$) negative correlation with child growth velocity (GRV), but no significant relationship with the other three nutritional status variables. It is apparent from the Appendix (Figure A10) that children who breastfed with colostrum had lower rates of undernutrition (HAZ, WAZ, WHZ) than the counterparts who were not fed with colostrum. Nevertheless, whether the index child was fed colostrum in the early days of life or not, was not significantly associated with any of the four child nutritional status variables.

5.3.2.6.3.2. Breastfeeding Duration.

The mean breastfeeding duration was 18.4 months (SD = 4.3) with a median of 19 months (Range=32) (Table A5). About 83% of children were breastfed into the second year. Duration of breast feeding showed a significant positive correlation with WAZ and WHZ, but no significant correlation was demonstrated with the indicators of chronic nutritional status (HAZ and GRV).

5.3.2.6.3.3. Frequency of Child Feeding.

The mean frequency of child feeding per day was 3.33 (SD =0.8) with about 72% of children feeding only between 2-3 times per day. Only 28% of the children were being fed for more than 3 times per day which is lower than the national average of 42% (TBS, 1993). Frequency of feeding was surprisingly not significantly associated with any of the child nutritional status variables during chi-square and correlation analysis.

5.4. Summary on Predictors of Nutritional Status.

This section presents results on the determinants of nutritional status both in terms of anthropometric indicators and weight growth velocity (GRV). The results are shown in Table 5, and the correlation matrix of independent variables is shown in the Appendix (Table B1). It is apparent from Table 5 that positive predictors of child's Ht/age were household per capita wealth base and maternal height ($p<0.005$), and per capita expenditure on non-foods ($p<0.05$). Positive predictors of Wt/age (WAZ) were: maternal height, expenditure on non-foods, child morbidity status and frequency of feeding ($p<0.005$), wealth base per capita ($p<0.01$), and house quality status ($p<0.05$). The only negative predictor of WAZ was age of weaning ($p<0.005$). Wt/ht (WHZ) was positively predicted by child morbidity status, expenditure on

Table 5: Stepwise Regression of Child Nutritional Status with Household and Maternal Differential Factors[a]

Independent Variable	HAZ		WAZ		WHZ		GRV	
			B[b]	F[c]	B	F	B	F
Child Age (month)	-0.13	1.9	0.14	2.9	0.08	35.4***	199.8	12***
Child Morbidity Status[d]	0.11	1.1	0.90	18.3***	0.96	18.7***	0.14	2.0
Child Immunization Status	0.07	0.5	0.12	2.1	0.07	0.8	0.08	0.7
Time to Fetch water (min)	0.13	1.8	-0.06	0.5	-0.10	1.2	-5.61	4.0*
Sanitation Index[e]	-0.01	0.0	-0.08	1.1	-0.01	0.0	-0.02	0.0
House Status Score[f]	-0.01	0.0	0.18	6.3*	0.20	7.0*	0.01	0.9
Household Size	0.12	1.5	0.16	3.7	0.10	1.3	-0.00	0.0
Time to Health Facility (min)	0.02	0.0	0.01	0.0	0.06	0.5	0.03	0.1
ENETAD[g]	0.07	0.4	-0.08	0.7	-0.04	0.2	0.01	0.0
Wealth base/capita & Year (Tsh)	0.00	11.2***	0.00	7.0**	0.05	0.4	0.05	0.3
Income/capita & Year (Tsh)	0.00	0.0	-0.02	-0.1	0.13	2.3	0.01	0.0
Expenditure/capita & Year (Tsh)								
Expenditure on food	-0.11	0.9	0.06	0.4	0.11	1.3	-0.16	5.5*
Expenditure on non-foods	0.00	4.3*	0.00	21.5***	0.00	16.9***	-0.05	0.2
Maternal Marital Status[h]	0.08	0.8	0.14	2.8	0.62	4.2*	0.01	0.0
Maternal Income Activity[i]	0.14	2.2	-0.08	1.0	-0.52	6.0*	-1423.5	5.0*
Maternal Height/BMI[j]	0.06	8.6***	0.07	14.2***	0.10	4.8*	-0.02	0.0
Maternal Behaviour								
Age of Weaning (month)	-0.05	0.3	-0.14	9.7***	-0.19	14.8***	-0.05	0.2
Breast Feeding Duration (month)	0.15	2.3	0.14	3.0	0.08	0.9	0.04	0.2
Frequency of child Feeding	0.10	1.0	1.04	13.9***	1.32	18.8***	-0.11	1.2
Birth delivery at Health Facil[k]	-0.01	0.0	0.04	0.3	0.05	0.3	-0.00	0.0
R^2	0.226		0.448		0.435		0.225	

a. Independent Variables used in the Regression Analysis were selected in order to minimize multi-collinearity. Statistical significance in chi-square and correlation analysis, and logical importance were given priority in selecting the variables (especially where many independent variables were significantly correlated) (See Appendix: Table B1).
b. Regression coefficient.
c. F-ratio statistics value.
d. Child morbidity status on a weekly recall (1=Not ill 0=Suffered an illness).
e. Sanitation index, possible range of scores 0-15 (1=≥10; 0=≤9).
f. House status -possible range of scores 0-6 (1=≥4, 0=≤3).
g. ENETAD implies percentage per capita net energy adequacy based on FAO/WHO RDA (2200 kcal per day).
h. Marital Status (1= Married, 0=Not married).
i. Maternal income activity (1 ≡ Owns an income activity, 0 ≡ No income activity)
j. Height was used in HAZ, WAZ, and GRV Equations, BMI with WHZ Equation.
k. Birth delivery (1=formal health facility, 0=Others).
*. Significant at p<0.05; **. significant at p<0.01; ***. significant at p<0.005.

non-foods, child age (as a control variable) and frequency of child feeding ($p<0.005$). Other positive predictors of WHZ were: house quality status, maternal BMI, and maternal marital status ($p<0.05$). The negative predictors of WHZ were age of weaning ($p<0.005$) and maternal ownership of an income activity ($p<0.05$). It was however, surprising to observe that frequency of feeding and marital status which were not significantly associated with any of the child nutritional status variables during chi-square and correlation analyses, were among the maternal differential determinants of child nutritional status. From the results, child WHZ and WAZ would increase by about 132% (B=1.32) and 30% (B=0.29), respectively , for a child who is fed more than 3 times per day as compared to one feeding three times or less, holding other factors constant.

Weight growth velocity (GRV) was negatively predicted by the time mother usually spends for a return journey to fetch water and the annual per capita expenditure on food ($p<0.05$), and maternal ownership of an income activity ($p<0.005$). Child age as a control variable, was a strong positive predictor ($p<0.005$) of GRV. However, all the independent variables which fitted in regression equations for Ht/age, Wt/age, Wt/ht and GRV, explained only about 23%, 45%, 44%, and 22% of the variations in the respective dependent variables.

CHAPTER SIX

DISCUSSION

6.1. Child Nutritional Status.

Findings of the present study compare well with those of earlier studies conducted in the country between 1991-1993 in which malnutrition among under-fives in the surveyed communities ranged from 43-59%, 26-37%, and 6-9.6% for stunting, underweight, and wasting, respectively (TFNC, 1994). The rates were however higher than those reported for the study region in the DHS of 1991/92 which were 39.4%, 20.7% and 4.5% for stunting, underweight and wasting, respectively. The difference may be due to the fact that DHS covers wider age ranges than the present study and the regional average may mask differences among districts or divisions in the region.

The highly significant positive prediction of child age on Wt/ht and GRV implies that older children are more adapted to environmental stresses than the younger ones.

6.2. Household Differential Factors.

6.2.1. Child Morbidity.

Findings of the present study confirm those of previous studies in which infectious diseases had negative effects on both child Wt/ht and Wt/age (Mbago & Namfua, 1992; Waterlow et al, 1992). This is because infectious diseases cause decrease in body nutrient status through increased metabolism (as in fever), reduced nutrient intake due to loss of appetite, and direct loss as in diarrhoea/vomiting (Tomkins & Watson, 1989). Lack of a significant relationship between morbidity and indicators of chronic malnutrition (HAZ and GRV) is not surprising as the reference period was too short to expect any influence on the indicators. The observed non-predictive association of morbidity status with GRV was probably due to the influence of sanitation condition which was better among households with children who were not ill than in those who were ill (See Appendix, Table B).

6.2.2. Household Size.

The mean household size of 6.9 (SD=2.4) is higher than the reported figure of 6.5 persons per household in the study district (TBS, 1989). The difference may partly be due to a wider village coverage in the former study (national census) as compared to the present one. This may also be a reflection of

population growth over time. Lack of a significant association between household size and child nutritional status contradicts findings of earlier studies in which a negative association was reported (Esrey & Sommerfelt, 1991; Braun & Pandya-Lorch, 1991; Mbago & Namfua, 1992). This relationship could have been modified by a positive contribution of household size to agricultural labour and other household productive tasks (Betrand et al, 1989: Kavishe & Mushi, 1993). It may also be due to a significant positive association of household size with factors like wealth base per capita, breastfeeding duration, marital status and mother's age (Appendix, Table B). These factors may tend to reverse the expected negative effect of household size on child nutritional status.

6.2.3. Education of Household Head.

Lack of a significant association between household head's education and all the four child nutritional status variables, contradicts findings of a number of previous studies in which father's education and/or education of the most educated household member was positively associated with the proportion of well nourished children in a household (Bhuiya et al, 1986; Yoneyama et al, 1988; Vella et al, 1992). The findings of the present study are however in agreement with a number of earlier studies which also observed low importance of father's education in predicting child nutritional status (Esrey & Sommerfelt, 1991;

farmers, probably balances the significantly higher per capita food availability from own production among the latter than the former. This may result into a non-significant influence of household head's occupation on child nutritional status.

6.2.5. Wealth base, Income, and Expenditure.

6.2.5.1. Wealth base.

The non-predictive associations between wealth base and wasting (WHZ), and growth velocity (GRV) could have been due to the influence of per capita available energy adequacy, household income per capita and household size which were highly positively correlated with wealth base (Table B). The observed significant positive prediction of wealth base on Ht/age and Wt/age confirms earlier studies in which wealth base was a positive determinant of child nutritional status (Bhuiya et al, 1986; Martorell & Habitch, 1986; Gopaldas et al, 1988; Lindjorn et al, 1993). This is because wealth base reflects the resource potential to meet child care requirements.

6.2.5.2. Income.

The positive significant but non-predictive association of income with WAZ may be due to influence of expenditure per capita and maternal education that were highly significantly and positively correlated with income (Appendix, Table B). Lack of association between income and chronic indicators of nutritional status (HAZ and GRV) may be due to decisions made by the person controlling the extra household income that determine relative tendency to buy food and non-foods. It is very common in the study community, to purchase productive and luxurious assets such as bicycles and radios, after major cotton and food crop sales. Similar observations have been reported whereby some households continue with their previous eating patterns even after introduction of cash economy (Kennedy, 1989).

6.2.4.3. Expenditure.

The observed positive association of overall expenditure with Wt/age and Wt/ht may be due to the combined influence of expenditure on both food and non-foods. The significant non-predictive association of expenditure on food with Wt/age and lack of a significant association with GRV during pearson correlation analysis (i.e before regression) may be false ones and were probably due to the observed significant positive correlation between each of the three expenditure variables with another (See Table B). Likewise, educated parents and those whose major occupation was not farming were likely to spend more

on food, as they had less available net energy compared to households whose major occupation was farming (Table B.). This may explain the negative predictive association between expenditure on food and GRV. It is the authors own view that limitation of financial resources in rural areas, renders households who are dependent on food purchase, at a comparative disadvantage of meeting child nutritional requirements. This may modify the expected positive effect of expenditure on food on child nutritional status reported in earlier work (Onchere, 1984; Kennedy & Peters, 1992).

The observed positive prediction of usual expenditure on non-foods (like soap, kerosine etc) with the three anthropometric indicators (HAZ, WAZ, WHZ) may be a reflection of care environment especially on aspects like body hygiene, and is probably modified by factors like parental education and occupation, and good practices regarding use of colostrum, higher child feeding frequency, small number of children, and relatively good quality of house that were observed (Table B.) to be significantly ($p<0.05$) and positively correlated with expenditure on non-foods. It appears that educated parents and those with other major occupations besides farming are more likely to spend on health care than those whose income is mainly confined to farming and are not educated. This is not surprising since Bairagi's (1980) study in rural Bangladesh also revealed that an interaction of family income (reflecting what is potentially available for expenditure) and mother's education positively determined child nutritional status.

6.2.6. Food Availability.

Energy availability from both own production and the net energy are above the minimum WHO/FAO recommendation (≥80% of RDA) for an active healthy life, suggesting that food availability may not be a major problem. The food situation is further improved by contribution of livestock especially milk which was not included in energy calculations. The highly significant positive association of root, but not cereal crops, with child nutritional status, reveals the importance of root crops for food security especially as production of the latter is declining with time (URT & UNICEF, 1992). The significant positive but non-predictive association of energy availability with child nutritional status (HAZ, WAZ, WHZ) may be due to the influence of factors like wealth base, income and rooming index which were positively correlated with the two energy variables (Table B).

Lack of predictive relationship between food availability and child nutritional status contradicts other studies in which a positive relationship was found (Onchere, 1984; Braun & Pandya-Lorch, 1991; Lindjorn *et al*, 1993). However, findings of the present study confirm the earlier impression found in country reports, that, with an exception of seasonal fluctuation in food availability, Sengerema district is generally food sufficient (URT & UNICEF, 1992; TFNC, 1993). Weaning practices may be an important child nutritional status determinant rather than the overall food availability.

6.2.7. Access to Health Facility.

Lack of a significant association between health services accessibility variables and child nutritional status, contradicts findings of earlier studies whereby health services accessibility was positively associated with Ht/age or Wt/age (Martorell, 1980; Yusufu, 1989) . The issue of walking distance or time not significantly affecting utilization of health services is confirmed by earlier national reports which indicate high attendance rate particularly at primary health facility, and coverage in antenatal care, child growth monitoring, and immunization (MOH, 1989; Kavishe; 1990).

Likewise, "Village "Health Days" reports in the programme area indicate improvement in health and nutritional status over time (Mwanza CSPD, 1995). This may mainly be due to closeness of health services to the villagers, through educational/advisory and first aid services offered by Village Health Committees in collaboration of village governments.

The rate of use of health facility for baby delivery observed in the present study, is lower than the National average of 53% (TBS, 1993). The similarity of status of children delivered outside a health facility to those delivered at a facility reflects the importance of traditional birth attendants (TBAs) whose service is already integrated in maternal and child health component of CSPD programme. This is also in agreement with

findings of a study in Kwazulu South Africa which suggested that, carefully trained TBAS can be valuable assets in rural obstetric services in the areas of health education, provision of rudimentary intrapartum care, and obstetric case findings (Larsen et al, 1983). Lack of significance influence of immunization status on child nutritional status, may be explained by the fact that most children (97%) were fully immunized.

6.2.8. Water, Sanitation and Housing.

6.2.8.1. Water Accessibility.

Lack of a significant association between water accessibility variables and child nutritional status indicators, contradicts studies in other communities that reported a positive association of water quality and quantity on child nutritional status (Esrey and Sommerfelt, 1991; Zumrawi; 1991). This may be explained by the fact that water situation was similar across most households, with 97% of them getting water from unprotected sources (Table A8). This also confirms findings of a study conducted in Bangladesh whereby source of water was among sanitation measures that were not associated with child nutritional status (Bhuiya et al, 1986).

Since no quantitative information was collected on amount of water, what was reported adequate might be inadequate for proper hygienic requirements. This may explain why the nutritional status of children from 54% of households who reported inadequacy

of water during dry season was not significantly different from those in which water adequacy was reported. The author's own experience with the programme area, showed that most people are already conditioned to using little water and the young children rarely take bath. Water inadequacy may partly explain the observed weekly prevalence of 7.3 cases per 100 of skin rashes (mainly scabies) among the study children (Table A7).

