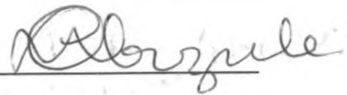# WATER AVAILABILITY AND NUTRITIONAL STATUS

OF UNDER FIVE CHILDREN

LIVING IN PERI-URBAN SETTLEMENTS

IN LUSAKA, ZAMBIA

Submitted in partial fulfilment

of the requirements of Master of Science

Applied Nutrition Programme

University of Nairobi - Kenya

By

CLARE MWILA MBIZULE

Date: 26|10|07
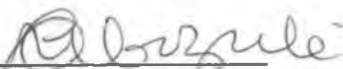
DECLARATION

I CLARE MWILA CHIPIMO- MBIZULE declare that this is my original work and has

not been submitted for examination in any other University.

CLARE MWILA CHIPIMO-MBIZULE

Date: 26/10/07

The thesis has been submitted for examination

with our approval as University Supervisors:

Prof. Nelson Muroki

(Associate Professor)

Date: 26/10/01

Department of Food Technology and Nutrition

Applied Human Nutrition Programme

DEDICATION

This work is dedicated to my children

Yambandiwe, Chiti and Kalelelya Mbizule

I took time away from being with you

Thank you for allowing me the leave of absence!

To Jeff – Thank you! More than you will ever know,

you provided the inspiration that led me

to grasp the future that I had

otherwise been too afraid to embrace

TABLE OF CONTENTS

CHAPTER ONE - INTRODUCTION)

CHAPTER TWO - LITERATURE REVIEW

CHAPTER THREE (STUDY SETTING)

CHAPTER FOUR - RESEARCH METHODOLOGY

CHAPTER FIVE - RESULTS

CHAPTER SIX - DISCUSSION

CHAPTER SEVEN - CONCLUSIONS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

ACKNOWLEDGMENT

ABSTRACT

This study examined the difference in nutritional status of children living in Chainda and Kamanga compounds, both of which are high density peri-urban settlements in Lusaka, Zambia. The focus of the study was on how water availability, diarrhoeal disease and parasitic infection influence the nutritional status of children under five years of age.

Residents of Chainda compound which was designated the poor water availability (PWA) area experience chronic water shortages. There is one borehole in the compound that supplies four public water standpipes. One standpipe serves an average of 325 households. Water is however available from these points at certain times of the day. Often the borehole breaks down leaving residents without water for days at a time.

Kamanga compound was designated the improved water availability (IWA) area. Irish Aid, an international NGO, has completely revamped the water supply system in this compound. There are 6 boreholes and these supply 14 public water standpipes. Each standpipe serves an average of 125 households. Residents of the IWA area are able to draw unlimited quantities of water throughout the day. On average, a resident of the PWA area takes 70 minutes to draw one 20 litre water load, as compared to 20 minutes for his/her counterpart living in the IWA area.

ix

Households in the two compound were randomly sampled (124 in PWA and 120 in IWA areas respectively). The study findings indicate that the amount of water drawn for daily use by households in the PWA area (101.45 litreS) was not significantly different from that collected by households in the IWA area (98.92 litres).

One week diarrhoea prevalence was not significantly different in the two study areas . Over half of the index children had diarrhoea in the one week prior to the survey (50.8% and 53.3% in the PWA and IWA area respectively). The prevalence levels peaked in the 24-35 month age group and then declined by over 50% in the older age categories. Parasitic infection rates were significantly lower in the IWA area as compared to the PWA area (11.7% and 21.8% respectively). This was likely because in the IWA area children were dewormed more regularly than their counterparts in the PWA area.

The daily dietary and caloric protein intake of index children (which were 1774 kcal and 39.7 gms protein in the PWA area and 1681 kcal and 34.5 gms protein in the IWA area) were higher than the levels recommended by FAO for children in this age group. The major nutritional problems of the study children were stunting and underweight and though not significantly different, the malnutrition rates were higher in the IWA area than in the PWA area (44.2% and 35% of children in the IWA area and 42% and 28.2% of children in the PWA area were stunted and underweight respectively).

DEFINITIONS

Water availability - The presence of readily useable and accessible water supplies.

Water accessibility - For urban areas, this is defined as the presence of a public water standpipe within 200 metres of the household.

Diarrhoeal disease - The passage of three or more loose stools within a 24 hour period.

Index child -   A single child aged between 12 and 60 months, pre-selected from among

The eligible children in a sampled household

ABBREVIATIONS

ACC/SCN   - Administrative Committee On Co-ordination - Sub Committee on Nutrition Of

The United Nations

Anthro   - Anthropometric Calculating Programme

CSO   Central Statistics Office (Zambia)

DD   Diarrhoeal Disease

gm(s)   Grams

HAZ   Height-for-age Z score

HH   Household

HHH   Household Head

IMF   International Monetary Fund

IWA   Improved Water Availability Area

IRC   International Reference Centre For Community Water Supply And Sanitation

K   Kwacha - the Zambian Currency

(100 ngwee = K1; K100 = US\$ 0.20 at the time of the study)

KAP   Knowledge, Attitudes And Practices

Kg   Kilogram

LCC   Lusaka City Council

Lcd   Litres Per Capita Per Day

Lt(s)   Litre(s)

LWSC   Lusaka Water And Sewerage Company

Ml   Millilitres

mm	Millimetres
MOH	Ministry of Health (Zambia)
NCHS	National Centre For Health Statistics
NGO	Non-Governmental Organisation
NS	Not Significant
ORS	Oral Rehydration Salts
PAHO	Pan American Health Organisation
PHC	Primary Health Care
PWA	Poor Water Availability
SAP	Structural Adjustment Programme
SD	Standard Deviation
SPSS	Statistical Package For Social Scientists
TNTC	Too Numerous To Count
UHC	Unfit For Human Consumption
UNICEF	United Nations Children's Fund
WAZ	Weight-for-age Z score
WHZ	Weight-for-height Z score
WHO	World Health Organisation

CHAPTER ONE

1.0 INTRODUCTION

In the developing world, the most usual causes of malnutrition are poor dietary intake aggravated by poor health due to infectious disease (especially diarrhoea) and parasitic infection with the three often bound together in a vicious cycle. With explosive population growth and economic decline, many developing world citizens are moving to urban centres in a fallacious search for improved living conditions (Mandle., 1982, WHO., 1977, Djukanovic et al., 1975). The majority find residence in low income, informal settlements in urban and peri-urban areas. The environment in these settlements is characterised by overcrowding, poor excreta disposal and poor water supply facilities (Harpham et al., 1988).

Aside from the inadequate/ inappropriate dietary intake which is virtually guaranteed in such low income communities, poor health due to diarrhoeal disease and parasitic infection are the next most serious threats to nutritional status espiecally of Under Five children (Cook., 1991, Keutsch., 1978, Sack et al., 1978, WHO/UNICEF., 1985). The common denominator underpinning the diarrhoeal disease and parasitic infection is poor water supply to and/or quality of water consumed by households, situations that provide few options for safe human excreta disposal or effective hygiene practices.

Water supply is critical to health as recognised by the PHC strategy endorsed by all the countries of the world at Alma Ata in 1978. The fact therefore, that estimates attribute 5 – 10% of child deaths among children in the developing world to water related diseases, makes water

1

availability in relation to nutritional status an important aspect to consider (Bradley., 1986, World Bank Tech. Papers., 1985, IRC., 1988).

Figure 1: Influence of poor water supply on nutritional status

POOR NUTRITIONAL STATUS

Infectious diseases

(diarrhoea)

Parasitic infection

Poor personal and food hygiene especially with respect to handwashing

Highly contaminated environment, flies are effective vectors of disease

Inadequate human waste disposal facilities

POOR WATER SUPPLY
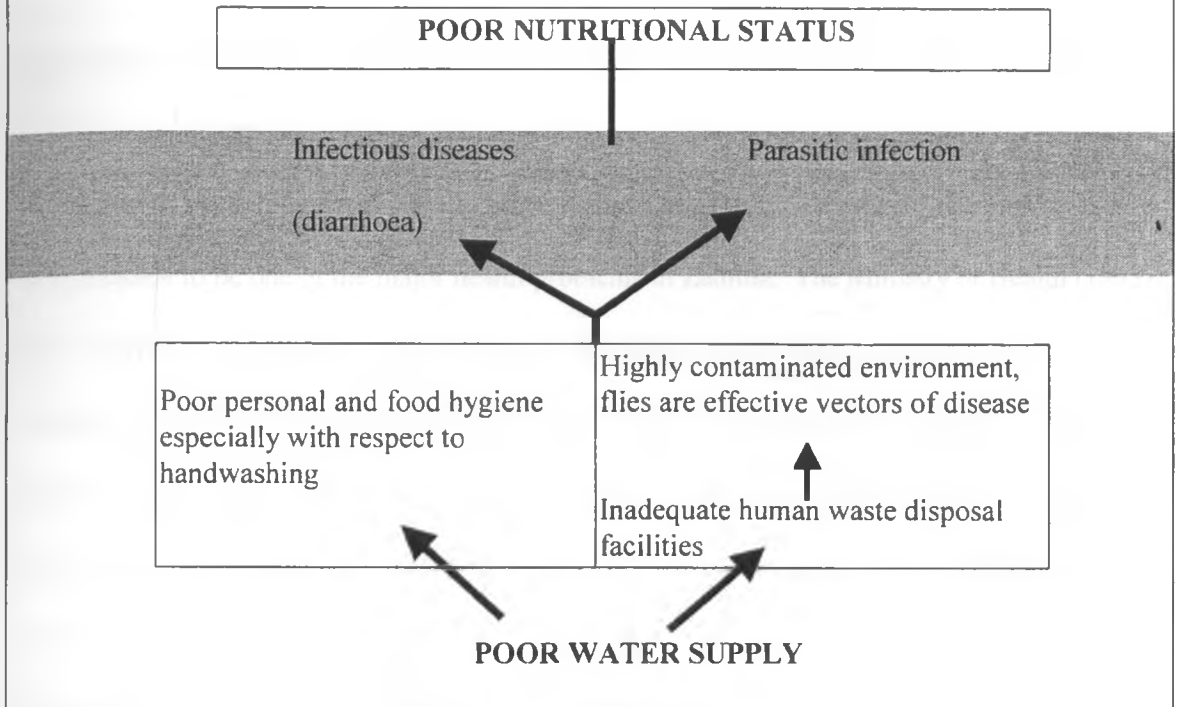
In Zambia, two provinces, Lusaka and Copperbelt, have seen a very rapid increase in their populations, due to a very high rate of urbanisation. Lusaka, the capital city of Zambia, has a population density of 48.4 persons per square kilometre compared to a national average of 11 persons per square kilometre (Central Statistics Office, 1993).

The majority of Lusaka residents live in settlements on the fringes of the city, in areas that in many cases do not have a water supply system in place. For the few settlements that do, the systems were likely constructed by local authorities in response to frequent outbreaks of epidemics like cholera and dysentery in these areas. Because the systems were designed to service populations of a much smaller size than they currently do, the resulting increased strain

on the available water resources supplied by these systems, has led in many instances to their frequent breakdowns, or has necessitated the need for rationing water usage, resulting in intermittent water supplies to residents.

Consequently, hygiene in these areas is poor, because of the water shortages. This results in infection and diarrhoea, which in turn precipitate or aggravate malnutrition which is already a public health concern in these communities (Kaite et al., 1992). Diarrhoeal diseases have been and continue to be one of the major health problems in Zambia. The Ministry of Health (1993), cites diarrhoeal diseases as a leading cause of death and mortality among pre-schoolers in Zambia. Through the combined efforts of the Zambian government and NGO's, efforts are being made to increase water access and availability to peri-urban settlements in Lusaka. One such example is Kamanga compound, where Irish Aid, an international NGO funded by the Government of Ireland, have installed water standpipes throughout the settlement, providing all Kamanga residents access to water within a 200 metre radius of their homes.

So far in Zambia, no studies have been carried out to elucidate the effects of improved water availability on the nutritional status of the residents in peri-urban communities that have benefited from improvements in the level of water supply in their communities, and particularly with regard to the very vulnerable group of children under five years of age. This study therefore sought to provide information on the nutritional status of children under five years of age living in two peri-urban high density settlements (namely Kamanga and Chainda) under different conditions of water supply and availability. As mentioned above, water access has been improved in Kamanga, and water is available to residents, throughout the day and without

3

limit. In Chainda, no efforts have as yet been made, to increase the level of water access and availability of residents. In this study, Kamanga will be designated the improved water availability (IWA) area, while Chainda will be referred to as the poor water availability (PWA) area.

The main objective of this study is to assess the influence of water availability on the nutritional status of Under Five children living in two peri-urban areas in Lusaka, Zambia, under different levels of water supply and availability. In order to achieve this objective, the following specific objectives were formulated:

1. To determine the environmental sanitation conditions prevailing in Kamanga (IWA area) and Chainda (PWA area).

2. To determine the total and faecal coliform counts in water consumed by residents in the study areas.

3. To determine the prevalence of diarrhoeal disease and parasitic infestations among index children in these areas.

4. To determine the average daily intake of protein and calorie among index children.

5. To determine the nutritional status of children under five years of age, using anthropometric indicators.

The following hypotheses were formulated:

1.   There is no significant difference in the nutritional status of children living in the IWA area and those living in the PWA area.

2.   There is no significant difference in the prevalence of diarrhoeal disease and parasitic infection among index children in the two study areas.

The study results are expected to be of particular benefit and interest and provide baseline data to the NGOs currently working in the two chosen peri-urban settlements as well as other NGOs implementing health and nutrition programmes in similar communities in Zambia.   Policy makers both in government and the Lusaka City Council will also benefit from the results.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Since the 1980's, rapid population growth has been concentrated largely in developing countries. In these countries, the largest family sizes are most common among the poor. Among the reasons given for their high fertility rates are; the high infant and child mortality rates experienced in their countries, early marriages, limited information about and access to safe contraception methods (World Bank, 1984). Children are often looked upon as a form of investment, providing short term benefits if they work during childhood and long term benefits if they support their parents in old age (World Bank, 1984).

The rapid population growth in developing countries has led to a lowering of the living standards of their people, by reducing the ability of their governments to provide and/or improve various social, health and economic services. Any existing services are subject to increased strain because they have to cater for a population that is far in excess of their original design capacity (Harpham et al, 1988; White, 1986). The deficiency in these services is most evident in urban areas, particularly in high density settlements that are commonly located on the fringes of the city. Water supply and waste disposal facilities are particularly deficient in these settlements and this has a bearing on personal and food hygiene with consequent effect on nutritional status. The impact of water supply deficiencies on the health and nutritional status of the peri-urban populations in developing countries is discussed in this chapter.

2.2 Rural-urban migration and living conditions in urban areas

Urbanisation in developing countries is taking place at a very rapid rate (Harpham et al., 1988). The drought experienced in the Sub-Saharan region over the last five years or so coupled with environmental degradation (aggravated by such practices as rampant tree felling either for fuel wood or to create farm land), has greatly reduced the ability of rural families to produce sufficient food to meet their needs. The declining living standards in rural areas and the growing pressure on available land arising from the explosive population increase, has led to an influx of rural dwellers into urban centres. The rural-urban migrants are attracted to the cities by often false illusions of higher incomes, improved social amenities and freedoms of urban life (Djukanovic et al, 1975). It is estimated that by the year 2000, 44% of the population will be living in urban centres (Harpham et al, 1988; World Bank, 1971). Harpham et al (1988), also note that many of the rural-urban migrants are unskilled and most can only find employment as casual labourers, domestic workers or street hawkers. These jobs do not pay well enough for one to afford good quality housing in good residential areas. The migrants therefore, mostly live in informal settlements, or slums located on the periphery of the city where it is easier to escape forceful eviction than from valuable and better located land closer to the city centre.