The observed association between time spent to fetch water and GRV, but not the other nutritional status variables, may be due to an advantage of growth velocity as many time point measurements are used compared to the usual anthropometric indicators which are exclusively one time point measurements. However, the positive association of time to fetch water (which adds to mothers workload) with child nutritional status may be a false one. This was probably influenced by positive contribution of mother's income and older siblings as alternative care takers. This possibility is suggested by a significant positive association of time to fetch water with mother's ownership of an income activity and number of parities (Appendix, Table B).

The negative predictive relationship of time to fetch water on GRV confirms reports from previous studies that found water supply to be a critical factor to child health and nutritional status (Mosley, 1985; Esrey & Sommerfelt, 1991; Zumrawi, 1991).

6.2.8.2. Sanitation and Housing.

The observed significant, though non-predictive, negative associations of ownership of latrine and sanitation index with child nutritional status (WAZ, GRV, WHZ), contradict earlier studies in which a positive association was observed (Gopaldas, et al, 1988; Zumrawi, 1991). The author's own experience in the community showed that those households with livestock like cattle and goats were also the majority of those without latrines. Therefore poor sanitation score due to lack of latrine and on assessment points related to proximity to domestic animals may be overshadowed by the contribution of animals to food availability (especially milk) for the children.

Moreover, lack of a predictive relationship between the sanitation variables and child nutritional status, implies that the observed associations may be false ones. These findings are not surprising as a study earlier conducted in Bangladesh also showed that measures of sanitation, in isolation from the overall socioeconomic status, were not significantly associated with child nutritional status (Bhuiya et al, 1986).

The observed mean rooming index of 4.8 m^2 per capita (SD=1.8) was comparatively higher than that reported in low income households of 3.6 m^2 (SD=1.4) in a Kenyan municipality (ANP, 1994). This may explain why living space in the rural area was not significantly associated with any of the four indicators of child nutritional status. The observed significant negative, but non-predictive

association, between house quality status and GRV may be due to the influence of food availability from own production and usual per capita expenditure on non-foods which were positively and negatively associated with house status score, respectively (Table B.).

The observed positive predictive relationship of housing quality on child nutritional status (Wt/age, Wt/ht) confirms findings of studies earlier conducted in Bangladesh (Bhuiya et al, 1986) and Ethiopia (Lindjorn et al, 1993). This is presumably because hygienic requirements are more likely to be ensured in relatively good, compared to poor, quality houses.

6.3. Maternal Differential Factors.

6.3.1. Maternal Education.

Lack of a significant association between maternal education and any of the four child nutritional status variables contradicts a number of previous studies in which a positive relationship was found (Gopaldas, et al, 1988; Karim & Chowdhury, 1990; Mbago & Namfua, 1992; Guldan et al, 1993). This is however not surprising as reports from other studies indicate that mother's education and child nutritional status or survival may not always be statistically demonstrated (Rawson, 1976; Bairagi, 1980; Kavishe & Mushi, 1993).

Findings of the present study may also be a reflection of inadequacy of nutrition and health relevant components in education curricula especially in the primary schools -the level which most mothers (61%) in the area had attended. It is the author's own opinion that the nutrition relevant information which most mothers have access to, is that obtained through MCH services and CSPD programme activities especially during village health days, which both formally educated and non-educated mothers have equal chance of receiving.

6.3.2. Maternal Employment.

The observed significant, but non-predictive, association between maternal ownership of income activity and Wt/age may be due to influence of mother's education and the duration of breastfeeding which were both significantly correlated with maternal ownership of income activity (Table B). The significant negative predictive relationship of maternal ownership of income activity on WHZ and GRV (Table 5) contradicts findings of previous studies in which maternal employment and income differential factors were consistently and positively related to dietary and anthropometric outcomes (Tucker & Sanjur, 1988; Tucker, 1989). Moreover, maternal income seem to be of minor contribution to household income as mean mother's income relative to total household income was only 2% (SD=3.6%), and only 57% of mothers with income generation activities (i.e., 24% of all mothers), had self control of the income they earned (Table A11).

The effectiveness of increased income on child nutritional status may also depend on expenditure decisions made by household income controllers as reported in an earlier study (Kennedy, 1989). Likewise, mothers with income activities were those whose major occupation was not farming. They were therefore at a disadvantage in terms of food availability from own production, besides the low incomes which imply low financial accessibility to food. It is the authors own opinion that if mothers are assisted to form area-appropriate income groups, the observed negative relationship between maternal ownership of an income activity and child nutritional status could be reversed.

6.3.3. Maternal Marital Status.

The observed, though non-significant, higher proportion of undernourished children among unmarried as compared to married mothers (Table 4 & Figure A6), and the significant positive prediction of marital status on Wt/ht confirms findings of earlier studies in which children of single mothers are more likely to be malnourished as compared to those of married counterparts (Ebrahim, 1982; Winges et al, 1985). This may be due to better quality of child care in households where both paternal and maternal parents live with, and can jointly monitor development of, the child.

6.3.4. Maternal Age.

The observed significant association between maternal age and Ht/age may be due to more experience in child care among older mothers than the younger counterparts. It may also be due to the influence of breastfeeding duration which showed a significant positive correlation with maternal age (Table B). Thus the positive effects of breastfeeding on child nutritional status may be more important than maternal age. Lack of association between maternal age and the three other child nutritional status variables contradicts findings of previous work whereby children with teenage mothers were more likely to be undernourished than those of older mothers (Miller, 1984; Grummer-Strawn, 1991; Mbago & Namfua, 1992). This could have been due to a highly significant positive and negative correlation of maternal age with household size and parental education, respectively (Table B). Therefore, older mothers were likely to be uneducated, and from households with many members and uneducated household heads, thus tending to cancel the expected positive effects of mother's experience on child nutritional status.

6.3.5. Maternal Nutritional Status.

The proportion of mothers with height below 145cm (the at risk of delivery and poor birth outcomes), compares well with the national DHS data (TBS, 1993). Likewise, the observed proportion of wasted mothers, on the basis of BMI, compares well with

findings of a nationally representative survey that reported 10% of non-pregnant women to be chronically energy deficient (TBS, 1993).

The positive predictive association between maternal BMI and child Wt/ht, and maternal height on child Ht/age and Wt/age confirm findings of a study previously conducted in Tanzania in which maternal anthropometric measures were positive predictors of both child birth outcomes and nutritional status up to the age of 24 months (Materu et al, 1993). This is because maternal nutritional status influences child nutritional status from foetal life, and during gestation period. This may also reflect the quality of care in the household. Lack of a predictive relationship between maternal height and child weight growth velocity (GRV) implies that environmental factors are likely to be more important on child growth development than mother's past nutritional and health status.

6.3.6. Maternal Behaviour.

6.3.6.1. Time in Contact with Child.

Lack of a significant association between time of the day for which mother used to be in contact with the child and the child nutritional status variables, contradicts previous studies in which mother's workload, which generally reduces time in contact with child, had negative influence on child nutritional status

(Mosley, 1985; Lukmanji, 1992) . However, the findings confirm those of another study previously conducted in Tanzania (Lukmanji et al, 1993). It seems that maternal time for home activities including child care decreases with her employment but total household time does not due to inputs of other household members as also previously reported (Tucker & Sanjur, 1988; Kavishe & Mushi, 1993). This signifies the importance of extended family structures in provision of alternative child care givers.

6.3.6.2. Fertility-Related Variables.

The mean age at first birth, and the proportion of mothers who had experienced teenage pregnancies, found in the present study are similar to the national figures of 18.8 years, and more than 67% of mothers, respectively (TBS, 1993). Lack of a significant association between mother's age at first birth and child nutritional status, contradicts previous studies in which it was concluded that children of young teenage mothers were more likely to suffer physical neglect including inadequate nutrition (Miller, 1984; Konner & Shotak, 1986). Findings of the present study, however, confirms those of an earlier study in which age at first birth had no effect on child nutritional status when other fertility factors were controlled (Zuravin, 1988). This may also be explained by advantages in child care accrued from extended family structure in the study community.

Lack of a significant association between birth order and child nutritional status, contradicts findings of a previous study in which first born children had the least favourable birth outcomes including poor nutritional status and shorter gestations (Miller, 1991). In the present study, children of higher birth order (>4) were more likely to be of older mothers, breastfed longer and from large household sizes than their counterparts of birth order less than 5 (Appendix, Table B). Mother's experience due to older age (Swenson, 1984), longer breastfeeding durations and the contribution of other household members to child care (Kavishe & Mushi, 1993) may tend to diminish any potential adverse biological effects attributed to higher pregnancy orders in infancy.

Lack of a significant association of parity and number of living children to the mother with child nutritional status, contradicts a previous study in which a negative relationship was reported (Zuravin, 1988). This may be due to the influence of mother's experience and breastfeeding duration that were significantly correlated with both parity and number of living children, thus tending to reverse the negative effect of number of parities/living children on child nutritional status.

6.3.6.3. Weaning Practices.

6.3.6.3.1. Use of Colostrum and Age of Weaning.

The findings of the present study (Table A5) are related to those of the nationally representative survey in which mothers who initiated breast feeding within one hour were only 44% and 30% for the country and study province, respectively (TBS, 1993). The significant, though non-predictive, negative association between age of weaning and GRV may be due to the influence of factors like parental education and maternal marital status that were negatively correlated with age of weaning (Table B).

The negative and highly significant predictive association of age of weaning on Wt/age and Wt/ht contradicts those of a previous work in which age at introducing complementary foods was positively related to child nutritional status (Schoff et al, 1991). This may be due to the high observed range (0-12 months) in weaning age (Table A5). Children weaned too late may be at a greater disadvantage of becoming undernourished than the counterparts weaned too early as the former are deprived of nutrients while the latter's major risk is mainly early exposure to infections.

Though non-statistically significant, the observed low rate of undernutrition (Figure A10) among children fed with colostrum as compared to those who were not, signifies the practical

importance of colostrum in both early child nutrition and immunity development.

6.3.6.3.2. Breastfeeding Duration.

The findings of the present study rate lower than those of the nationally representative survey whereby median duration of breastfeeding was 21.6 months and about 95% children were breastfed into the second year (TBS, 1993). This is a reflection of cultural differences in weaning practices. The observed positive, but non-predictive, association of breastfeeding duration with WAZ and WHZ may be due to influence of factors like maternal occupation and experience due to older age which showed significant positive associations with breastfeeding duration (Appendix, Table B).

Lack of a predictive relationship between breastfeeding duration and child nutritional status contradicts a previous study in which a positive relationship was found (Karegero, 1989; FAO & TFNC, 1992). Since generally most children were breastfed to the second half of second year, duration of breastfeeding may be a less important differential factor than the overall contribution to child care of the extended family structures.

6.3.6.3.3. Frequency of Child Feeding.

Child frequency of feeding was not significantly associated with any of the child nutritional status variables, but surprisingly it was a significant determinant of WAZ and WHZ. Lack of a correlative association was probably confounded by birth order of an index child which had a significant negative correlation with frequency of feeding (Table B). This implies children whose birth order was less than 5 were likely to be more frequently fed than the counter parts whose birth order was greater than or equal to five.

The observed predictive relationship of frequency of feeding on child Wt/age and Wt/ht confirms a study conducted in urban areas of Tanzania whereby frequency of feeding was a positive predictor of Wt/age (Mbago & Namfua, 1992). This is because the small size of stomachs and less developed digestive systems for young children, implies that children need to eat more frequently to meet their energy and protein requirements.

CHAPTER SEVEN

CONCLUSIONS AND RECOMMENDATIONS

7.1. Conclusions.

Findings of this study, suggest that a multiplicity of factors interact to influence child nutritional status. Since the age group studied falls in the middle of the age ranges for children under five years of age, the observed rate of malnutrition may also closely approximate the overall situation among the under-fives in the area. It can therefore be concluded that the prevalence of protein energy undernutrition, especially stunting, is higher than that reported for the province (Mwanza) and the country.

The following conclusions can be made regarding factors influencing child nutritional status:

1. Height for age (stunting) is positively determined by wealth base per capita, per capita normal expenditure on non-foods, and maternal height.

2. Weight for age (underweight) is positively determined by child morbidity status (a child reported ill is more likely to be underweight compared to one who is not ill), quality status of a living house, wealth base per capita, normal

expenditure on non-foods, maternal height, and child frequency of feeding. Age of weaning is a negative determinant of weight for age.

3. The positive determinants of weight for height (wasting) are: child morbidity status, age of the child, house quality status, normal expenditure on non-foods, maternal marital status, maternal BMI and child frequency of feeding, whereas the negative determinants are maternal ownership of an income activity, and age of weaning.

4. Weight growth velocity (GRV) is positively determined by age of the child (older children are more likely to attain the expected growth for age than the younger counterparts), whereas normal expenditure on food and maternal ownership of an income activity are negative determinants of GRV.

7.2. Recommendations.

1. There is need for the programme to support activities for increasing household income which will in turn improve on wealth base and expenditure on child care, and by implication child nutritional status. This may be done through the already identified CSPD programme component of support for income generation for youth and women's groups to contribute to resource base for proper child care. Important activities would include promotion of the already locally existing income groups, as well as identifying and facilitating formation of the potential income groups.

2. Expansion of government and HESAWA efforts for provision of safe and potable water is paramount. A strong linkage between village health committees and the district water department is needed.

3. Health education also needs to stress on economically possible improvements on house quality status, like having functioning windows of wide size.

4. There is need to explore community appropriate measures to improve nutritional status of mothers if sustainable improvement in child nutritional status is to be achieved.

5. Educational and advisory efforts to change behaviours like not giving colostrum to babies, use of prelacteals, and too late or too early weaning, should be encouraged to ensure nutritional and health benefits of proper breast feeding and child feeding practices. Continuing advocacy is also needed in order to maintain good trends of breast feeding.

6. It is important to strengthen family life education /advocacy and services in order to minimize pregnancies to unmarried girls/women.

7. There is need for concerted efforts to increase child food intake through advising on increased child feeding frequency to four or more times per day. A combination of both efforts to improve frequency of feeding and community appropriate nutrient density improving technologies may give better results. It is important to study the quality of foods eaten by young children in the area, in order to have a better understanding of the influence of dietary factor in child nutritional status and take appropriate measures for improvement. The on-going efforts in the programme to establish village-managed day care centres needs to be encouraged.

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APPENDICES.

APPENDIX A:

Table A1: Distribution of Mothers by Marital Status in Sengerema Division.

Marital Status	No. of mothers	% all mothers
Single (Never Married)	39	11.0
Married (monogamy)	228	64.0
Married (polygamy)	64	18.0
Others[a]	25	7.1
Total	356	100.0

a. Others include: separated, divorced and widowed.

Table A2: Distribution of Mothers by type of major Occupation

Type of Occupation	% all Mothers
Farming (Crop & animal)	85.4
Selling Foods and/or Alcoholic Beverages	9.0
Others[a]	5.6

a. Others include Formal employment, selling handcrafts, TBA/herbalist, small shops, and other petty business.

Table A3: Distribution of Household Heads by major Occupation

Type of Occupation	Frequency	% all HHd Heads
Farming (crop/animal)	273	78.0
Selling crops/fish	24	6.9
Formal Employment & Casual Labour	11	3.4
Others[a]	30	8.6

a. Other businesses include; carpentry, shop/kiosk, milling machine, knitting and selling clothes, catering business, fuel (kerosine, charcoal) selling, traditional healer, selling handicrafts etc.

A2: FOOD AVAILABILITY:

Table A4: Adequacy of Food Available from Crop Sources in Sengerema Division.

Variables	Status in the area	
% Mean adequacy calories[a] produced/ capita/ day.	107.2	(SD=80.6)
% Mean adequacy of net[b] calories from crops	103.9	(SD=95.3)
% Household producing less than 80% of required calories	39.7	
% Household whose net calories availability is less than 80% of requirement.	41.1	
% Household whose own production was not sufficient[c] between two previous harvest seasons.	34.0	
Mean acres of cassava cultivated	1.98	(SD=1.36)
Mean acres of sweet potato cultivated.	1.00	(SD=0.7)
Mean tins of cereal crops	64.9	(SD=79.0)

a. Calories adequacy based on recommended intake per capita per day by FAO/WHO. An average of 2200 kcal. per capita per day is recommended.

b. Net calorie availability-determined from net food available. Net food available was determined, for each crop, by subtracting amounts sold & donated from amounts in storage, harvested, purchased & donated in.

c. Sufficiency assessed in terms of respondent's response whether food from own production sufficed household requirements for a period between two previous harvesting periods.