Poor housing is the most visible sign of a low-income area. Common construction materials vary from country to country or from city to city but include sun dried mud bricks, timber, paper cartons and iron or asbestos sheeting. Roofing materials include flattened drums, iron, asbestos or plastic sheets and grass thatch while the threat of eviction reduces the incentive of residents of these communities to invest in home improvements, possibly poverty too, limits their ability to afford durable house construction materials. Harpham et al (1988) further note that the

7

informal/illegal nature of these settlements and their location, places them far beyond the reach of the inner city network so that social services such as water and excreta disposal are usually lacking altogether. Roads and health services are also generally unavailable. The settlements are overcrowded and congested thus contributing to high disease incidence and mortality. Factors such as vermin, lack of rubbish disposal, poor personal hygiene, contamination of food, low literacy and inappropriate weaning and other feeding practices, common in such environments, further threaten the already poor health of peri-urban residents

2.3 Rural-urban migration in Zambia and the rise of peri-urban settlements

Zambia today ranks among the most highly urbanised countries in sub-Saharan Africa. According to the 1993 census data (Central Statistics Office, 1993), 42% of Zambia's population, about 3.2 million people, live in urban areas. The Lusaka and Copperbelt provinces of Zambia have been identified as the most highly urbanised amongst the 9 provinces. These provinces also have the highest population concentrations of 48.4 and 46.3 persons per square kilometre respectively, compared to an overall national average of 11 persons per square kilometre (CSO, 1993). Prior to independence in 1964, the colonial government severely restricted the movement of indigenous people to the towns. Many who did come were attracted by the prospect of employment on the copper mines located in Copperbelt Province. In 1973, the Zambian government enacted Article 24(1) of the Constitution of Zambia removing restrictions on the movement of people to towns. This resulted in a phenomenal influx of many rural Zambians into towns and cities. Their prime motivations for migration being the quest for better living conditions and job opportunities. The cities and towns grew at an alarming rate

and in the case of Lusaka, the population increased from just 55,000 persons in 1954, to over 1.3 million today (CDG/DESWOS, 1983).

The urban migrants required housing and other social services such as water, roads and electricity. Sadly, neither the Urban Councils, nor employers could cope with the demand, and many of the migrants found themselves living in squatter compounds. Plots on which the migrants built were allocated to them by the local Party Chairmen of the ruling party, in much the same way as their village chiefs apportioned them land back home (CDG/DESWOS, 1983). The housing structures built were mostly temporal and rudimentary, often constructed of mud bricks with grass thatch or plastic sheet roofing. In recent years, some of the squatter settlers have improved their housing, building houses with more permanent materials, but the lack of finance and the insecurity of tenure continues to constrain others. Available services in these peri-urban settlements are at best minimal and woefully inadequate, and at worst non-existent. Of all the problems facing the residents of these settlements, the lack of access to adequate amounts of water for their domestic use ranks as the most critical. Any services that have been made available within the peri-urban settlements were in response to periodic cholera and dysentery outbreaks that have become increasingly more frequent over the last 7 years.

2.4 Water and its relationship to diarrhoeal disease

Water plays an essential role in supporting human life. It is a daily necessity and a key factor in human health and well being. The average human requires between 2.5 and 5 litres of water per day for normal functioning (Tebbut, 1988; IRC, 1988), but beyond this, other amounts are required for personal hygiene, cooking, washing clothes and utensils etc. While the amount of

water used for food preparation and cooking is relatively constant, the availability of water in the community and the amount of time required to get it, greatly influences the total amount of water used for other purposes (IRC, 1988). Because of its central role in daily life, water has great potential for transmitting a wide variety of diseases (Schneider et al., 1978; Tebbut, 1988).

In Africa and the rest of the developing world, more than 20% of children die before their fifth birthday. The predominant causes of death are infectious disease and malnutrition. Water related diseases, of which diarrhoea is the most common infection (Cairncross et al., 1991), account for 5-10% of the deaths overall (Bradley, 1986). A water related disease is defined as one related in some way to water or to impurities in water (Feachem, 1986; Cairncross et al., 1991). Bradley (1986), defines four major categories of such diseases i.e. water vectored, water based, water washed and water borne (see Table 1). Only the latter two are closely related to the prevalence of diarrhoeal disorders in developing countries (Schneider et al., 1978).

Table 1: Classification of the water related infections

Transmission mechanism	Definition	Prevention strategy	Examples
1. Water borne	Disease agents are present in water and cause infection when a sufficient dose is ingested	Improve water quality	Cholera Ascariasis Bacillary dysentery Giardiasis Gastro-enteritis Diarrhoea Entero-viruses
2. Water washed	Disease arises due to poor personal and/or domestic hygiene	Increase access to amount of H_2O. Improve hygiene	As in 1 above
3. Water based	The disease agent spends a part of it's life cycle in a host that lives in water	Improve quality Decrease need for water contact & control snail populations	Trachoma Scabies Louse borne fever
4. Water related insect vector	The insects that carry disease to humans breed in or near water	Improve surface water management and destroy insect breeding sites	Sleeping sickness Malaria
5. Infection related to defective sanitation	Parasitic ova are present in the soil or food contaminated by faeces	Sanitary disposal of faecal material Improve food hygiene	Ascariasis Hookworm

10

The faecal-oral group is the largest of all the water related infections and includes many of the

water borne and water washed diseases (Bradley, 1986). Acute diarrhoeal disease is a major

outcome or at least a definite symptom of the diseases in the faecal-oral group (Cairncross et al.,

1991). The main cause of acute diarrhoea is infection of the gut with viruses or bacteria that are

present in the faeces of infected persons and must be ingested by the host in order to gain access

to the gut (Cook, 1991). These micro-organisms and also parasitic ova are potentially water

borne but can be transmitted by any other faecal-oral route as shown in Figure 1.

Figure 1 Faecal-oral transmission route (Adapted from Laike, 1992)
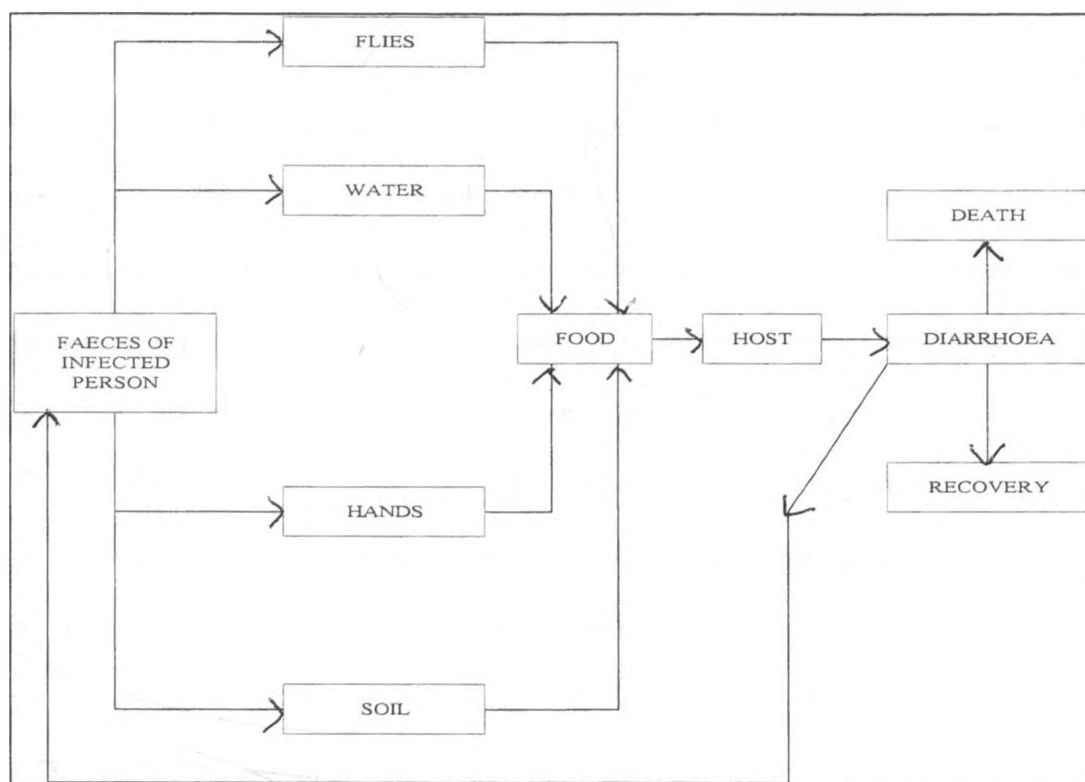
Generally, water related intestinal infections increase malnutrition, which in turn predisposes the

child to even more severe infections (Bradley, 1986). A vicious cycle of malnutrition and

infection results, from which few children survive.