Table A5: Child Weaning Practices in Sengerema Division.

Variable	Status in Community
Mean Age at introducing foods (months)	1.92 (SD=2.7)(Rg=12)[a]
Mean time of day for mother's contact with child (hrs).	4.6 (SD=1.7)
% children introduced to weaning foods in month zero.	55.9
% children introduced to a second food by end of month 4.	47.5
% children introduced a third food by end of month 4.	17.4
% children 1st foods introduced after 6 months of birth.	4.5
% Mothers that expressed out colostrum (i.e. not fed to child)	66.7
% Children given prelacteals.	58.4
% Children fed nothing for Hrs while colostrum expressed out	15.7
% Mothers initiated breast-feeding within one Hour	40.0
% Mothers, initiated Breast after one day of Birth	38.5
% Mothers who judged colostrum as unsuitable for babies.	44.4
Mean Breastfeeding duration(months)	18.8 (SD=4.6)
Median Breastfeeding duration (month)	19.0 (Rg=32)
% Children Breastfed to 2nd year	83.0
Mean frequency of child feeding/day	3.3 (SD=0.8)
% HHd, Child common foods contain meat or milk products.	86.5
% HHd, child foods contain legumes	76.4
% HHd, child common food contain fruits or vegetables.	98.6
% HHd, alternative child care givers Were older siblings.	59.3
% HHd, alternative child care givers are grandparents.	19.7

a. Rg implies "Range".
b. All Percentages are based on valid cases of HHds, or mothers or children.

A3:. ACCESS TO HEALTH SERVICES, PREGNANCY HISTORY AND CHILD HEALTH.

Table A6: Access to Health Services and Pregnancy History.

Variable	Status in the Area
Mean No. of Pregnancies	4.8 (SD=2.9) (Rg=15)
Mean No. of living Children	3.9 (SD=2.4) (Rg=11)
Mean Birth Order of the Child	4.2 (SD=2.8) (Rg=14)
Mean Age at 1st Pregnancy (Years)	17.5 (SD=2.4) (Rg=12)
% Mothers, got Teenage pregnancy	83.4
Time to Health Facility (Min.)	99.0 (SD=59.7) (Rg=299)

NB: 83% of mothers reported first pregnancy at age of <20 years.

Table A7: Child Health Practices and Morbidity Status in Sengerema Division.

Variable	Status in the Area
% children completed immunization.	96.6
% Children delivered at formal Health facility.	48.6
Weekly prevalence of diseases (cases/100 children age 18-36 (months)	
Overall (all Diseases)	58.7
URTI	52.3
Malaria/fever	33.7
Diarrhoea	12.4
Skin rashes/blisters	7.3
Eye disease (conjunctivitis)	6.0
Vomiting	3.1
Others[a]	2.1

a. Others include: Measles, chicken pox, pneumonia, and stomach disturbances/passing worms.

Table A8: Access to Water, Latrine ownership, Environmental Sanitation and House Status.

Variable	Status in the Area
% HHd, Water unprotected sources	97.0
% HHd, Water directly from lake	10.0
% HHd, adequate water in dry season	46.0
% HHd with latrines	84.8
% HHd animal dung seen in living house.	20.5
% HHd, animal seen in house	19.9
% HHd, garbage in close proximity[a]	31.2
% HHd, Human faeces in close proximity	10.1
% HHd, Latrine no raised walls	45.4
% HHd, Latrine no windows	83.8
% HHd, Latrine not roofed	80.0
% HHd, Latrine not covered	69.9
% HHd, Latrine dirty[b]	22.8
% HHd, House roofed of iron sheets[c]	14.3
% HHd, House wall-bricks[d]	53.4
% HHd, House floor-concrete[e]	6.2
% HHd, House with functioning windows[f]	73.4
% HHd, House with satisfactory window size[g]	57.6

a. Close proximity imply within 10m from living house.

b. Latrine judged dirty if human faeces was seen on the surface of the latrine or walls.

c. Most other houses were roofed of grass or maize stover.

d. Most bricks were soft soil bricks, only 1.4% had a cement finishing.

e. Most other floors were normal bare soil.

f. Functioning windows imply openable and closable windows.

g. Common window size of 45cm x 45cm or larger were judged satisfactory.

A5: INCOME, EXPENDITURE AND WEALTH BASE

Table A9: Household Income Activities/Sources in Sengerema Division.

Activity	% HHd depending on activity as: One of sources[a]	Main source[b]
Selling grainy food crops	78.1	70.7
Selling cotton.	47.5	21.3
Selling traditional alcoholic beverages.	16.6	8.1
Casual labour.	9.8	3.4
Fishing/selling fish	9.8	7.0
Selling cooked foods,	9.0	4.2
Selling cow milk.	7.9	5.9
Selling horticultural crops	7.6	3.6
Selling livestock.	7.3	3.1
Salary	6.2	4.5
Selling Handicrafts	4.5	0.6
Others[c]	13.5	8.4

a. Percent of households depending on the activity/source one of income sources.

b. Percent of all households dependent on the activity/source as the major income source.

c. Others include: Small shops/kiosks, selling kerosine and/or charcoal,s wood and/or mason work, traditional healing, sewing & knitting, remittances, milling machine, house for renting, bicycle and sewing machine for hire

Table A10: Maternal Income Activities in Sengerema Division

Activity	% Mothers Dependent on activity as one of sources[a]	Main source[b]
Selling traditional alcoholic beverages	29.2	28.6
Selling raw grainy crops	24.7	20.1
Selling cooked foods	24.0	22.7
Produce & sell cotton	6.5	5.2
Selling Handcrafts[c]	5.2	4.5
Selling Horticultural produce/sugar cane	5.8	4.5
Salary	3.2	1.9
Others[d]	7.8	7.8

a. Percent of mothers dependent on the activity as an income generation activity/source based on mothers who reported to own an income activity (154 mothers).

Table A10: (Continued)

b. Percent mothers dependent on the activity as main income generation activity or source based on those with an income activity.

c. Handcrafts mainly include: Earthen pots.

d. Others include: Selling livestock, traditional healing, selling milk, selling fuel sources (kerosine, charcoal), sewing/knitting, sewing machine for hire, business kiosk, & remittances.

Table A11: Wealth Base, Income and Expenditure among Households in Sengerema Division .

Variable	Status in the Area
Mean wealth base per capita & year (Tsh)	20659 (SD=24317)
Mean HHd income per capita & year (Tsh)	43303 (SD=19950)
Mean mother's income per year (Tsh)	7207 (SD=13190)
Mean mother's income relative to total HHd income (%)	1.8 (SD=3.6)
% Mothers with self control of income	57.0
% Mothers, income control jointly with husband	34.0
% Mothers, income by other HHd members[a]	3.0
Mean total expenditure/ capita & year (Tsh)	11688 (SD=6732)
Mean food expenditure/capita & year (Tsh)	7213 (SD=4648)
Mean non-foods expenditure/capita/year (Tsh)	4192 (SD=2555)

a. Other include: Parents of the mother, co-wife etc.

Figure A3: Child Nutritional Status by Maternal Education, Sengerema, Tanzania (Jan-Mar, 1995)

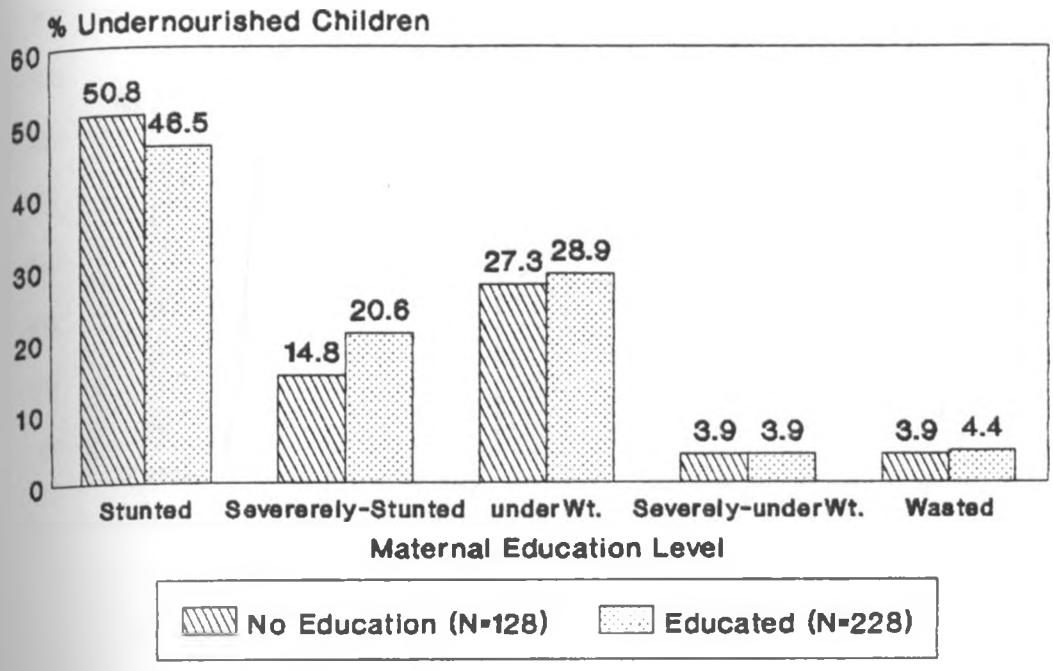


Figure A4: Child Nutritional Status by Household Head's Education Level, Sengerema, Tanzania, (Jan-Mar, 1995)

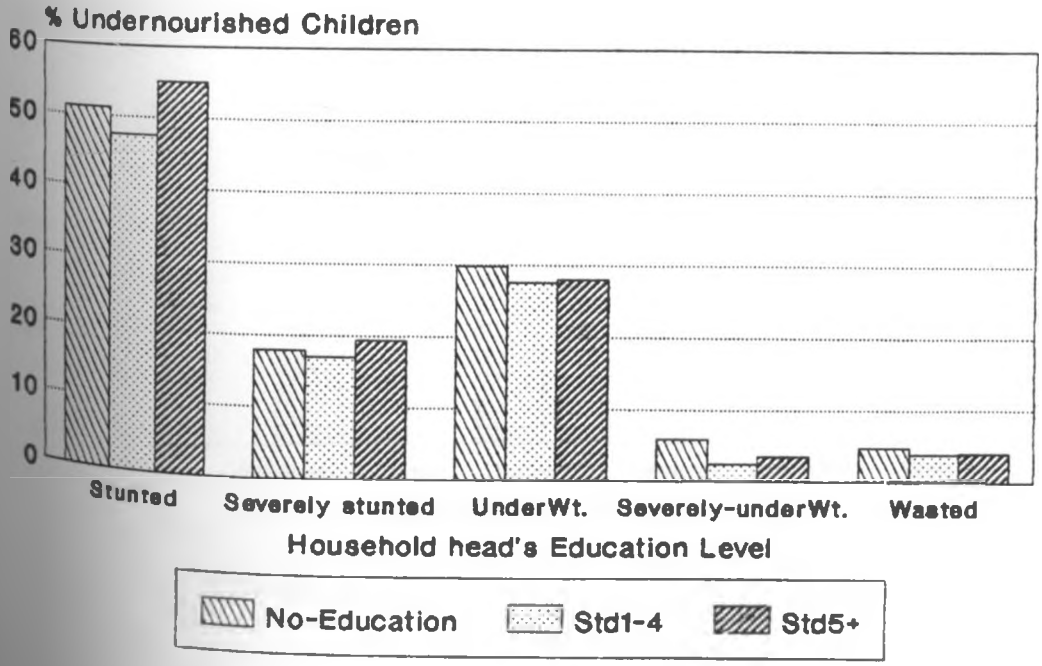


Figure A5: Child Nutritional Status by Household Head's Education, Sengerema, Tanzania, (Jan-Mar, 1995)

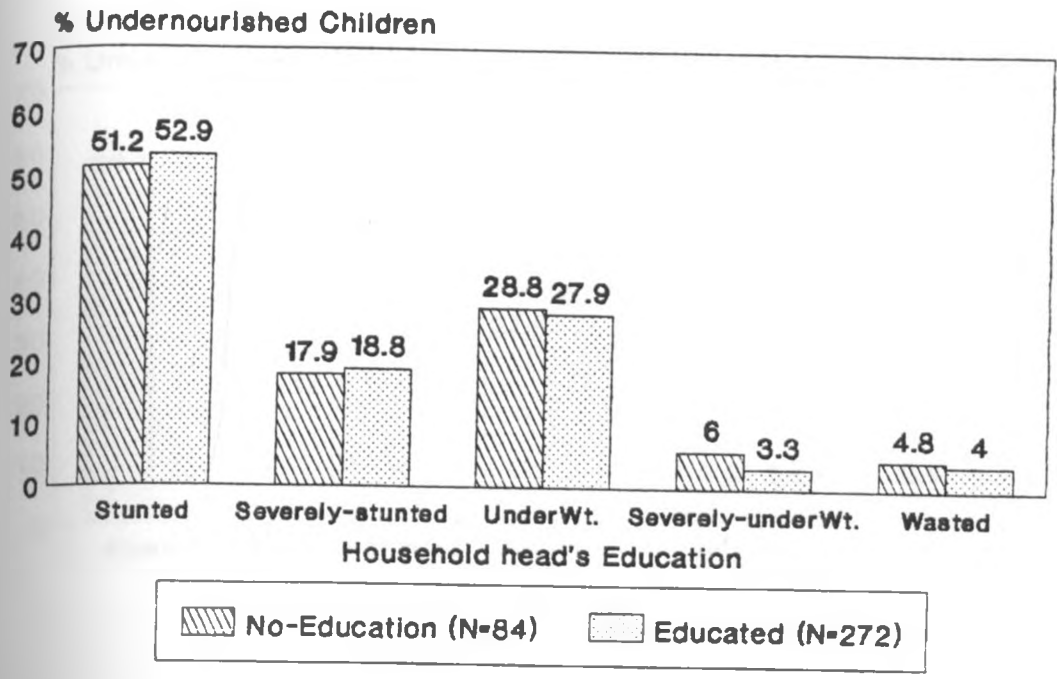


Figure A6: Child Nutritional Status by Maternal Marital Status, Sengerema, Tanzania, (Jan-Mar, 1995)

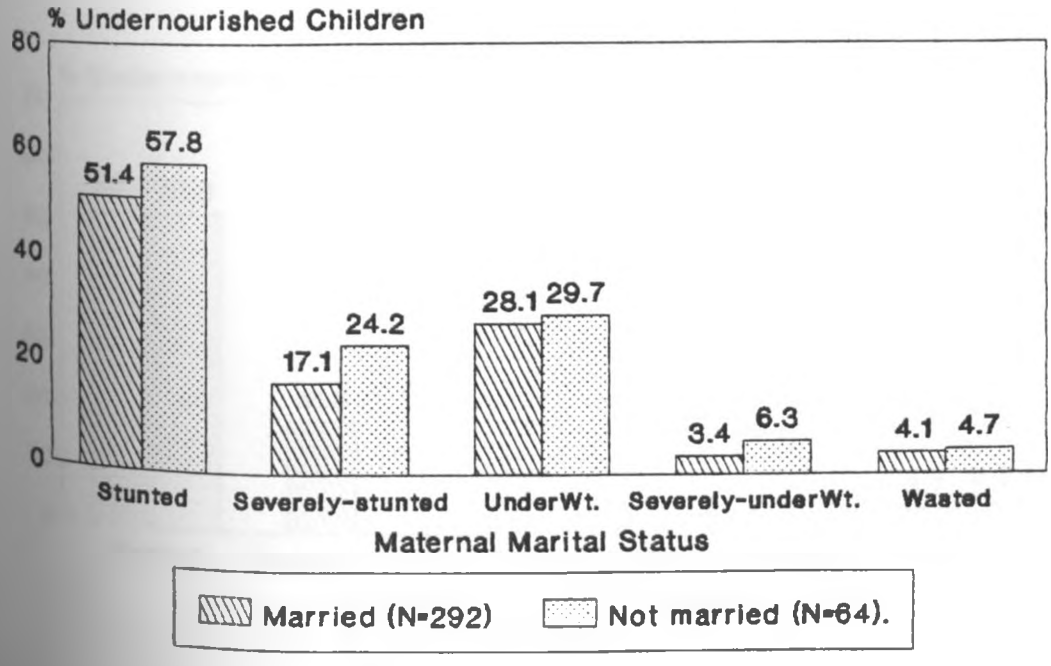


Figure A7: Child Nutritional Status by Maternal Occupation, Sengerema, Tanzania (Jan-Mar, 1995)