11

2.5 Diarrhoeal disease and nutritional status

It is a well established fact, that morbidity and particularly diarrhoeal disease, has a negative influence on nutritional status and is infact, a major factor in the causation or aggravation of malnutrition, especially among children under five years of age (Cook, 1991; Keutsch, 1978; Sack et al., 1978; WHO/UNICEF, 1985). Studies carried out in Guatemala by Guzman et al (1968), found that children in villages with environmental improvements showed slightly better growth than children in villages without similar improvements. However, the growth was still far below the expected standard. Several other authors have found evidence of a linkage between diarrhoeal disease and growth faltering (Guzman et al, 1968; McGregor et al., 1961).

Mata et al, (1972), in a community based prospective study, found that the rate of enteric infections in infants at 3 and 6 months correlated well with their growth between 3 and 12 months. Infants with the highest rate of infections had significantly lower weight gains between the age of 3 and 12 months. As enteric infections increased, growth retardation increased. During the first three months of life, all these infants showed adequate growth performance. This was attributed to the fact that in the first three months of life, breast milk provides enough energy and nutrients to support normal growth. The child also acquires passive immunity from the mother's milk. An evident departure from the normal growth pattern was observed after three months of age. This can be explained by the fact that weaning foods are often introduced to the child at this age. In the absence of safe water and excreta disposal facilities, these foods are prepared under very poor hygienic conditions thereby exposing the infants to the micro-organisms that cause diarrhoeal disease, which consequently leads to poor nutritional status. In addition, poor diarrhoea management as reflected by inadequate knowledge about the causes

12

and prevention of diarrhoea can exacerbate the problem. The poor growth associated with diarrhoeal disease is due to a number of factors which include malabsorption of nutrients, anorexia, altered metabolism and nutrient loss. These factors are discussed below.

i.   Malabsorption of nutrients

Enteric viruses damage the surface of the gastro-intestinal tract, leading to the rapid passage of food through the gut, which allows little time for nutrient absorption. The enteric viruses also affect the normal maturing process of intestinal villi. Since digestive enzymes and nutrient transport systems are located on the villi, malabsorption of nutrients is further aggravated (Tomkins et al, 1983). This results in a gradual deficit in physical growth if the diarrhoea episodes are frequent and/or prolonged

ii.   Anorexia

Children receiving solid foods have been shown to reduce food intake during diarrhoea (Hoyle et al., 1980, Tomkins et al., 1983). The withholding of certain foods by parents during diarrhoeal disease may compound anorexia. Additionally, in severe diarrhoea, the buccal mucosa is very dry, making it very hard to swallow food, with consequent decrease in food intake (Tomkins et al., 1983; WHO 1991).

iii.   Altered metabolism

Infections lead to a variety of metabolic responses, and there are profound effects on the utilisation of diet and endogenous nutrient stores. For every $1^{\circ}C$ rise in body temperature, there is an increased energy expenditure of between 10 - 15% (WHO, 1991). Clearly then, the nutrient requirement of the body is increased during infection. If the child is not having a sufficient intake of food, whether due to anorexia or insufficient food being available to cater

13

for the child's increased needs, the body's stores of carbohydrate are rapidly depleted, particularly as the effective use of fat is also inhibited (Tomkins et al., 1983). The body stimulates gluconeogenesis in an effort to maintain the basal metabolism (Tomkins et al., 1983). Protein catabolism is enhanced to provide substrate for the synthesis of acute phase proteins that are necessary during the various phases of the infection, leading to a decrease in the lean body mass. As a result of this and the decreased protein intake, the synthesis and deposition of new tissue is slowed down or stopped altogether resulting in a slowing down of child's growth. In the short term, repeated episodes of diarrhoeal disease manifest as wasting and underweight. Over a longer period of time, stunting of the child's growth will ultimately take place.

iv.   Nutrient loss

The cells of the intestinal mucosa are in a continual state of turnover and in a healthy subject, the nutrients resulting from the breakdown of these cells are generally well re-absorbed with minimal faecal losses. Infection may cause increased losses and/or poor absorption as any cause of intestinal damage is likely to lead to increased rates of cell shedding. Increased permeability of the intestinal mucosa may also occur, allowing leakage of endogenous nutrients between the intestinal cells, with considerable nutrient loss in the faeces (Tomkins et al, 1983; WHO 1991).

2.6 Water and parasitic infection and their relationship to nutritional status

Hookworm and Ascaris are intestinal parasites whose spread is perpetuated in environments with poor personal hygiene and poor excreta disposal practices. Both are therefore of interest in studies on sanitary conditions of communities. Both parasites lay numerous eggs that escape

14

their host in the faeces and their ova need to mature in warm moist soil before becoming infective to man.

The Ascaris ova must be ingested and usually gain access to the host via fingers or food and so increased use of water for washing food and hands, together with improved sanitation measures can greatly reduce transmission (Bradley, 1986). The Ascaris adult worm is between 10 and 25 cm long, weighs about 3gms and lives in the small intestine where it feeds on partially digested food, thereby using up a considerable amount of the food taken in by the child (Bradley., 1986). If the child is already on a low dietary intake as is common with most children in the developing world, Ascaris infection can precipitate malnutrition (Cook, 1991).

The Hookworm larvae penetrate the skin from damp contaminated soil (Bradley 1986). The major preventive strategy is the hygienic disposal of faecal matter and the wearing of shoes especially when entering pit latrines. The major nutritional problem associated with Hookworm in anaemia.

CHAPTER THREE

STUDY SETTING

3.1 The country

Zambia is a landlocked country in Southern Africa. It covers an area of 753,000 square kilometres and lies between 8° and 18° south latitude and between 22° and 33° east longitude. The country is bordered by eight neighbours with Malawi and Mozambique on the Eastern border, Zimbabwe, Botswana and Namibia to the South, Angola to the West and Zaire and Tanzania on the Northern frontier. Zambia was a British colony and gained independence in October 1964. Administratively, the country is divided into nine provinces and fifty-seven districts. The nine provinces are Central, Copperbelt, Luapula, Eastern, Lusaka, Southern, Western, North-Western and Central. Zambia has had a multi-party system of government since 1991, when multi-party politics were adopted, following 27 years of one party, socialist rule. Zambia has a total population of nearly 9 million people and 73 tribal groupings.

The Zambian economy is heavily dependent on copper, which is the country's main export, accounting for over 80% of foreign earnings (CSO, 1993). When world copper prices slumped in 1975, Zambia experienced a sharp decline in copper revenues leading to an acute shortage of foreign earnings. Inflation increased and government spending on essential services such as health, education and agricultural production inputs declined. These problems persist even today (United Nations, 1994). The external debt burden of Zambia currently stands at around US $800 per head - one of the highest in the world.

16

In 1992, the newly elected Movement For Multi-Party Democracy (MMD) government embarked on a structural adjustment programme (SAP) in partnership with the World Bank and the International Monetary Fund (IMF). Cost sharing was introduced where health and education services had previously been free to the people. The government is currently making efforts to diversify the economy with particular attention being paid to stimulating agricultural production. The last four years of the structural adjustment programme have seen massive lay offs following the privatisation of many parastatal companies.

3.2 Climate and vegetation

Zambia lies on the Central African plateau. The altitude varies from 900m in the south east to over 2000m in the north east. The vegetation is mainly savannah woodland with a small amount of forest and swampland and the climate is sub- tropical with three distinct seasons;

1. The cool dry season which begins in mid-April and ends mid August.
2. The hot dry season which begins in mid August and ends in late October.
3. The rainy season which begins in early November and runs through to mid April. The heaviest rains are experienced between December and March.

The northern half of the country receives between 1100 to 1400mm of rain per year, while the rest of the country receives between 600 and 1100mm per year.

3.3 The study sites

Lusaka is the capital city of Zambia and is located in Lusaka province. The city has a diverse mix of the 73 Zambian tribes. Kamanga and Chainda compounds are located within urban Lusaka and in close proximity to each other. This facilitated movement of the principal researcher between the two study sites, and made them an ideal choice for the study. The communities also have similar ethnic and employment profiles and both areas were accessible during the rainy season when the study was conducted.

Chainda compound

Chainda compound is a high density peri-urban settlement, located in Lusaka province and 20 km east of Lusaka, the capital city of Zambia. It is an illegal settlement which emerged in the mid 1960s when people re-settled there after being evicted from the site chosen for the construction of the present International airport. Chainda is encircled by a road that separates it from a low density residential area to the north, small holder farms to the south and west and a large commercial farm to the east. The roads in the settlement are narrow and poorly maintained. The houses in Chainda are reasonably well spaced and there is a general sense of order and tidiness about the settlement.

Information available from a socio-economic analysis carried out by World Vision (1993) indicates that the population of Chainda is close to 8000, with approximately 1300 households. Eighty five percent of the houses in Chainda are constructed of sun dried bricks and the remainder of the houses of cement blocks. The roofing material of the houses is either

18

corrugated iron sheets or flattened drums, most often held down by heavy stones, to prevent them being blown off in heavy storms.

There is a clinic in the area that was constructed by the Rotary Club of Lusaka. On completion, the clinic was handed over to the Ministry of Health who provide staff and drug supplies. The clinic provides out patient services only, and patients have to pay for treatment and drugs. Serious health cases are referred to the University Teaching Hospital about 25km away in Lusaka city. The clinic has no ambulance and as yet no maternity facilities available although a maternity wing is currently being built at the clinic by the Rotary Club of Lusaka, and is expected to be ready before the end of 1996.

A few years ago, the Lusaka City Council (LCC) sunk one borehole at the clinic and this essentially caters for the whole of Chainda. The borehole supplies five public water standpipes, scattered through the compound, although only four were functioning during the time of the study. Each standpipe serves an average of 325 households. Water is only available from the standpipes around 5am, noon and at 4pm, for no more than two to three hours at a time. Water collection is primarily the responsibility of the women. Only single men living alone collect their own water.

The women have to wake up as early as 4 am and queue for water. Leaving home this early makes the women vulnerable to attack and rape. The women, however, feel they have little choice but to venture out at such an hour if they are to avoid long treks to the nearby farms and residential areas where they sometimes are forced to draw water. In most cases, the women try to ensure that they move together in groups to minimise the risk of being caught alone by rapists or thieves.

19

The women make several trips back and forth from their homes to the water points, until they have collected their daily requirement of water. Often the standpipes run dry before their needs have been met. When this happens the women have to wait until the water starts flowing again later on in the day. Sometimes it becomes necessary for them to look for water in the residential and farm areas surrounding their compound. This is especially so on days when the standpipes do not yield any water at all, usually because the pump has broken down which happens regularly. At such times, all the residents have to resort to drawing water from sources outside of their compound. During the final survey period (which lasted 6 days), there were two days when water was not available at all within the compound.

Only ten households (less than 1%) have electric power in their homes. For those without this facility, the main cooking fuel is charcoal and lighting is by way of candle or home made paraffin lamps. The majority of people in formal employment in Chainda are employed as domestic servants, watchmen, drivers and labourers on the surrounding farms. A few are self employed, mainly as marketeers or street hawkers.

Chainda is still listed as an illegal settlement. World Vision, an international NGO currently working with the people of Chainda to improve their livelihood, has reached an agreement with the Lusaka City Council on the legalisation of the settlement. The formal papers giving legal status to Chainda are expected to be signed early in 1996. When this is done, the local council with the assistance of World Vision Zambia will undertake improvements in Chainda in the course of 1996.

Kamanga compound

Kamanga is also a high density peri-urban settlement, located in Lusaka Province. It lies 16 km east of Lusaka, along the same road that leading to Chainda. Kamanga is completely enclosed by low density residential areas. According to information made available by Irish Aid, the compound was first settled in the mid 1960s, although the majority of people living there moved into the area in the 1980s. Roads within Kamanga are very poor, and both the house and plot sizes are very small. Consequently houses in the settlement are very close together giving the compound a very crowded appearance.

A baseline survey carried out for Irish Aid and CARE International (Mukuka et al.,1993), estimates the population to be around 9000 persons, with about 1500 households. The majority of Kamanga residents in formal employment work either as farm labourers, house servants, watchmen, bakers, cleaners, typists, electricians or carpenters. Those in the informal sector are mostly hawkers engaged is selling foodstuffs, charcoal, home brewed beer, firewood and other commodities whether at home or at the market. Practically all of the houses in Kamanga (about 90%) are constructed of sun dried mud bricks. Roofing material is either scrap iron sheets, pieces of asbestos sheets or plastic sheeting held down by stones. The remaining 10% of the houses in Kamanga are constructed of cement blocks. None of the residents have electric power in their homes, and the main cooking fuel is charcoal and lighting is by way of candle and home made paraffin lamps.

In contrast to Chainda, a very different water supply situation exists here. Irish Aid, an international NGO, supplied the financing for 6 boreholes within the compound. These supply 14 public water standpipes, each of which serves an average of 125 households. Every

household in Kamanga is within 5 - 10 minutes walk of a water point. Each household pays a monthly water levy of K200 (approx. US$ 0.40) as a contribution towards electricity costs incurred in running the boreholes. Water is available to the residents from the water points throughout the day. There is no limit to the amount of water a resident can draw. The borehole pumps are normally shut off around 4 pm in the afternoon but there is sufficient water held in the overhead storage tanks to meet the needs of the residents overnight. In the morning, Kamanga residents may spend up to 15 minutes at the maximum queuing for water at the standpipes. At other times of the day, no queues are observed. Only one house in Kamanga has piped water into the house through direct connections to a public water standpipe. The house owner funded the pipe connections. Irish Aid still retains the responsibility for running and maintenance of all of the boreholes, except for one which has been handed over to the Lusaka Water and Sewerage Company (LWSC). The long term plan is to hand over the responsibility for all the boreholes to this company.

The nearest clinic for the residents of Kamanga is in Chelston, which is about 3 km away, and an average walk of 15 minutes. The clinic has maternity facilities and will be upgraded to the status of a district hospital in 1996. Clinic staff conduct regular immunisation outreach services to Kamanga. Kamanga was until recently an illegal settlement. With the assistance of Irish Aid, the legal status of Kamanga has been formalised and environmental improvements are being carried out. Irish Aid is currently working on a project to encourage the construction of Ventilated Improved Pit (VIP) latrines by residents. CARE International is also currently implementing a community managed health project, focusing on health education and immunisation.

22

CHAPTER FOUR

RESEARCH METHODOLOGY

4.1 Study design and study period

The study was a cross-sectional survey and was descriptive and analytical nature. It was carried out between January and March 1995. The two study areas chosen were Kamanga compound where Irish Aid had improved water access and availability, and Chainda compound which has yet to benefit from water supply improvements.

4.1.1 The study sample

The sampling unit was the household and a pre-study census carried out before the main survey, established a sampling frame of all potentially respondent households.

4.1.2 Inclusion criteria

Any household having at least one child aged between 12 and 60 months, which child had lived in the study area for at least 12 months prior to the survey was included in the sampling frame.