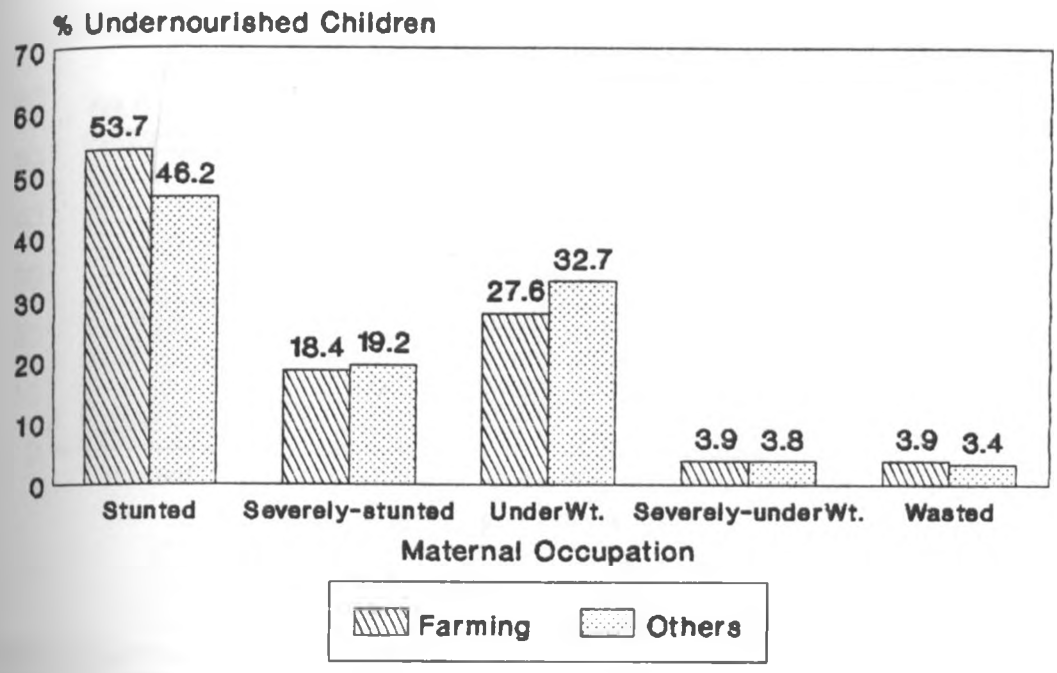


Figure A8: Child Nutritional Status by Household Head's Occupation, Sengerema, Tanzania (Jan-Mar, 1995)

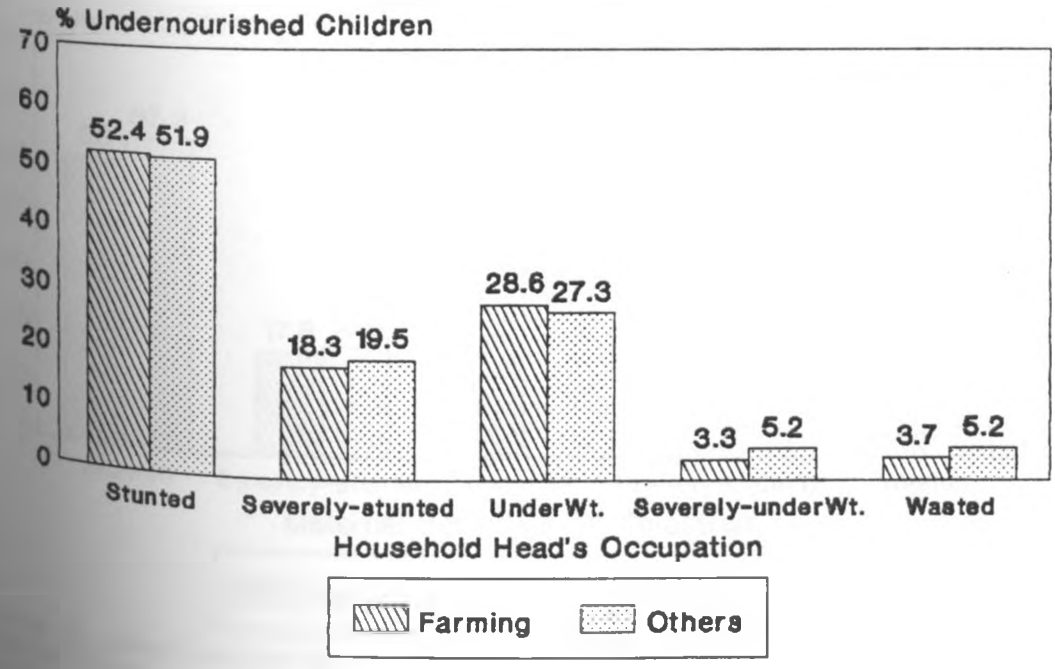
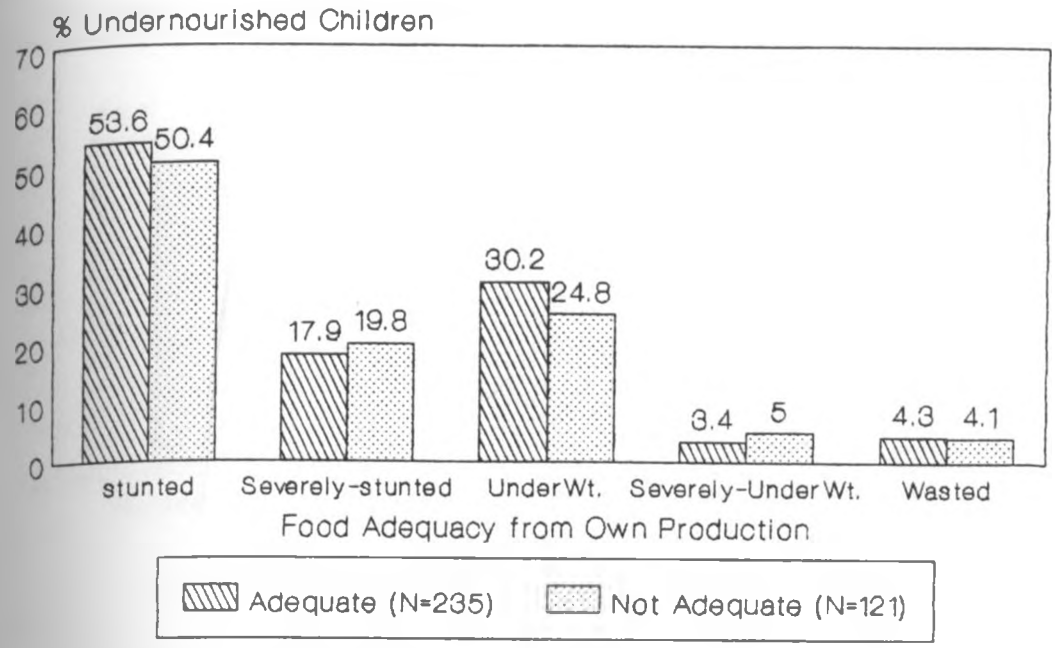
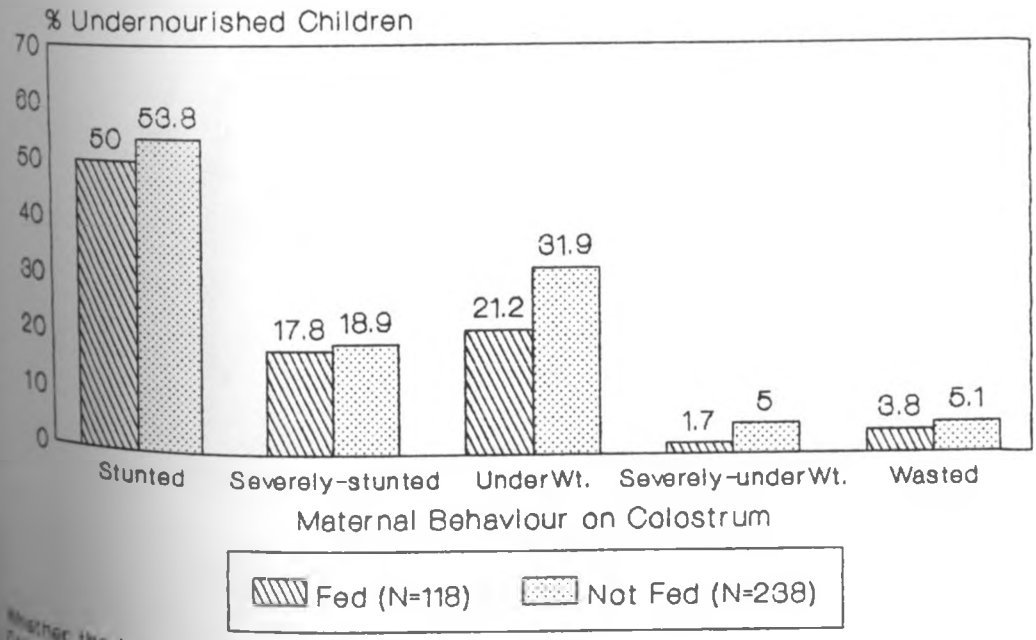


Figure A9: Child Nutritional Status by Reported Food Adequacy From Own Production, Sengerema, Tanzania (Jan-Mar, 1995)



Adequacy based on respondent's recall between two previous harvesting seasons.

Figure A10: Child Nutritional Status by Maternal Behaviour on Colostrum, Sengerema, Tanzania, (Jan-Mar, 1995).



Whether the index child was fed Colostrum or Not.

Figure A11: Child Nutritional Status by Frequency of Feeding per Day, Sengerema, Tanzania, (Jan-Mar, 1995)

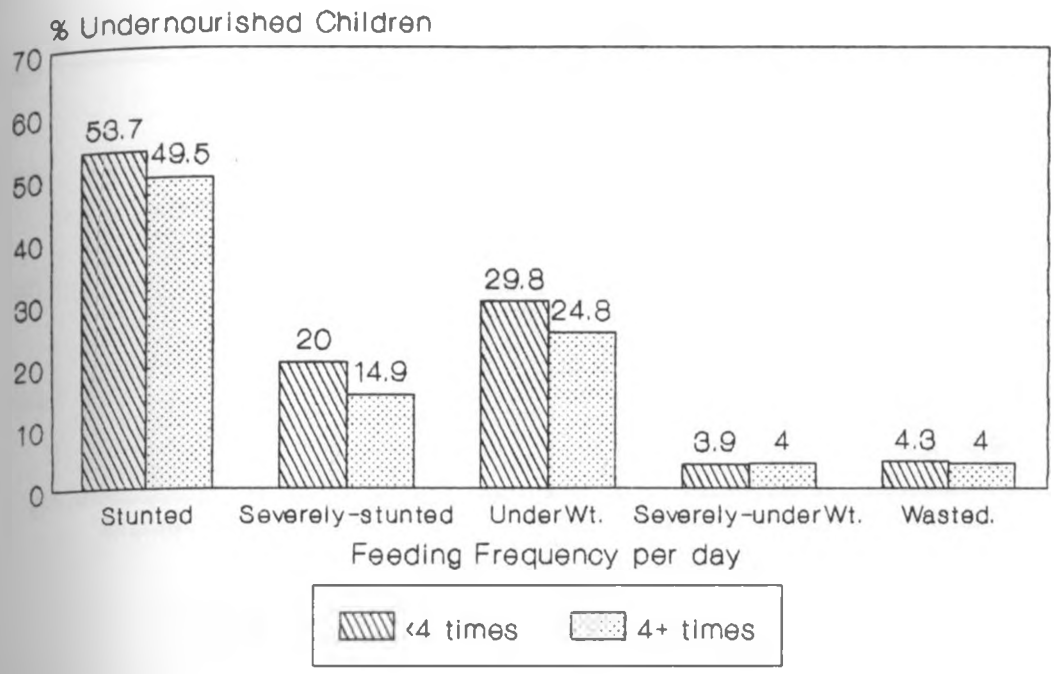


Figure A12: Child Nutritional Status by Immunization Status, Sengerema, Tanzania (Jan-Mar, 1995).