4.2 Sample size and sample size determination

The data of the Zambia Demographic and Health Survey (Kaite et al., 1992) show that 25% of Zambian children living in urban areas are underweight. Sample size was calculated using this value. The minimum sample size was arrived at using the following formula (Fisher et al.,1991).

$$n = \frac{2(z)^2 \, Xp^1 q}{d^2}$$

where;

n = desired sample size

z = the standard normal deviation, usually set at 1.96, corresponding to the 95% confidence interval

p_1= the proportion of the children with malnutrition in the 'experimental' population

p_2= the proportion of children with malnutrition in the 'control' population

$q = 1-p^1$

$d = p_2 - p_1$

The respective values taken were;

$p_1 = 0.25$ (25 % estimate from Health and Demographic Survey 1992 for urban areas - expected for Kamanga)

$p_2 = 0.35$ (35% is the expected underweight level in Chainda)

$d = 0.10$

$z = 1.96$

$q = 0.75$

The calculated sample size was therefore;

$$\frac{2(1.96)^2 \times 0.25 \times 0.75}{(0.1)^2} = 144$$

The total number of children required to be sampled in each area was therefore 144.

4.2.1 Sampling method

Chainda has five sections/sub-divisions while Kamanga has ten. The final sample frame had 361 and 432 households from Chainda and Kamanga respectively. Proportionate sampling was done to ensure adequate representation of households from each section as shown in Figures 2 and 3. Only one child (index child) was chosen from each household, using simple random sampling.

24

Fig.2 Summary of the procedure for the sampling procedure of index children in Kamanga (IWA area)

Stage 1	Purposive sampling of Kamanga compound

Stage 2	Pre-Survey census in the 10 sections of Kamanga

Stage 3	432 Households eligible for inclusion in the sample frame

Section	A	B	C	D	E	F	G	H	I	J
Eligible HHs	(37)	(29)	(45)	(34)	(54)	(47)	(55)	(31)	(50)	(58)

Stage 4: Proportionate random sampling of households (proportion = no. eligible in section X 144/432

	12	10	15	11	18	15	18	10	16	19

Stage 5: Simple random sampling of one eligible child (index) from each sampled HH

144 children

Fig. 3 Summary of the procedure for the sampling procedure of index children in Chainda (PWA area)

Stage 1	Purposive sampling of Chainda compound

Stage 2	Pre-Survey census in the 5 sections of Chainda

Stage 3	361 Households eligible for inclusion in the sample frame

Section	A	B	C	D	E
Eligible HHs	(68)	(75)	(43)	(92)	(83)

Stage 4: Proportionate random sampling of households (proportion = no. eligible in section X 144/361

	27	30	17	37	33

Stage 5: Simple random sampling of one eligible child (index) in the HH

144 children

In the final analysis, due to the constraints of time and money, data was collected on only 124 households in Chainda and 120 in Kamanga. However, as this number of households represented more than 80% of the sample frame, it was thought to be sufficient to give plausible results.

4.3 Study instruments

Data collection was done using a structured questionnaire (Appendix 2), focus group discussions, 24 hr dietary recall and anthropometric measurements. Laboratory examination of stool and household and standpipe tap water samples was also carried out.

4.3.1 Structured questionnaire

The questionnaire (Appendix 2) consisted of a series of structured questions covering demography, water and sanitation information, household income and expenditure, anthropometric measurements and 24-hour dietary recall

1. Demography

The demographic information for the description of the study population included; sex and age of all household members, their occupation, marital status and the relationship of all household members to the mother of the index child.

2. Water and sanitation information

The information required in this section included the distance travelled to water source, amount of water collected daily by each household and water treatment (if any) before use. The amount

of water collected by each household for their daily needs was estimated by making an assessment of the size of water container used to draw water. Care was taken to ensure that any additional amounts of water drawn in smaller containers, by children and/or family members other than the regular water collector were included. In addition, data on the availability and type of toilet facilities, quality of housing and size of the house were recorded.

3. Socio-economic information

Here, the survey sought to establish information on the household's expenditure over the previous month for specific items such as rent, cooking fuel, food, medical treatment, education and transport as well as the amount of income available to the household.

4. Child related information

Required information about the index child included whether or not the child had experienced diarrhoea in the 7 days prior to the survey, and if so, how long the diarrhoea had lasted. The respondent was also asked the age of the child (date of birth), birth order, birth weight (if known), whether or not the child had been treated for worms in the three months prior to the survey and if the child was fully immunised. Road to health cards were used to verify age and other information where applicable. Anthropometric measurements of index children were also taken. Height boards were used to take the length of children less than 24 months and height of those older than 24 months.

5. Anthropometric measurements

The nutritional status of all the study children was assessed by taking height and weight measurements with height boards and Salter scales.

27

6. 24- hour dietary recall

A 24-hour dietary recall questionnaire was administered to mothers of 40 randomly selected index children in each study site. The dietary recall recorded information on the types and quantities of food and snacks their children had consumed during the previous 24 hours. The average daily consumption of calorie and protein was calculated using Food Consumption Tables for East and Central Africa (West et al., 1987).

7. Parasitic infections

At the end of each interview, the mother was given a clean stool container and asked to collect a sample of the index child's first stool the following morning. The samples were collected on a daily basis and throughout the day by a specifically assigned guide in each area, and kept in a coolbox until they were delivered to the laboratory in the late afternoon. The guide rejected any samples that were more than a day old. The mother was given a fresh stool container and asked to collect a fresh stool sample the following day.

At the laboratory, the samples were kept in a refrigerator and examined after the fieldwork had been completed. The method used to prepare the stool samples for microscopic examination was the formal - ether concentration technique. The parasites that were of interest to the researcher in this study were Hookworm and Ascaris as these are the intestinal parasites that are commonly associated with poor excreta disposal practices as well as poor personal and environmental hygiene.

28

8. Bacteriological quality of the water

The researcher with the assistance of a laboratory technician from LWSC collected water samples of stored drinking and cooking water from residents of both compounds as per the protocol recommended by WHO (1984). These water samples were subjected to bacteriological testing by the technician. The method used to determine the total and faecal coliforms was the membrane filtration technique (WHO, 1984).

4.3.2 Focus group discussions

Focus group discussions were held with mothers of index children in both Chainda and Kamanga. A schedule of the discussions is reproduced in Appendices 3 and 4.

4.4 Implementation of the study

4.4.1 Selection and training of the enumerators

Census enumerators

A pre-survey census was carried out in each of the two study sites over a two week period from 9th January 1995, to determine which households were eligible for inclusion in the sampling frame. In Chainda, 3 local youths who had completed secondary school were chosen as enumerators because of their familiarity with the area and the community. In Kamanga, 3 community health workers were recruited. A simple questionnaire (Appendix 1), was drawn up to indicate the household number and the section in which the house was located.

The census enumerators were given simple training on how to approach the mothers and were instructed to begin the interview by introducing themselves and then explain the purpose of their

29

visit. The enumerators were also told to explain that not all of the households would be visited during the final survey, as this would depend on which households were chosen during the sampling process. Emphasis was placed on the need to ask the questions correctly and record the answers clearly and concisely. The enumerators were also instructed to ask mothers for road to health cards in order to verify the child's age. The principal researcher then sorted the completed census forms. A total of 361 households in Chainda and 432 in Kamanga met the inclusion criteria.

Enumerators for the definitive study

Permission was sought from the Head of the Nutrition Department at the Natural Resources Development College in Lusaka, to use the entire class of final year students as enumerators. The students (11 in total) were studying for a diploma in nutrition. An agreement was reached to release the students for 7 days to help with the administration of the survey questionnaire. The students also took weight and height measurements of the index child. The college agreed that the students' participation in the survey would count towards their training in how to conduct community surveys, thereby relieving the college authorities of the need to organise such an exercise separately, with a consequent saving in time and money. The principal researcher also hired a qualified nutritionist Ms Mary Simasiku to work as research assistant.

Training of the enumerators took place on 30th January 1995 at the college premises and took the entire day. Prior to this, the researcher had spent two afternoons with the students during their class time, basically explaining the objectives of the study and going over the main points of the questionnaire.