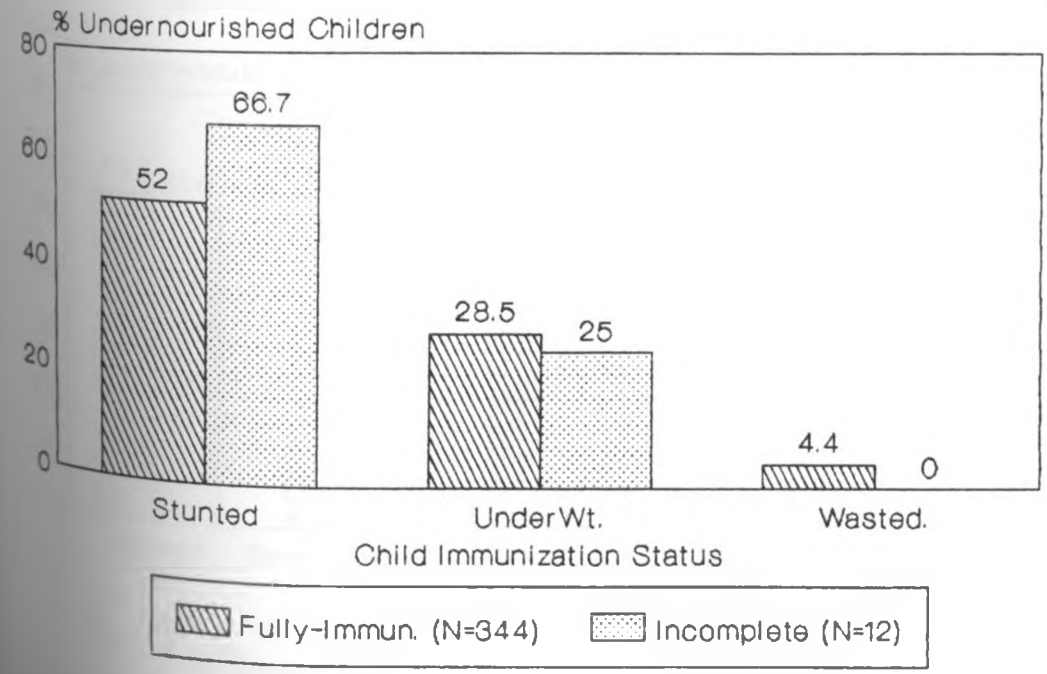
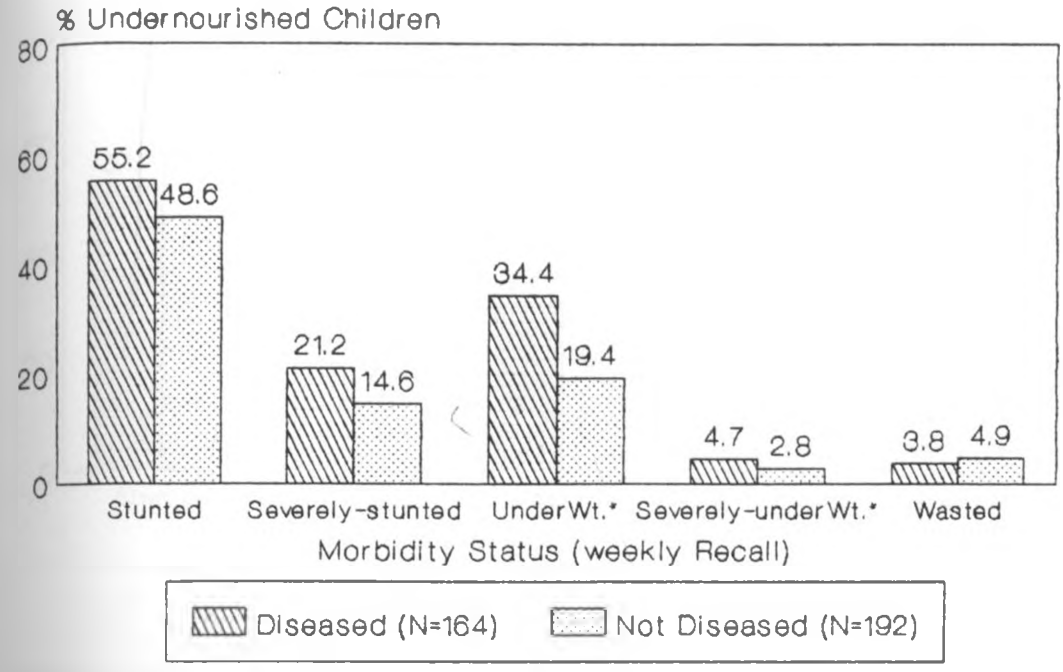
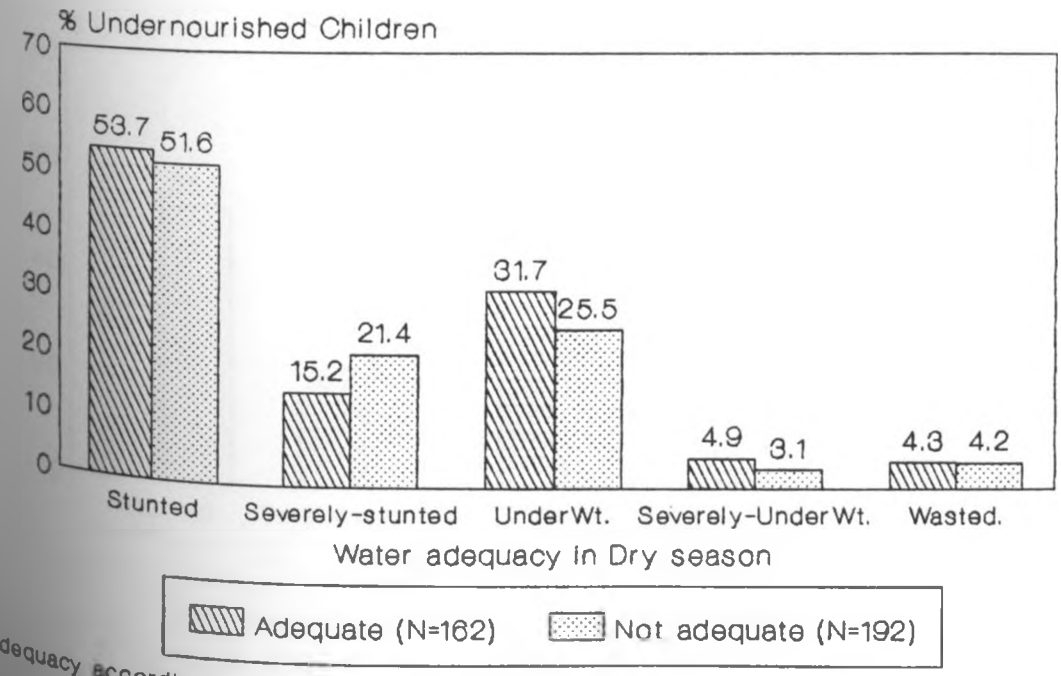


Figure A13: Child Nutritional Status by Morbidity Status, Sengerema, Tanzania, (Jan-Mar, 1995)



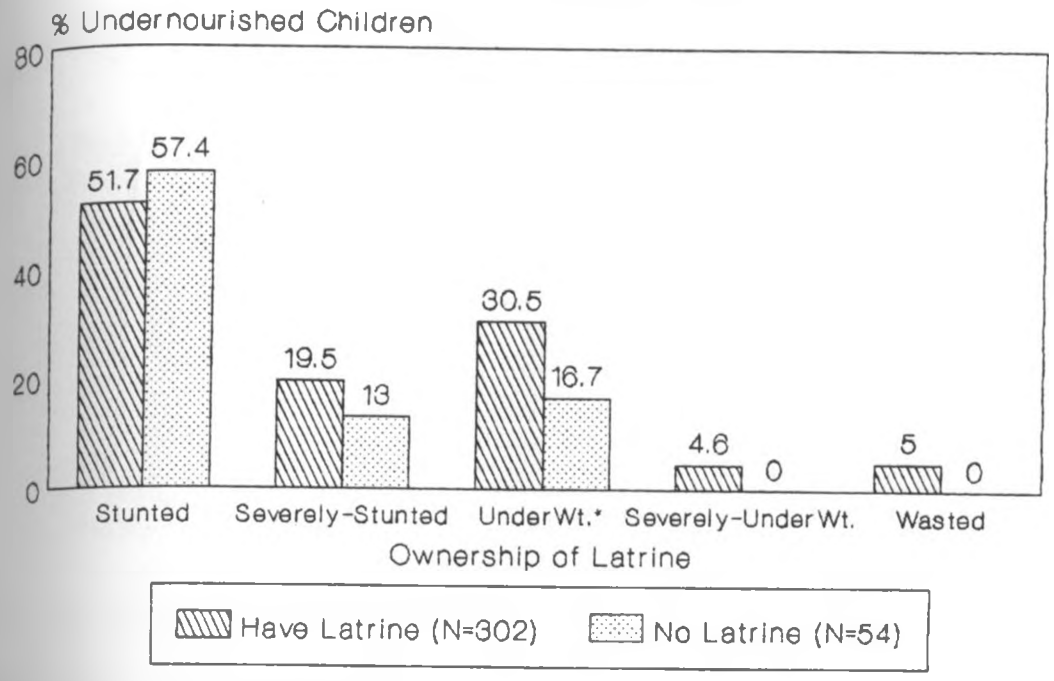
* Significant at p<0.05, Chi-square

Figure A14: Child Nutritional Status by Reported Water Adequacy in Dry Season, Sengerema, Tanzania, (Jan-Mar, 1995).



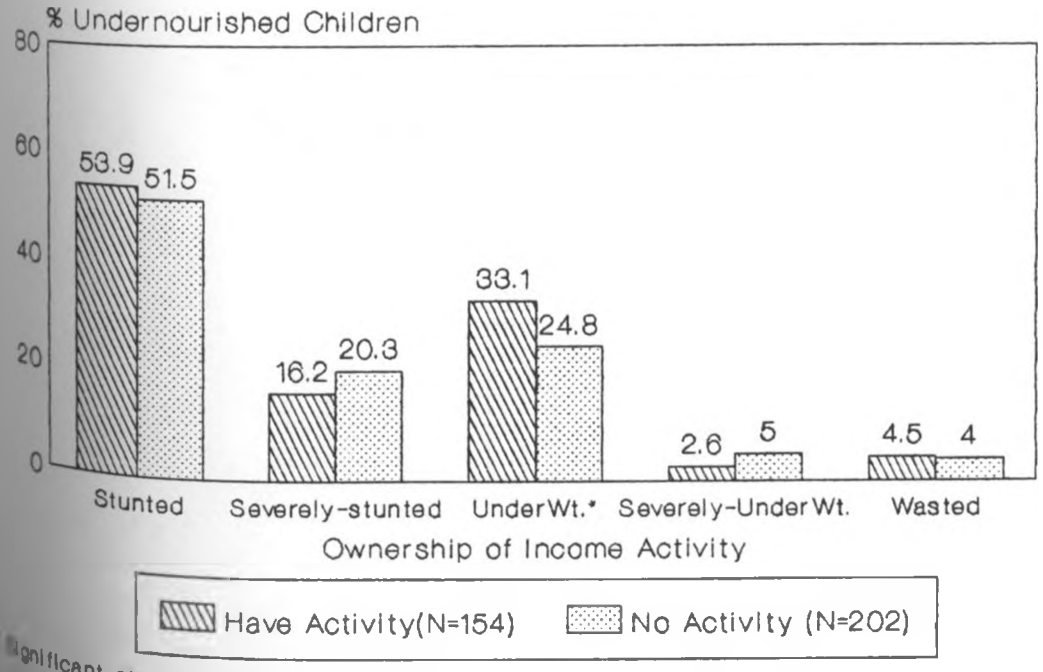
Adequacy according to Mother's judgement

Figure A15: Child Nutritional Status by Household Ownership of Latrine, Sengerema, Tanzania, (Jan-Mar, 1995).



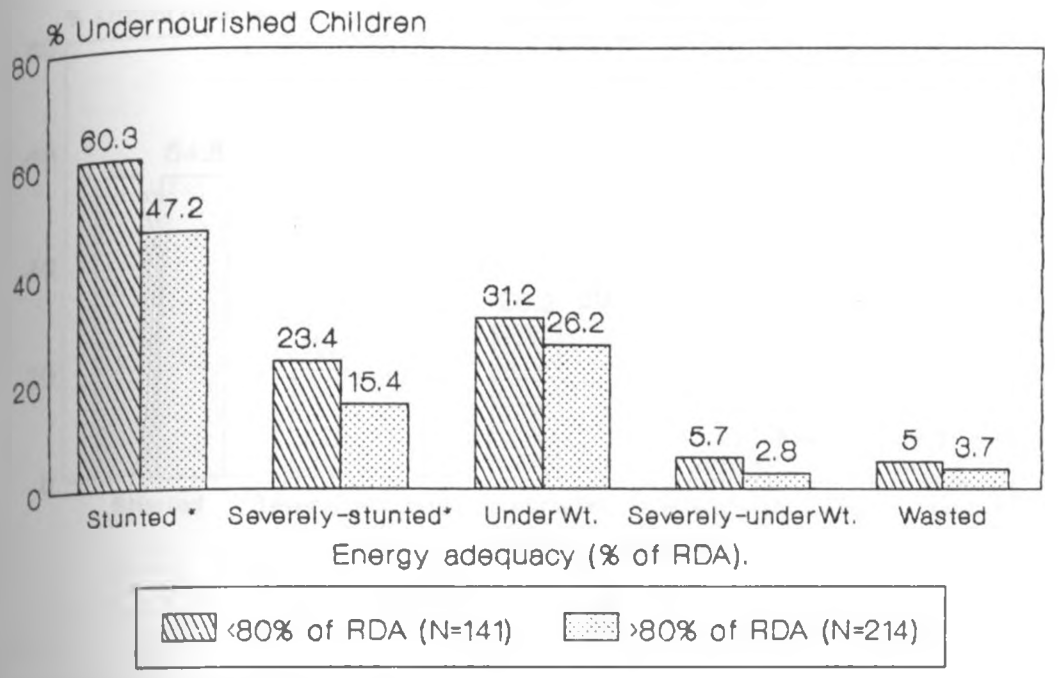
*Significant at p<0.05; Chi-square.

Figure A16: Child Nutritional Status by Maternal Ownership of Income Activity , Sengerema, Tanzania, (Jan-Mar, 1995)



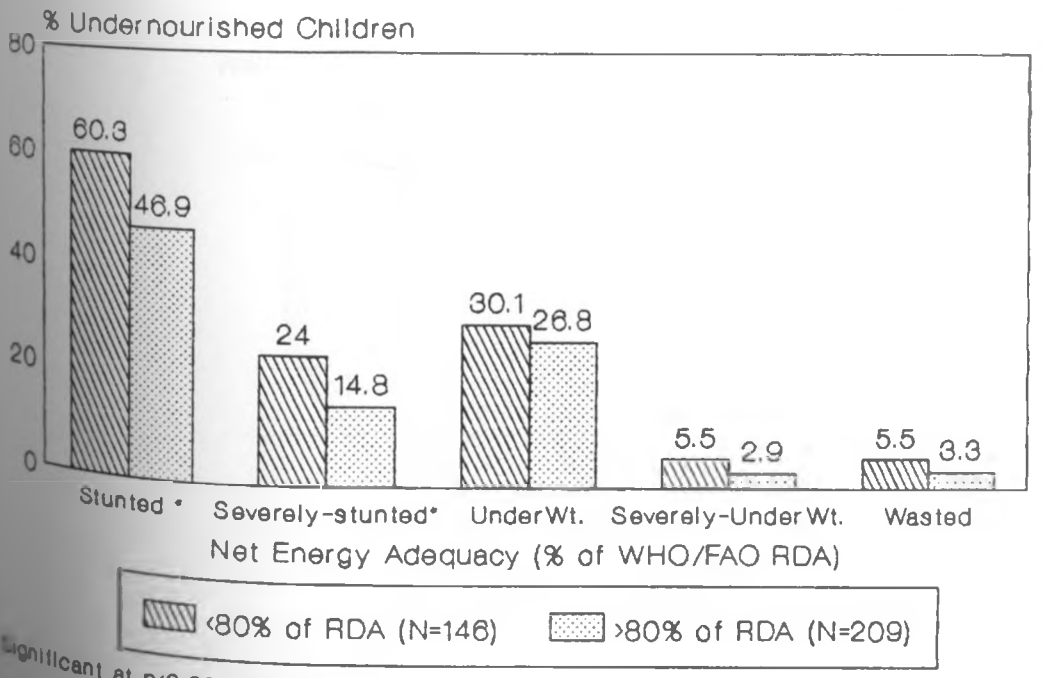
*Significant at p<0.05, Chi-square.

Figure A17: Child Nutritional Status by Energy Adequacy From Own Production Sengerema, Tanzania, (Jan-Mar, 1995)



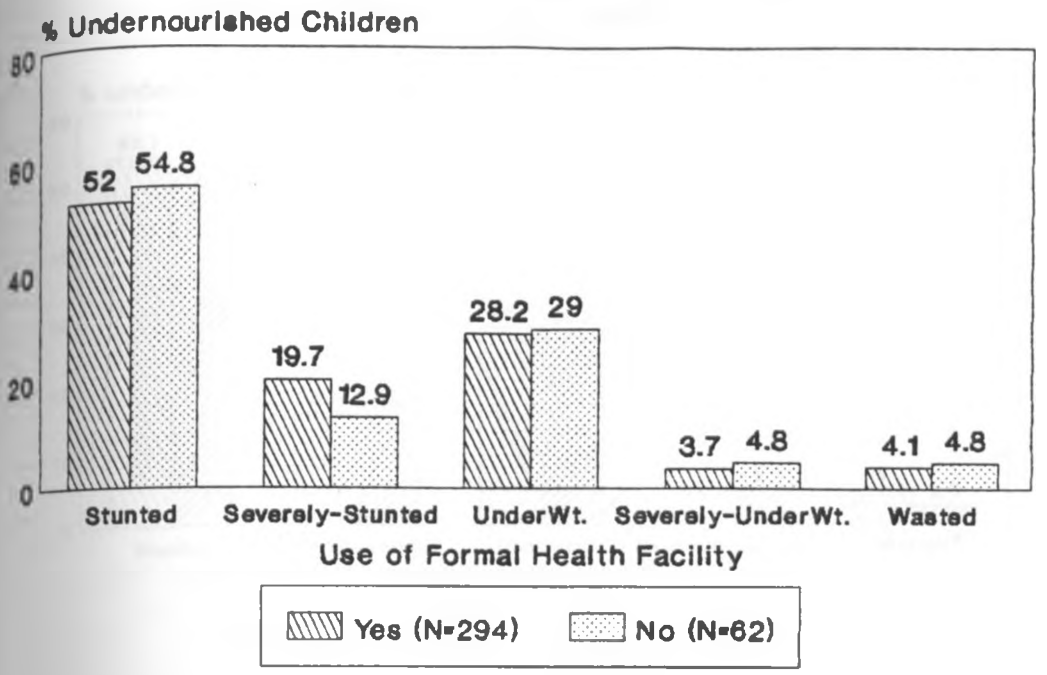
* Significant at p<0.05, Chi-square

Figure A18: Child Nutritional Status by Net Energy Availability from Crop Sources, Sengerema, Tanzania, (Jan-Mar, 1995)



* Significant at p<0.05, Chi-square

Figure A19: Child Nutritional Status by Maternal Use of Health Facility for Birth Delivery, Sengerema, (Jan-Mar, 1995).



Figur A20: Distribution of Mothers by BMI Status, Sengerema, Tanzania, (Jan-Mar, 1995).

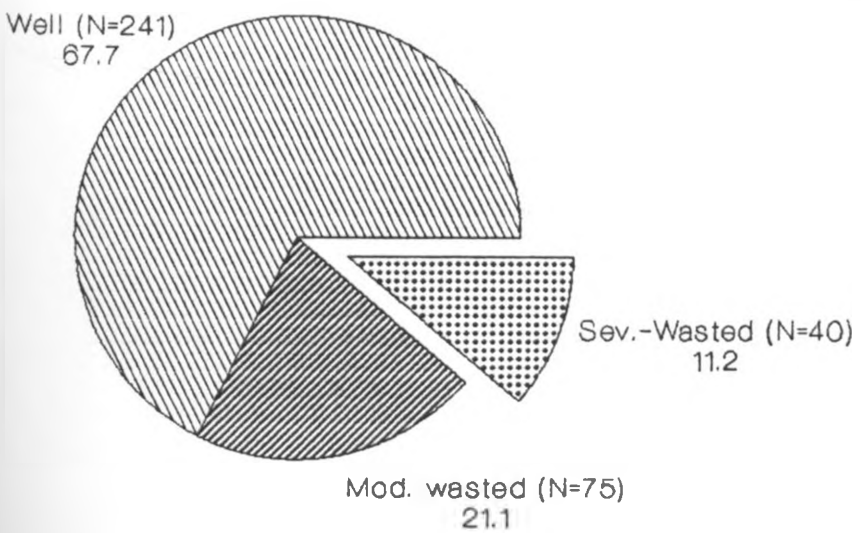
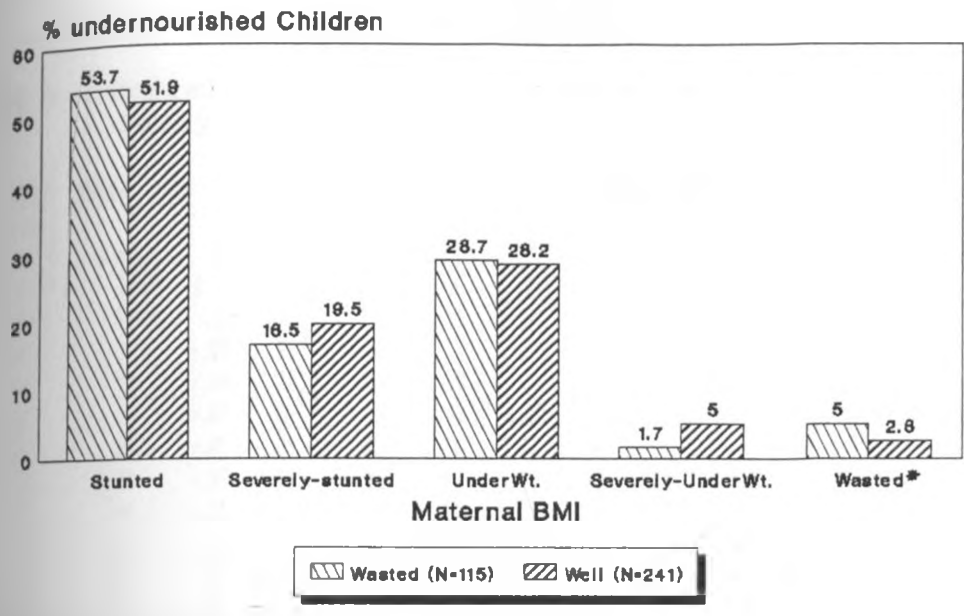


Figure A21: Child Nutritional Status by Maternal BMI,Sengerema, Tanzania (Jan-Mar, 1995)



Wasted implies BMI<20.
* Significant at p<0.05; Chi-square.

APPENDIX B:

Table B : Correlation Matrix of Independent Variables used in the Study.

	KNEAD	KNETAD	WTH	HHINK	KFDX	KNFDX	KTEX	MINC	SANXS	Q40T
KNEAD	1.00									
KNETAD	.83*3	1.00								
WTH	.20*3	.17*3	1.00							
HHINK	.56*3	.55*3	.12	1.00						
KFDX	-.02	-.02	-.05	.29*3	1.00					
KNFDX	.06	.02	-.08	.28*3	.60*3	1.00				
KTEX	-.03	-.02	-.07	.31*3	.91*3	.82*3	1.00			
MINC	-.06	-.03	-.01	.08	.02	-.01	.02	1.00		
SANXS	.02	-.08	-.03	.01	.07	.06	.10	-.02	1.00	
Q40T	.02	-.06	-.10	-.06	-.08	-.10	-.08	.01	.21*3	1.00
DIS	-.01	-.04	.00	.01	.00	.04	.02	-.04	.10*3	-.04
AGW1	-.06	-.04	-.04	.03	.00	-.03	.01	.05	.00	.01
MINCO	-.02	-.02	.00	.06	.01	.02	.03	.75*3	-.08	-.07
RINCM	-.02	.02	-.05	.02	-.05	-.07	.29	.71*3	-.04	.06
BMI	.01	.03	.11	.04	.16*2	.07	.09	.03	-.03	.02
AGYR	.06	.08	-.02	-.02	-.03	-.14*	-.09	.10	.01	.08
ABF	.04	.06	.01	.07	-.05	.04	.07	.12*	-.03	.06
MED2	-.02	-.04	-.02	.18*2	.15*2	.17*3	.14*2	.11*	-.07	.04
HED2	-.07	-.08	.06	.11	.08	.16*3	.15*2	.04	-.02	-.11*
MT2	-.09	-.07	-.02	-.04	-.06	-.11*	-.18*	.12*	.00	.04
MOC	-.25*3	-.20*3	-.12*	.11	.19*3	.13*	.17*2	.31*3	.06	-.00
HOC	-.12*	-.14*3	-.05	.12	.18*3	.15*2	.20*3	.12*	.04	-.02
QBF	-.08	-.05	-.07	-.06	.18*3	.12*	.16*3	-.08	-.03	-.00
FRQ	-.08	-.10	-.02	.11	.14*	.12*	.10*3	.08	-.04	.02
LIVD	.02	.06	.03	-.04	-.04	-.16*3	-.08	.02	.01	-.02
Q23	.08	.06	-.06	.16*	.00	.04	.02	.05	.09	.01
Q28	.08	.09	.02	.12	.09	-.12*	.08	.05	-.05	.02
Q30	.14*	.14	.01	-.07	-.08	-.00	-.07	-.04	.02	-.06
HOUSE	-.23*3	-.16	-.21*	-.15	.02	-.03	.02	.03	.08	-.01
Q38A	.13	.14	.01	.02	-.06	-.10	-.07	.12*	-.09	-.04
PAR2	.02	.00	.06	-.05	-.04	-.23*3	-.14*	.06	.00	.06
RSCO	-.11*	-.08	-.01	.11	.16*3	.17*3	.15*2	.03	.00	.15*2
REC	-.07	-.06	.17*3	-.37*3	-.21*-	.27*3	-.28*3	.03	-.02	.05
CAGE	.04	.06	.08	-.09	.02	.07	.06	.00	-.07	-.03
IMR	-.05	-.02	.06	-.06	-.06	-.01	-.04	.01	-.02	.14*2
CHOBX	.21*3	.16*3	.05	.33	.06	.10	.06	-.04	-.03	-.09
PREG	.02	.05	.01	.07	-.01	-.82	-.01	.04	.00	.02

Table B : Correlation Matrix of Independent Variables used in the study (continued).

	DIS	AGW1	MINCO	RINCM	BMI	AGYR	ABF	MED2	HED2	MRT2
KNEAD										
KNEAD										
FTE										
SHINK										
KFDI										
KNFDI										
KTEI										
MINC										
SAMIS										
Q4CT										
DIS	1.00									
AGW1	.07	1.00								
MINCO	-.05*	.69	1.00							
RINCM	.08	.12	.89*3	1.00						
BMI	.01	.16	.04	.08	1.00					
AGYR	-.10	.07	.05	.19	.06	1.00				
ABF	.00	.06	-.02	.06	.07	.20*3	1.00			
MED2	.00	-.02	.03	.02	.07	-.30	.01	1.00		
HED2	.01	-.00	.06	.03	-.05	-.21*3	-.09	.27*3	1.00	
MRT2	-.07	-.07	.09	.02	.02	-.08	.06	.02	-.20*	1.00
NOC	.00	.02	.22*3	.07	.01	.00	.00	.11*	.02	.14*2
ROC	-.02	.02	.05	.17*3	.05	.04	-.07	-.05	.05	.10
QBF	-.08	.36*3	-.02	-.03	.03	.03	.02	-.00	-.00	-.07
FRQ	.09	.04	.08	.03	.04	.00	-.03	.07	.09	.06
LIVD	-.13*	.09	-.02	.08	.09	.67*3	.17*3	-.22*3	-.13*	-.11*
Q23	.09	-.00	-.02	.01	.00	-.08	-.03	-.10	.04	.05
Q28	.01	.09	.09	.07	.06	-.06	.06	.23*3	.02	.07
Q30	.02	.07	-.01	.05	-.11	-.02	-.00	-.08	.02	-.09
HOSE	.01	-.00	.00	-.05	-.00	.11*	.02	- .10	-.05	.10
Q38A	-.03	.07	.03	.12	-.01	.02	.01	-.03	-.01	-.02
PAR2	-.13*	.05	-.00	.11	.07	.72*3	.20*3	- .22*3	-.14*2	.11*
HSCO	.01	-.00	.00	-.02	.08	-.02	.07	.20*3	.08	-.01
EXPC	-.05	.02	.01	.02	.03	.29*3	.14*	-.19*3	-.14*	.12*
CARE	-.14*2	.05	-.01	.03	.03	.13	.19*3	.01	.02	-.14*
INS	.00	.02	.04	.01	-.02	-.00	.04	.02	-.03	.01
CPCOI	.07	-.01	-.03	-.07	-.08	-.22*3	-.03	.07	-.02	.09
PUBE	-.11*	.07	-.03	.09	.09	.70*3	.19*3	-.27*3	-.14*2	-.10

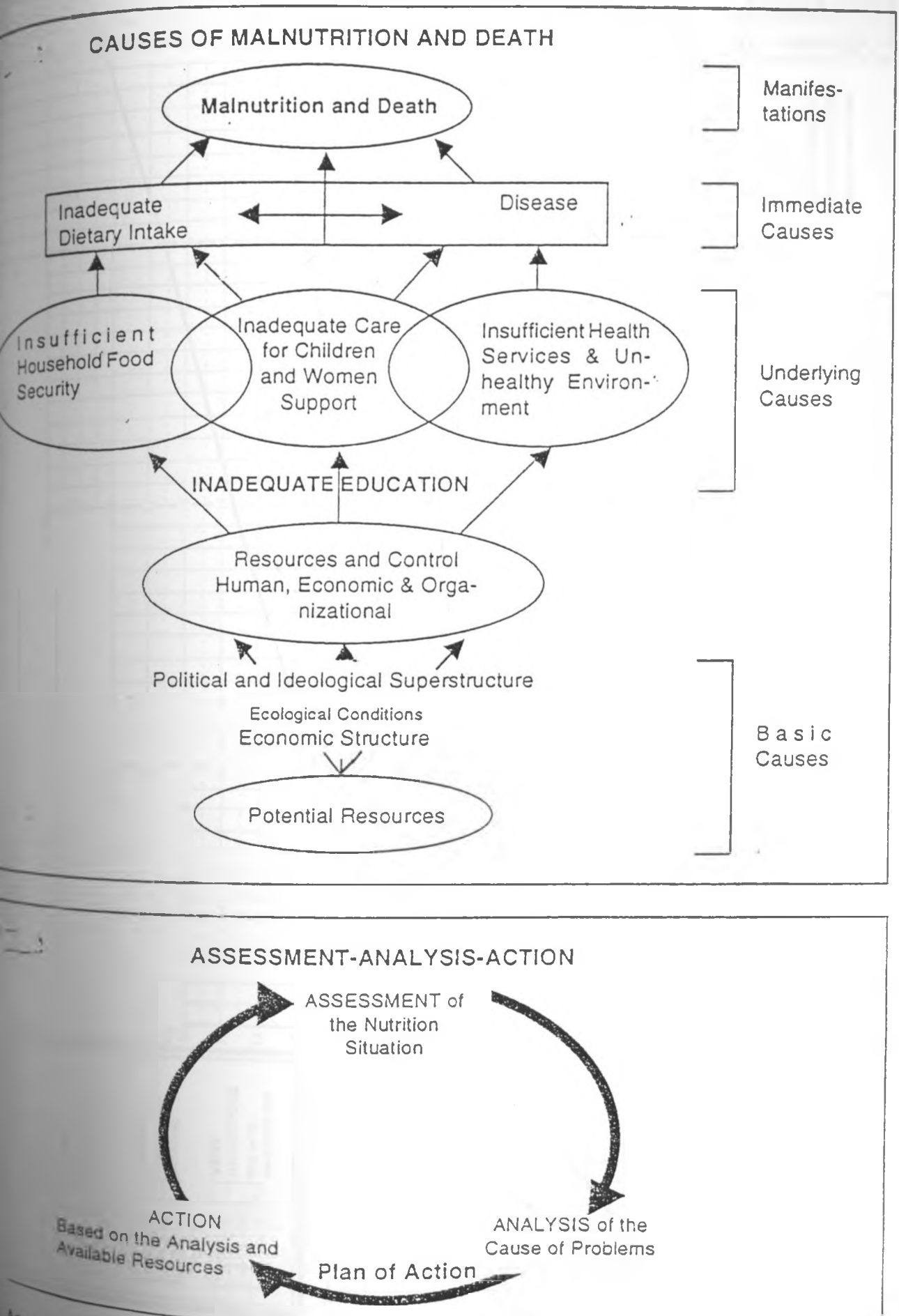
Table B : Correlation Matrix of Independent Variables used in the Study (Continued).

	MRT2	MOC	HOC	QBF	FRQ	LIVD	Q23	Q28	Q30	HUSE	Q38A	PAR2	HSCO	HZEC	CAGE	IMN	CRODX	PREG
MOC	.14*2	1.00																
HOC	-.07	.34*3	1.00															
QBF	-.07	-.04	.02	1.00														
FRQ	.06-	.13*	.11*	.09	1.00													
LIVD	-.11*	-.01	-.01	.03	-.06	1.00												
Q23	.05	.09	.18*3	-.02	.05	-.05	1.00											
Q28	.07	.12*	.07	-.10	.07	-.18*3	.02	1.00										
Q30	-.09	-.12*	-.14*	.05	-.08	.01	-.12	-.07	1.00									
HUSE	.01	.11*	-.01	-.01	-.09	.14*2	-.08	-.04	-.08	1.00								
Q38A	-.02	-.04	.01	-.06	-.06	.10	-.06	-.07	.03	-.05	1.00							
PAR2	-.11*	.02	.01	.05	-.05*3	.79*3	-.03	-.20*3	.00	.14*2	-.08	1.00						
HSCO	-.00	.12*	.15*3	.14*2	.18	-.04	.11*	.05	-.18*3	.03	-.25*2	-.01	1.00					
HZEC	.12*	-.13*	-.23*3	.05	-.08	.32*3	-.09	-.05	.01	.05	.06	.34*3	-.08	1.00				
CAGE	-.14*	-.09	.03	.06	-.05	.20*3	-.04	-.04	.01	-.01	.03	.07	.00	.06	1.00			
IMN	.01	-.01	-.05	-.00	.01	-.10*	-.09	.02	-.04	-.04	.07	-.04	.03	.06	.06	1.00		
CRODX	.09	-.01	.11	-.00	-.02	-.29*3	.09	-.01	.05	-.01*	.04	-.24*3	.04	-.22*3	.01	-.04	1.00	
PREG	-.10	.00	-.04	.05	-.05	.80	-.04	-.19	.05	.12*	.11*	.87*3	-.05	.38*3	.12*	-.09	-.21*3	1.