The training was carried out by the principal researcher and the training period was limited to a day mainly because the students were only available for 7 days, but also largely because much of the necessary aspects of community surveys were already known to the students who had just completed a course in the subject. Six groups were formed by pairing the students, the research assistant made up the sixth group. The pairing was done in such a way that in each group there was at least one member able to speak either Bemba or Nyanja languages fluently. These are the two languages commonly spoken in the study communities. Training covered translation of the questionnaire into Bemba and Nyanja, methods of interaction with household members and interviewing techniques.

The enumerators were also taught how to correctly assess the volume of the different types of water containers used to draw water in the study areas. As with the census enumerators, emphasis was placed on the need to ask the questions correctly and record the answers clearly and concisely. The need to record figures carefully so that there was no ambiguity was also stressed.

Enumerators were told to always ask for the road to health cards of the under five year olds, so that information about dates of birth and immunisation status could be verified for the index child. Where such a card was not available, a birth certificate was requested and the mother was led through a careful probing exercise to determine whether or not the child had been fully immunised. In the case of other household members for whom age information was also required, the enumerators were instructed to ask for a national identity card if the respondent could not easily remember when they or other members of the family were born. The

31

enumerators were led through all the sections of the questionnaire, before being asked to practice interviewing each other in the vernacular.

The last exercise of the day involved the students practising how to take weight and height/length measurements. Children of college staff were specifically assembled for this task. In the case of each child, two measurements were taken and the average calculated, the required accuracy for the height/length measurements was 0.1 cm. Two measurements were taken for each case and the average calculated. The required accuracy was to within 0.1 kg for weight. Children were weighed without shoes, but with any light clothing on, because the weather was a little chilly. All weights were immediately corrected for this by subtracting 120 gms which was the corrective weight arrived at by weighing 10 pairs of children's clothes during the pre-test.

4.5 Pilot study

A pilot study was carried out on 26th and 27th January 1995, to determine the suitability of the tools. A peri-urban area known as Jack compound located 13 km South of Lusaka city, was chosen for the pilot study. This site was chosen with the help of CARE International (Zambia), who are currently implementing a community managed health project in Kamanga compound alongside the Irish Aid funded compound upgrading project, which installed the water standpipes in the settlement. CARE International was at the time in the process of initiating a similar project in Jack compound, and the co-operation of the community there was therefore assured. Jack compound has very similar characteristics to Chainda compound (PWA area) although the former has no water supply system at all as the one which was there broke down

32

several years ago. Residents have to travel distances of between 3 and 7 km outside of their compound to draw water.

A total of twenty households in Jack compound with children aged between 12 and 60 months were randomly selected by the area residents' development committee for the pilot study. The mothers of the identified index children in these households were interviewed. The weight and height/length measurements of the index child were also taken. Mrs Mutinta Hambayi, a community nutritionist working for the National Food and Nutrition Commission in Lusaka, assisted the principal researcher in the pilot study. Following the pilot study, it was concluded that the questionnaire required only minor modifications and that the definitive study could therefore begin on 31st January 1995 following training of the enumerators.

4.6 Survey implementation and data collection

In each study site, 144 households were randomly selected using a table of random numbers. Each enumerator pair was given a list of households to visit identifying the pre-selected index child. The enumerators were instructed to ask if the particular child was present prior to interviewing the mother. If the pre-selected child had died or travelled out of the study area, the interview with that household was terminated. The questionnaire was the main study tool and the respondent was the mother or guardian (preferably female) of the child. At the end of each day, the questionnaires were collected by the principal researcher and roughly screened to ensure accuracy in the data collection. The principal researcher alternated between the two study sites throughout the day, in order to monitor the performance of the enumerators and to give assistance and guidance where needed.

At the end of the 6 days with the students, a total of 250 questionnaires had been administered i.e. 123 in Kamanga and 127 in Chainda. The principal researcher returned to the field for a further 6 days with the research assistant to administer 40 dietary recall questionnaires in each study site using the 24-hour dietary recall method. Coding of the questionnaires began immediately after the major survey was completed and was done by the principal researcher. During coding, 3 of the questionnaires in Kamanga and 7 in Chainda were found to be unusable because either the age or sex of the index was missing and nutritional indicators could not be calculated using the Anthro software.

In mid February, samples of stored household water were requested from 22 previously sampled households in both Kamanga and Chainda. The sampling was carried out by the principal researcher with the assistance of a laboratory technician from the LWSC. In late March, focus group discussions were held with 10 mothers in Chainda and 7 in Kamanga, whose children had been sampled in the main survey. Numerous informal interviews were conducted while in the field with the project staff of CARE International and Irish Aid in Kamanga, and World Vision staff in Chainda.

4.7 Data processing and analysis

Coded responses were entered and cleaned in a Dbase III+ format and the data was analysed using SPSS for Windows (Statistical Package for Social Scientists). Nutritional indicators were calculated using the Anthro programme of the World Health Organisation.

The data was analysed using t-test to test the difference in the two study sites. Correlation analysis was done whereby Pearson 'r' of independent variables with specific nutrition indicators as dependent variables was carried out using SPSS for Windows in order to identify factors that potentially affect the nutritional status of pre-school children in the study areas.

4.8 Limitations of the study and problems encountered

1. It was not possible to analyse more than 22 household water samples due to lack of funds to purchase chemicals for the analysis. Data on the quality of water from the standpipes was obtained from the LWSC records.

2. Some parents feared that their children would be bewitched if their stool was given to strangers thereby making it impossible to collect more that 50% of the requested stool samples in each study area. Only 51 stool samples were collected in the PWA area and 49 in the IWA area.

CHAPTER FIVE

RESULTS

The study sought to compare the nutritional status of children living in two peri-urban settlements in Lusaka, Zambia. The peri-urban settlements were chosen on the basis of their differing water supply conditions. One area, Kamanga had good water supply and was designated the Improved Water Availability (IWA) area, while the other, Chainda had intermittent water service and was in this study called the Poor Water Availability (PWA) area. The results presented in this chapter are based on data collected on 124 children living in the IWA area, and 120 children living in the PWA area. The data was collected in January/February (1995) during the rainy season. Information from focus group discussions and informal interviews has been used where appropriate to enrich background information and explain quantitative data.

5.1 Characteristics of the study populations

A total of 120 and 124 households were sampled in IWA and PWA areas respectively. The total number of persons (736 in Chainda and 732 in Kamanga) was practically the same. The family size (6.2 $\pm$ 2.4 in the IWA area and 6.0 persons $\pm$ 2.2 in the PWA area) was not significantly different.

Table 2: Age and sex distribution of the study population by area

	Proportion of the population (%)		
Characteristic	IWA (N=120)	PWA (N=124)	Significance (X^2)
Sex distribution: male	50.5	52.5	Not Significant
female	49.5	47.5	Not Significant
Age distribution: 0-15	55.0	55.8	Not Significant
16-45	41.0	40.0	Not Significant
45+	4.0	4.2	Not Significant

It is clear from Table 2 above that the two communities have a population essentially made up of young people. Over 50% of the population (i.e. 55.0% in the IWA area and 55.8% the PWA area) were aged between 0-15 years. Less than 5% of the population in each area were aged over 45 and both communities had slightly more males than females. The dependency ratio in the IWA area is 1.2 as compared to 1.26 in the PWA area.

Employment profiles for those aged above 16 years were practically the same in both study areas as shown in Figure 4.