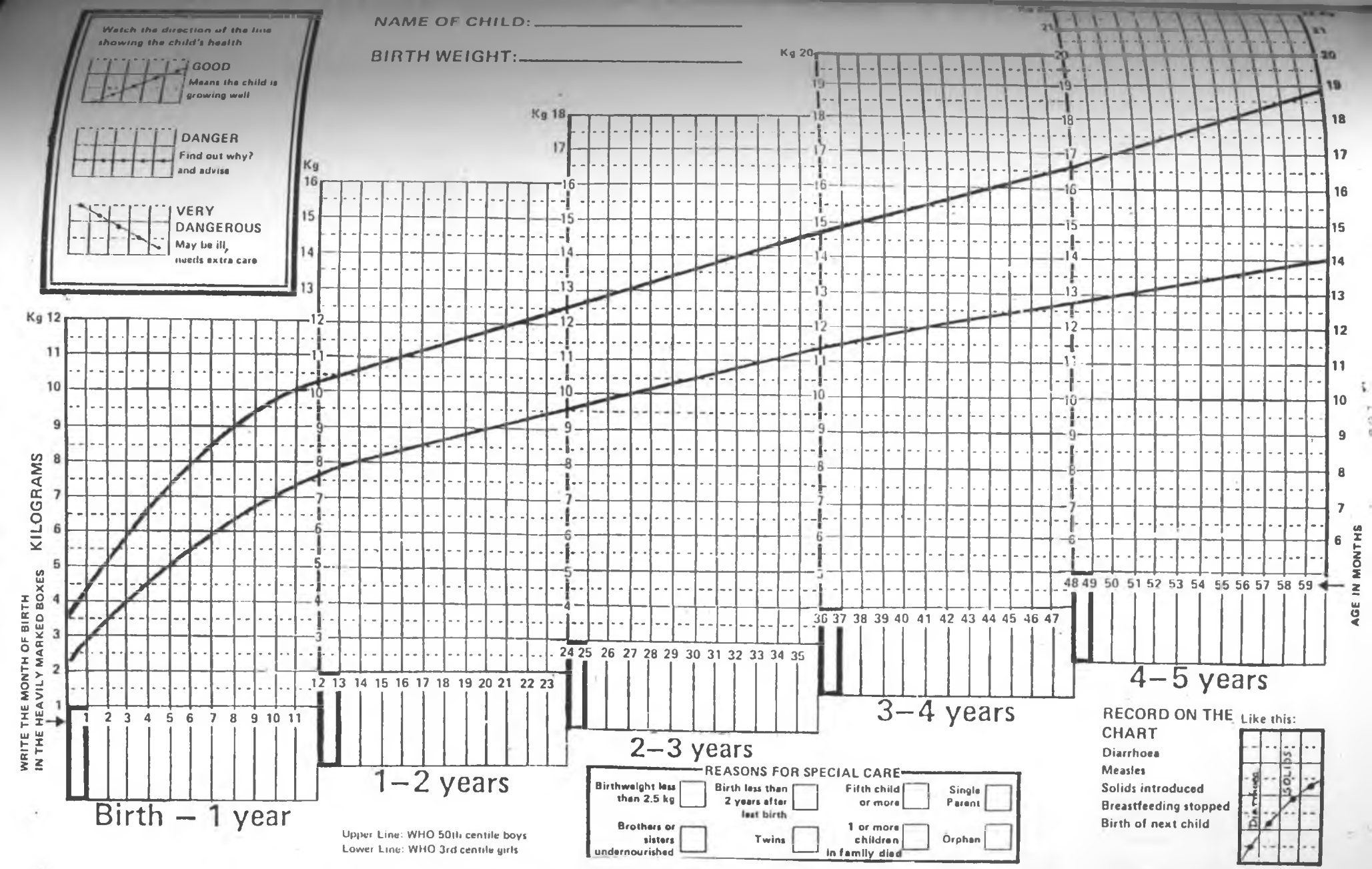
KMEAD = Energy adequacy ratio from own production (%).
KMETAD =Net Energy adequacy ratio (%)
WTH = Wealth base per capita (Tsh).
HHINK = Total Household income per capita and year (Tsh).
KPDX = Total Household annual expenditure per capita (Tsh).
KFDX = Household annual expenditure per capita on food.
KNFDX = Household annual expenditure per capita on non-foods.
KTXX = Total household annual expenditure per capita.
MINC = Mother's ownership of income activity (0=No, 1=Yes).
SANIS = Sanitation score (index) (<10=0, 10 through 15=1).
Q40T = Ownership of latrine (0=No, 1=Yes).
DIS = Child morbidity, one week recall (0=ill, 1=not ill).
AGWL = Age of Weaning (months).
MINCO = Mother's annual cash income (Tsh).
RINCM = Mother's income relative to total household income (%).
BMI = Mother's body mass index.
AGYR = Mother's age (years).
ABF = Breastfeeding duration
MEDI = Mother's education (0= No education, 1= Educated).
HEDU2 = Household head's education (0=No education, 1=Educated).
MRT2 = Mother's marital status (0= Not married, 1=Married).
MOC = Mother's major occupation (0=Farming, 1=Others).
HOC = Household head's major occupation (0= farming, 1=others).
QBF = Child was given colostrum (0=No, 1=Yes).
FRQ = Frequency of child feeding per day (0=<4, 1=≥4).
LIVD = Number of living children belonging to the mother.
Q23 = Time of day mother has contact with child.
Q28 = Mother's age at first Pregnancy.
Q30 = Time to nearest health facility (minutes).

Table B.: Correlation Matrix of Independent Variables Used in the Study (Continued).

HUSE = Use of formal Health facility during delivery of index child (0=No, 1=Yes).
Q38A = Time mother uses for return journey to fetch water (minutes).
PAR2 = Birth order of index child (0=<6, 1=>6).
HSCO = House quality status score (0=<4, 1=>4).
HSZEC = Household size (0=<7, 1=>7).
CAGE = Child's age (months).
IMM = Child immunization status (0=not completed immunization, 1=Fully immunized).
CRODX = Rooming index (square metres per capita).
PSEG = Number of parities to mother.



Appendix C1: The Conceptual Framework of Malnutrition and Triple A (Assessment-Analysis-Action) Cycle.



Appendix C2: Child Growth Monitoring Chart.

FOOD COMPOSITION TABLE

CTA ECSA

FOR ENERGY AND EIGHT IMPORTANT NUTRIENTS IN FOODS COMMONLY EATEN IN EAST AFRICA

The symbols after each nutrient or energy value provide an indication of the contribution that a food can make in supplying that nutrient or energy – = insignificant contribution ○ = minor contribution ● = good source the relative contribution is represented by the number of symbols

COMPOSITION PER 100 GRAMS EDIBLE PORTION (– = not analyzed)	ENERGY kilojoules	ENERGY (kilocalories)	PROTEIN grams	CALCIUM milligrams	IRON milligrams	VITAMIN A micrograms	THIAMIN milligrams	RIBOFLAVIN milligrams	NIACIN milligrams	VITAMIN C milligrams
CEREALS & GRAIN PRODUCTS										
1. Maize, yellow immature on cob, fresh	685 ●●	166 ●●	5.0 ●●	18 ○	1.8 ●	80 ●●	0.16 ●●	0.08 ●	1.3 ●●	8 ●
2. Maize, white whole kernel, dried	1443 ●●	345 ●●	9.4 ●●	16 –	3.6 ●	0 –	0.33 ●●	0.10 ●	2.2 ●●	0 –
3. Maize, yellow whole kernel, dried	1477 ●●	353 ●●	10.4 ●●	13 –	4.9 ●	25 ●	0.32 ●●	0.12 ●	1.7 ●	4 ○
4. Maize, white on cob, roasted	1523 ●●	364 ●●	8.0 ●●	2 –	3.0 ●	0 –	0.02 ○	0.09 ●	2.2 ●●	0 –
5. Maize, flour, 60-80% extraction	1397 ●●	334 ●●	8.0 ●●	6 –	1.1 ○	0 –	0.14 ●	0.05 ○	1.0 ●	0 –
6. Maize, meal (unga wa mahindi)	1427 ●●	341 ●●	9.3 ●●	17 –	4.2 ●	3 ○	0.30 ●●	0.08 ●	1.8 ●●	3 ○
7. Maize, meal (dona)	1435 ●●	343 ●●	10.0 ●●	12 –	2.5 ●	0 –	0.35 ●●	0.13 ●	2.0 ●●	3 ○○
8. Millet, finger, whole grain	1318 ●●	315 ●●	7.4 ●	397 ●●	17.0 ●●●	4 ○	0.18 ●	0.11 ●	0.8 ●	1 ○
9. Millet, finger, flour	1331 ●●	318 ●●	5.6 ●	315 ●●	54.0 ●●●	4 ○	0.22 ●	0.10 ●	0.8 ●	0 –
10. Millet, bulrush, whole grain	1418 ●●	339 ●●	10.0 ●●	22 ○	21.0 ●●●	4 ○	0.30 ●●	0.22 ●●	1.7 ●	3 ○
11. Rice, lightly milled, parboiled	1393 ●●	333 ●●	7.0 ●	9 –	1.7 ○	0 –	0.25 ●	0.03 ○	2.8 ●●	0 –
12. Rice, milled, polished	1393 ●●	333 ●●	7.0 ●	6 –	1.7 ○	0 –	0.10 ●●	0.03 ○	2.8 ●●	0 –
13. Sorghum, whole grain	1435 ●●	343 ●●	11.0 ●●	26 ○	11.0 ●●●	3 ○	0.34 ●●	0.15 ●	3.3 ●●●	0 –
14. Sorghum, flour	1410 ●●	337 ●●	9.5 ●●	28 ○	10.0 ●●●	3 ○	0.28 ●●	0.09 ●	3.4 ●●●	0 –
15. Wheat, whole, parboiled	1381 ●●	330 ●●	12.0 ●●	54 ○	6.1 ●●	0 –	0.36 ●●	0.09 ●	3.8 ●●●	0 –
16. Wheat flour, 85% extraction	1423 ●●	340 ●●	11.0 ●●	36 ○	3.6 ●●	0 –	0.37 ●●	0.08 ●	2.8 ●	0 –
17. Wheat flour, 70% extraction	1393 ●●	333 ●●	10.0 ●●	27 ○	2.2 ●●	0 –	0.07 ○	0.04 ○	1.0 ●	0 –
Wheat products:										
18. White bread	1004 ●●	240 ●●	7.7 ●●	37 ●	1.7 ●●	0 –	0.16 ●●	0.08 ○	1.0 ●	0 –
19. Brown bread	974 ●●	233 ●●	7.7 ●●	43 ●	2.2 ●●	0 –	0.20 ●●	0.08 ●	2.1 ●●	0 –
20. Cakes	1394 ●●	337 ●●	7.8 ●●	10 –	1.0 ●	0 –	0.14 ●	0.03 ○	1.0 ●	0 –
21. Pancakes	552 ●●	132 ●●	1.9 ●	2 –	0.3 ○	0 –	0.04 ○	0 –	0.3 ○	0 –
STARCHY ROOTS, TUBERS & FRUIT										
1. Breadfruit, pulp, raw	414 ●	99 ●	1.5 ○	28 ○	2.0 ●●	2 ○	0.08 ●	0.05 ○	0.7 ●	31 ●●●
2. Cassava, bitter, fresh	577 ●	138 ●	1.2 ○	68 ●	1.9 ●●	5 ○	0.04 ○	0.05 ○	0.6 ●	31 ●●●
3. Cassava, meal	1331 ●●	318 ●●	1.6 ○	66 ○	3.6 ●●	0 –	0.06 ●	0.05 ○	0.9 ●●	4 ○
4. Plantain, ripe, raw	536 ●	128 ●	1.2 ○	8 –	1.3 ●	130 ●●●	0.08 ●	0.04 ○	0.6 ●	20 ●●
5. Potato, raw	313 ●	75 ●	1.7 ○	13 –	1.1 ●	4 ○	0.07 ●	0.03 ○	1.3 ●●	21 ●●
6. Sweet potato, yellow, raw	456 ●	109 ●	1.6 ○	33 ○	2.0 ●●	300 ●●●	0.09 ●	0.04 ○	0.7 ●	37 ●●●●
7. Sweet potato, pale, raw	456 ●	109 ●	1.6 ○	33 ○	2.0 ●●	6 ○	0.09 ●	0.04 ○	0.7 ●	37 ●●●●
8. Taro/Cocoyam, raw	393 ●	94 ●	1.8 ○	51 ●	1.2 ○	0 –	0.10 ●	0.03 ○	0.8 ●	8 ●
9. Turnip/Swede, root, raw	75 ○	18 ○	1.0 ○	38 ○	0.5 ○	2 ○	0.03 ○	0.05 ○	0.5 ●	75 ●●●●●
10. Yam, fresh	464 ●	111 ●	1.9 ○	52 ●	0.8 ○	2 ○	0.11 ●	0.02 ○	0.3 ○	6 ●
11. Yam, flour	1297 ●●	310 ●●	3.4 ○	20 –	1.1 ○	0 –	0.10 ●	0.08 ○	1.1 ●●●●	0 –
GRAIN LEGUMES & LEGUME PRODUCTS										
1. Beans/peas, fresh, shelled	435 ●	104 ●	8.2 ●●●	22 ○	1.8 ●	20 ●	0.15 ●●	0.15 ●●	1.6 ●●●	25 ●●
2. Beans, dried	1339 ●	320 ●	22.0 ●●●	120 ●	8.2 ●	2 –	0.37 ●●	0.16 ●	2.4 ●●	1 ○
3. Beans, green in pod, raw	146 ○	35 ○	2.5 ●	43 ●	1.4 ●	30 ●	0.08 ○	0.12 ●	0.5 ●	27 ●●●
4. Bonavist/Hyacinth bean, dried	1272 ●	304 ●	23.0 ●●●	90 ●	9.0 ●●	10 ○	0.54 ●●●	0.14 ●	2.3 ●●	20 –
5. Chickpea, whole seeds, raw, dried	1326 ●	327 ●	20.0 ●●●	250 ●●	11.0 ●●	10 ○	0.48 ●●	0.16 ●	1.8 ●●	8 ○
6. Cowpea, mature pods, dried	1331 ●	318 ●	23.0 ●●●	80 ●	5.0 ●	2 ○	0.90 ●●●●	0.15 ●	2.0 ●●	2 ○
7. Cowpea, young green pods, raw	163 ○	39 ○	3.7 ●	54 ●	1.4 ●	76 ●●	0.14 ●	0.10 ●	1.0 ●	24 ●●
8. Kidney bean, red, dried	1339 ●	320 ●	22.0 ●●●	120 ●	8.2 ●	1 ○	0.37 ●●	0.16 ●	2.4 ●●	1 ○
9. Lentil, dried	1360 ●	325 ●	25.0 ●●●	64 ●	7.0 ●	10 ●	0.41 ●●	0.19 ●	2.2 ●●	0 –
10. Mung bean, green, dried	1347 ●	322 ●	24.0 ●●●	100 ●	7.0 ●	19 ●	0.52 ●●●	0.20 ●	2.4 ●●	0 –
11. Mung bean, black, dried	1305 ●	312 ●	24.0 ●●●	110 ●	8.9 ●●	6 ○	0.48 ●●	0.21 ●	2.3 ●●	0 –
12. Pea, dried	1251 ●	299 ●	22.0 ●●●	90 ●	18.0 ●●●	2 ○	0.88 ●●●●	0.17 ●	3.0 ●●●	0 –
13. Pigeon pea, dried	1293 ●	309 ●	20.0 ●●●	160 ●	5.0 ●	9 ○	0.72 ●●●●	0.14 ●	2.9 ●●●	0 –
14. Soya bean, dried	1703 ●●	407 ●●	34.0 ●●●●	185 ●	6.1 ●	9 ○	0.71 ●●●●	0.25 ●	2.0 ●●	0 –
15. Velvet bean, dried	1381 ●	330 ●	21.0 ●●●	130 ●	–	5 ○	0.12 ●	0.10 ●	3.0 ●●●	2 ○
NUTS & SEEDS										
1. Bambara groundnut, fresh	1448 ●●●	346 ●●●	19.0 ●●●●	62 ●	12.0 ●●●	0 –	0.47 ●●●●	0.14 ●●	1.8 ●●●	–
2. Cashew nut, dried	2343 ●●●	560 ●●●	17.0 ●●●●	76 ●	18.0 ●●●●	1 ○	0.65 ●●●●	0.25 ●●●	1.6 ●●●	7 ●
3. Coconut, immature kernel, fresh	799 ●●	191 ●●	2.0 ○	29 ○	1.8 ●	0 –	0.08 ●	0.06 ●	0.6 ●	8 ●
4. Coconut, mature kernel, fresh	1640 ●●●●	392 ●●●●	3.5 ●	21 –	2.5 ●	4 ○	0.03 ○	0.03 ○	0.6 ●	2 ○
5. Groundnut, dry	2393 ●●●●●	572 ●●●●●	23.0 ●●●●	49 ●	3.8 ●●	2 ○	0.79 ●●●●	0.14 ●●	15.5 ●●●●●	1 ○
6. Melon seeds, without coat	2499 ●●●●●	595 ●●●●●	26.0 ●●●●	53 ●	7.4 ●●●	0 –	0.10 ●	0.12 ●●	1.4 ●●	–
7. Pumpkin seeds, without coat	2414 ●●●●●	577 ●●●●●	23.0 ●●●●	57 ●	2.8 ●●	3 ○	0.15 ●●	0.12 ●●	1.4 ●●	2 ○
8. Sunflower seeds, without coat	2477 ●●●●●	592 ●●●●●	20.0 ●●●●	100 ●	7.6 ●●●	0 –	1.36 ●●●●●	0.16 ●●	3.3 ●●●●●	–

Appendix C3: Food Composition Table for ECSA Region.

APPENDIX D:

HOUSEHOLD QUESTIONNAIRE
UNIT OF APPLIED HUMAN NUTRITION, UNIVERSITY OF NAIROBI

HOUSEHOLD AND MATERNAL DIFFERENTIAL FACTORS DETERMINING NUTRITIONAL STATUS OF CHILDREN (18-36 MONTHS) IN SENGEREMA DISTRICT CSPD PROGRAMME AREA, MWANZA, TANZANIA

SECTION A: IDENTIFICATION
Questionnaire No.....

Date of Interview .....(day/month/year)
Name of Interviewer.....
Name of Respondent .....
Name of Head of household (if not respondent).... ....
Name of village .....
Name of ward.....
Name of ten cell leader (balozi) ....
Household number ....
Name of the Index child .... Sex ....

SECTION B: DEMOGRAPHY

1. How many people are staying in this household? (Include father, mother, children and all those living in the household at least for the past 3 months) ... ...
Please give following information for each.

NAME	SEX	AGE (in YRS)	RELATION TO INDEX CHILD
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			

Codes: Relation to index child

00 = Index child
01 = Father
02 = Mother
03 = Brother/Sister
04 = Other Relatives (Grand parents, uncle, aunts etc.)
05 = Other (specify) ....

2. For how long have you lived in this area? ... ...(Years).

3. Where does the father of the child reside ? ....

codes:
1 = always with the household
2 = sometimes with the household
3 = never with the household
4 = other (specify) ....

SECTION C: EDUCATION/MARITAL STATUS/OCCUPATION

4. What is the highest education level of
(a) You (Mother) .....
(b) Household Head (if not mother) ....

Codes:
00 = No education
01 = Adult education
02 = Primary School - Class 1 - 4
03 = Primary School - Class 5 - 8
04 = Secondary School - Form 1 - 4
05 = Secondary School - Form 5 - 6
06 = Higher Education (Colleges)

5. Please tell me your (mother) marital status.....

Codes:
1 = Single (Not happened to be married)
2 = Married monogamous
3 = Married polygamous
4 = Separated
5 = Divorced
6 = Widowed

6. What was the type of work performed most part of last year by:

(a) You (Mother of the child) ....

(b) Household head (if not mother) ... .

Codes:
01 = crop Farming
02 = Animal farming
03 = Both crop and animal farming
04 = House wife
05 = Formal employment
06 = Casual labour
07 = Selling foodstuffs
08 = Selling handicrafts
09 = Sewing/knitting
10 = Traditional healer
11 = Fishing
12 = Iron smith
13 = Preparation/selling traditional alcoholic beverages.

SECTION D: FOOD AVAILABILITY AND CHILD WEANING PRACTICES

7. Please, give information about Food crop Harvests, purchases, donations in and out, and sales, for all crop seasons in last year (1994) and stock at the beginning of the Seasons.

CODE	CROP	AMOUNT IN STOCK (Kg)	AMOUNT HARVESTED (Kg)	AMOUNT PURCHASED (KG)	AMOUNT DONATED IN (KG)	AMOUNT SOLD OUT (KG)	AMOUNT DONATED OUT (KG)
1	Maize						
2	Millet						
3	Sorghum						
4.	Bulrush millet						
5	Paddy						
6	Groundnuts						
7	Beans						
8	Sunflower						
9	Peas						
10	Bambaranut						
11	Chick Peas						
12	Green gram						
13	Sesame						
14	Other (specify)						

8. For last year, how many acres did you cultivate for cassava and sweet potato?.

   (a) Cassava ... ... (acres)
   (b) Sweet potato ... ... (acres).

9. Which cropping system was used for the above crops.
   1= Intercropping the two root crops
   2= Each crop cultivated separately

10. Was household's own-grown food enough to last between the last two cropping seasons (harvests) ?...
codes: 1 = yes. 2 = no
If yes, go to question 11

11. If no, how did the family meet the deficit ? ... ...
1 = Purchase 2 = Gifts

12. Was this adequate to satisfy the household's needs ?
1 = Yes 2 = No

13. Is .... (name of the child) still breastfeeding? ...
1 =Yes 2 = No
If yes, proceed to question 15

14. If no, at what age did the child stop breastfeeding? ... ... (months), why ? ... ...
Codes : Why
1 = Next pregnancy 4 = Child refused
2 = No milk 5 = Child ill
3 = Mother ill 6 = To wean off breast
7 = Mother divorced/separated. 8 =Others (specify)... ....

15. Did you breastfeed your child immediately after birth (within one hour of birth) ? ... ...
1 = Yes 2 = No
If no proceed to question 17

16. If yes, was the child given the first/yellowish milk? ....
1= Yes 2 = No

17. If no, how soon did you start breastfeeding your child after birth ? ....
1 = Within one hour
2 = Within the first day of birth
3 = After one day of birth
4 = After two days
5 = After three days
6 = After four days
7 = After five days

18(a). If first milk was not given to the child, then what was given? ....
1 = Plain drinking water 4 = Canned milk/infant formula
2 = Goat milk 5 = Sweetened water
3 = Cow milk

18(b). What was the reason for not immediately initiating breastfeeding? ...
1 = The first/yellowish milk is dirty
2 = The yellowish milk is bad
3 = The milk may cause diarrhoea
4 = Mother underwent a caesarian section
5 = Milk was not flowing from breasts
6 = Others (specify).

19. For how long was the child exclusively breastfed ? ... months

20. What were the first foods (including water) you introduced to your child and when?

Type of Food (Liquid, solid)	Food Name	Age of Child (Months)

21. How often does the child eat per day ? .... times.

22. What do you usually feed the child with ?

i)_____ vi) _____
ii)_____ vii) _____
iii)_____ viii) _____
iv)_____ ix)_____
v)_____ ___ x) _____

23. Approximately, how much time in a day do you spend with the child ..... (hours).

24. Who takes care of the child when you are away from home ?...

1 = house girl. 2 = older siblings. 3 = grand mother.
4 = father 5 = other (specify).

SECTION E: INFORMATION ON CHILD BEARING, ACCESS TO HEALTH SERVICES, AND CHILD MORBIDITY STATUS.

25. How many times have you (mother of the child) given birth ?...

26. How many living children do you have? ....

27. What is the birth order of the index child? ...

28. What was your (mother's) age at first birth? ... ..(years)

29. Where was ... ... (name of child) delivered? ... ...

codes: 1 = formal health facility
2 = traditional birth attendants
3 = at home
4 = on the way to a formal health facility.
5 = on a safari
6 = other (specify).

30. How much time is required to reach the nearest health facility ... ... (hour:minutes)

31. How do you normally travel to the facility? .....

1 = on foot.
2 = by bicycle.
3 = by bus/car
4 = by boat
5 = by ferry
6 = others (specify).....

32. Has the child completed immunization ? (check information on growth cards).

codes: 1 = yes 2 = no.
If yes, continue to question no.34

33. If the child has not completed immunization, which vaccines?...

codes: 1 = BCG (Repeat) 2 = DPT1 3 = DPT2
4 = DPT3 5 = OPV1 6 = OPV2
7 = OPV3

34. Has ... ...(name of the child) been ill within the last 7 days ? ....

codes: 1 = yes 2 = no
If no, continue to section F.

35. What illness(es) has the child experienced?

Codes: Illness
1 = Diarrhoea
2 = Cough
3 = Runny nose (cold)
7 = Vomiting
4 = Fever/malaria
5 = Measles
6 = Skin diseases
8 = others (specify).....

SECTION F: WATER, SANITATION, AND HOUSING.

36. What is the main source of water for the household ?

1 = protected bore wells
2 = river
3 = piped water
4 = traditional wells
5 = lake water
6 = dam water
7 = Improved traditional wells

37. Is the amount of water adequate? ....
(a) During dry season .....
(b) During rainy season....
1 = yes 2 = no

38. Approximately, how much time do you spend for a return journey to collect water (hour:minute)

(a) During dry season .....(Hr: min)

(b) During rainy season .....(Hr: min)

39. Estimate living space for the household?....
(a) Number of partitioned rooms in house ... .

(b) Number of non partitioned houses in the household compound .....

40. Do you have any latrine? ....

1 = yes 2 = No

SECTION G: HOUSEHOLD INCOME, MOTHER'S INCOME, AND HOUSEHOLD, WEALTH BASE.

41. What are the major income generating activities this household, and what income was earned by the household in the last one year? (Record the main income generating activities for this household in order of importance)

Activity code	Estimated income earned in the past One Year (Tshs).

Activity code for question 41.

1 = Sales of cereal crops
2 = Sales of root crops
3 = Sales of horticultural crops.
4 = sales of cotton
5 = Sales of livestock
6 = Selling pulses
7 = Sales of home craft
8 = Selling oilseeds
9 = Husband's salary (Net)
10 = Casual labour
11 = My (mother's) salary
12 = Fishing
13 = Selling fish
14 = Remittances
15 = Others (specify) ... ...
10. Business (specify) ....
11. Others (specify) ....

42. Do you (mother) participate in any income generating activity
1 = Yes 2 = No
If no, continue to question 45

43. Please, give information on your (mother's) income generating activities, and estimate income earned in the last one year

Activity	Income earned in the past One Year (Tshs).

Mother's Income Sources codes (question 43):

1 = Sales of crops
2 = Selling cooked food
3 = Sales of livestock
4 = Sales of hand crafts
5 = Salary (Net)
6 = Business (specify) ....
7 = Horticultural activities
8 = Traditional healing
9 = Fishing
10 = Traditional drama
11 = Other (specify) ....

44. Who controls income earned by you(mother) ? .....
1 = Self (mother)
2 = Husband
4 =Others (specify).....
3 = Jointly with my husband

45. What is your household's usual weekly expenditure pattern?
(a) Purchasing relish and other foods .... (Tsh)
(b) Other expenses (kerosine, soap, etc.) .... ..(Tsh)

46. Which and how many of the following items do you posses?

Code: Article	Type,model, breed	How many	Value (Tsh)
1. Radio			
2. Bicycles			
3. Sewing machine			
4. Cattle			
5. Goats			
6. Sheep			
7. Chicken			
8. Ducks			
9. Donkey			
10. Rabbit			
11. Pigs			
12. Dove			
13. Guinea fowl			
14. Motorcycle			
15. Car/vehicle			
16. Ox-plough			
17. Milling machine			
18. Shop/kiosk			
19. Refrigerator			
20. Others (specify)			

SECTION H: ANTHROPOMETRY AND GROWTH MONITORING DATA

This section must be filled for the Index child. If more than one eligible child (18 to 36 months) in a household, the index child be chosen randomly).

47. Name of the child ..... Sex.... (M/F)
48. Exact date of Birth ..../..../... (day/month/year)
(Verify date of birth with growth card or birth certificate)

49. Weight of the child in Kg (tolerance, ± 0.5 kg)
First measurement ..... Kg
Second measurement ..... Kg
Average weight ....Kg
50. Height or Length of the child in cm (tolerance ± 0.1 cm)
First measurement ....cm
Second measurement .... .cm
Average height/length ..... Cm

Note: For children less than 2 years of age, take recumbent length; 2 years and above, take height.

51. Record child's weight and exact age in months for the past four village health days.(four consecutive assessment quarters).
(Use child's growth card, if not available, use village health days data notebook/register, preferably refer to both).

MONTH OF MEASUREMENT	WEIGHT OF CHILD IN (Kg)	AGE OF CHILD (Months)	RECORDED FROM (Data source)	WEIGHT POINT POSITION IN CARD (RED, GREY, GREEN)

Note:
RED = Severe undernutrition (Danger)
GREY = Moderate undernutrition (Poor)
GREEN = Well nourished (Good)

Codes for data source:
1 = growth card
2 = village register/notebook
3 = both growth cards and village register/notebook.

SECTION I: OBSERVATIONS:

53. OBSERVE the following and indicate (1=Yes) if the condition exists and (2=No), if it does not.
    1. Animal dung visible in the house ......
    2. Animals in the living house ......
    3. Heap of garbage within 10m from the house .....
    4. Human faeces within 10m from the house .....

54. OBSERVE the following and indicate (1=yes) if the condition exists and (2=No), if it does not.
    1. Latrine not housed .....
    2. Latrine housed but not ventilated ..... .
    3. Latrine, no door ....
    4. Latrine not covered .....
    5. Latrine not clean ....
       (e.g.human faeces seen on top of latrine).

55. OBSERVE the following about the house in which the mother and child sleep.
    (a) House roof is made of ....
    (b) Walls are made of .....
    (c) Floor is made of .....

    Codes for Q. 55(a)- Q. 55(c)

    1 = Iron sheets 2 = Grass/ maize stems or leaves
    3 = Soil and trees 4 = Cement 5 = Soil bricks

APPENDIX E:

CHECK LIST OF ASPECTS COVERED DURING KEY INFORMANT INTERVIEWS AND FOCUS GROUP DISCUSSIONS

These included information on:

- Major child health problems in the area, and measures normally taken.
- Advocacy and awareness creation seminars that have been undertaken.
- Who attends the seminars-mothers, fathers, both father and mother.
- Major household income sources.
- Women income generation activities, women income generation groups.
- Child weaning practices.
- Attitudes of parents on village Health day activities (including growth monitoring).
- Whether village Health workers motivated, does the village pay them?, What are terms of payment (food, money, work for them?).
- Whether there child day care health centres, and how they are operated.
- Whether child health and nutritional status is an agenda in village meetings.
- Deliberations of village meeting on interventions regarding undernourished children last quarter
- Knowledge of mothers on interpretation of child nutritional status from growth cards.
- Any food taboos and reasons attached to them.