Figure 4: Employment profile of persons aged 16 years and above in the PWA and IWA areas
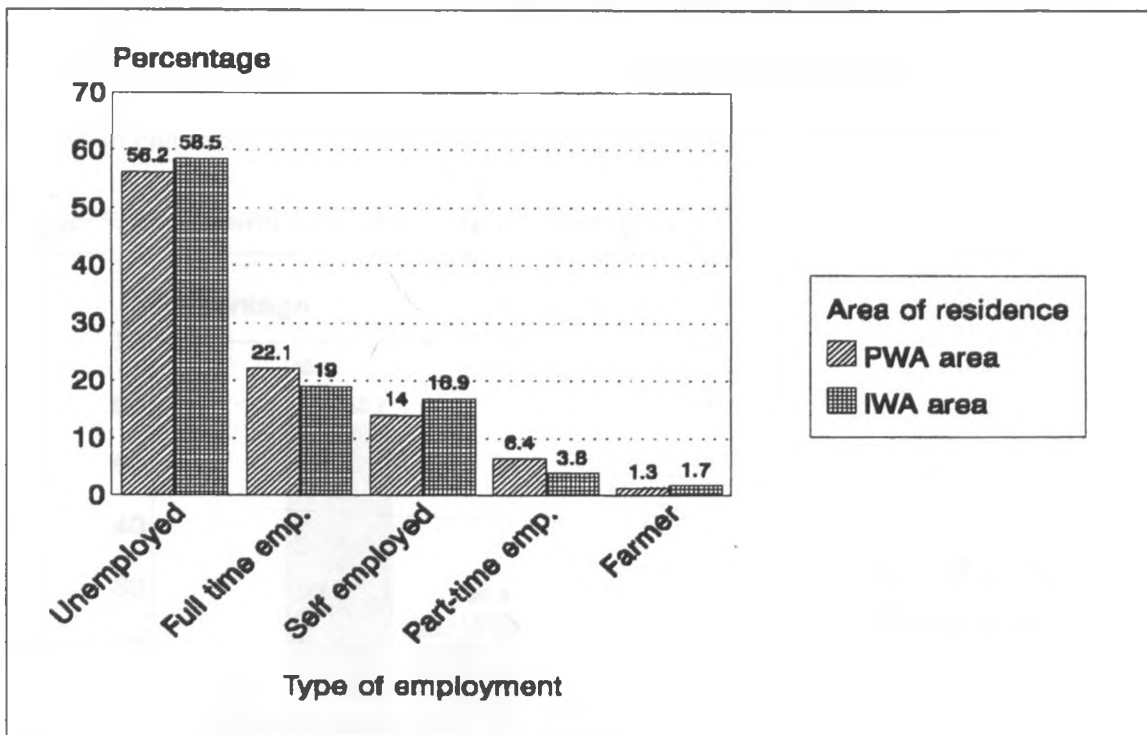
Over 50% of eligible persons in both study communities were unemployed (i.e. 58.5% and 56.2% in the IWA and PWA areas respectively), while those in full time and self-employment constituted above 36% of the population in both study areas.

A small number of people were engaged in piecework in both areas i.e. 3.8% and 6.4% in the IWA and PWA areas respectively. Farming is not a popular occupation in these communities, less than 2% of residents in both the IWA and PWA areas were engaged in this type of work.

5.1.1 Characteristics of household heads

Approximately equal numbers of households, 7.5% (9) in the IWA area and 8.1% (10) in the PWA area were female headed. There was also no significant difference in the mean education level among household heads in the two study areas, which was 7.4 years ± 2.7 and 7.3 years ± 2.9 in the IWA and PWA areas respectively. The maximum level of education of household heads in both study areas was 12 years. Although not statistically significant, the PWA area had more household heads in full time employment and fewer unemployed household heads as shown in Figure 5.

Figure 5: Employment status of household heads by area

38
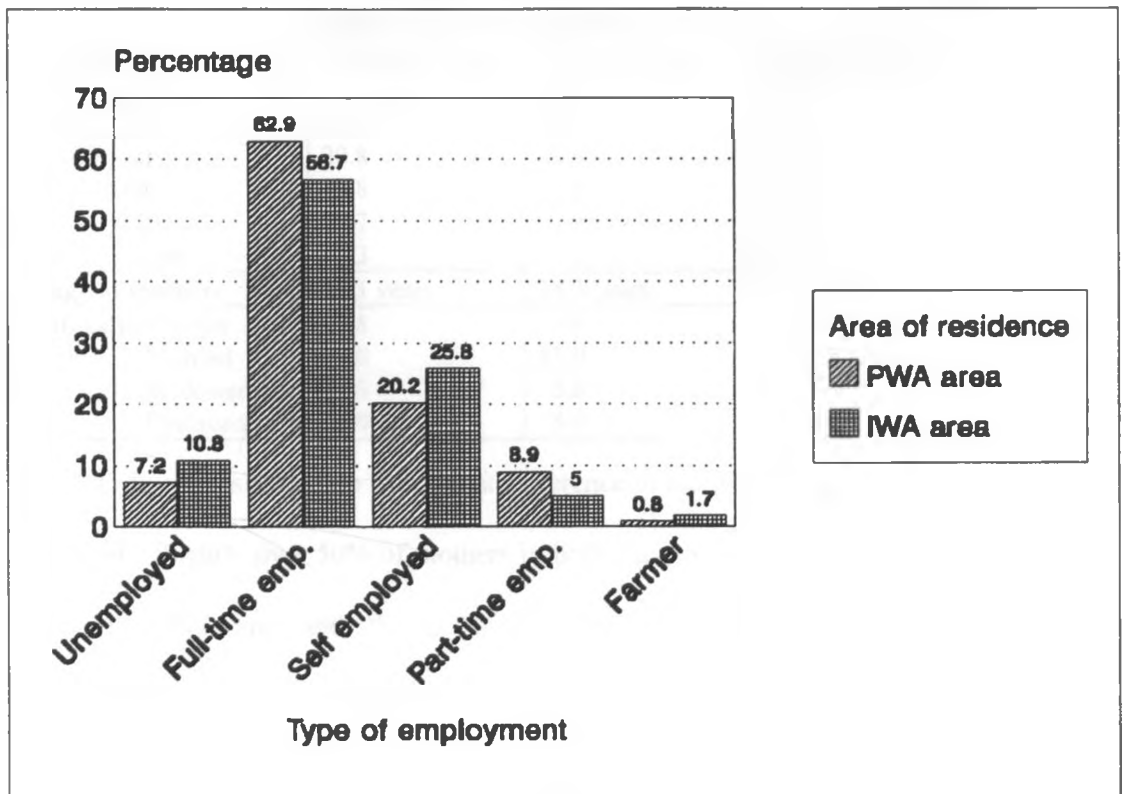
5.1.2 Characteristics of mothers of index children

Selected characteristics of the mothers of index children in the study areas are shown in Table 3. The age distribution of mothers was practically the same in both communities. There was however, a slightly higher proportion of mothers aged over 40 in the IWA area (13.3%) than in the PWA area where above a half as many (7.3%) of mothers fell into this category. The mean age of mothers in the IWA (29.1 ± 7.1 years) was not different than that of mothers in the PWA area, which was 28.3 ± 7.1 years.

Majority of the mothers of index children (about 85% in both study areas) were married. The number of unmarried mothers was low in both study areas, though the proportion unmarried in the IWA (0.8%) was lower than in the PWA area where it was 4%.

Table 3: Selected characteristics of mothers of index children

Characteristic	Proportion of the population (%)		
	IWA (N=120)	PWA (N=124)	Significance (X^2)
Age: 16-20 years	3.3	4.8	p=0.55
21-25 years	34.2	28.2	p=0.32
26-30 years	20.8	22.6	p=0.74
31-35 years	15.8	21.0	p=0.30
36-40 years	6.7	11.3	p=0.21
over 41 years	13.3	7.3	p=0.12
Mean age of mothers	29.1 years	28.3 years	p=0.75
Marital status: Single	0.8	0.8	p=0.10
Married	85.0	85.0	p=0.92
Widowed	5.0	5.0	p=0.28
Divorced	5.0	5.0	p=0.95

The two study areas showed no significant difference in the distribution of mothers by type of employment. Slightly over 50% of mothers in both study areas are housewives, while the rest (2.5% in the IWA area and 4% in the PWA area respectively), are either in part-time employment or farming. Few of the mothers in either compound are in full time employment

(4.2% in the IWA area and 6.5% in the PWA area respectively). A little over a third of the mothers (37.5% in the IWA area and 34.7% in the PWA area) are engaged in some small scale business enterprise, mostly selling foodstuffs either from the house or market and brewing beer.

Figure 6: Employment status of mothers of index children by area
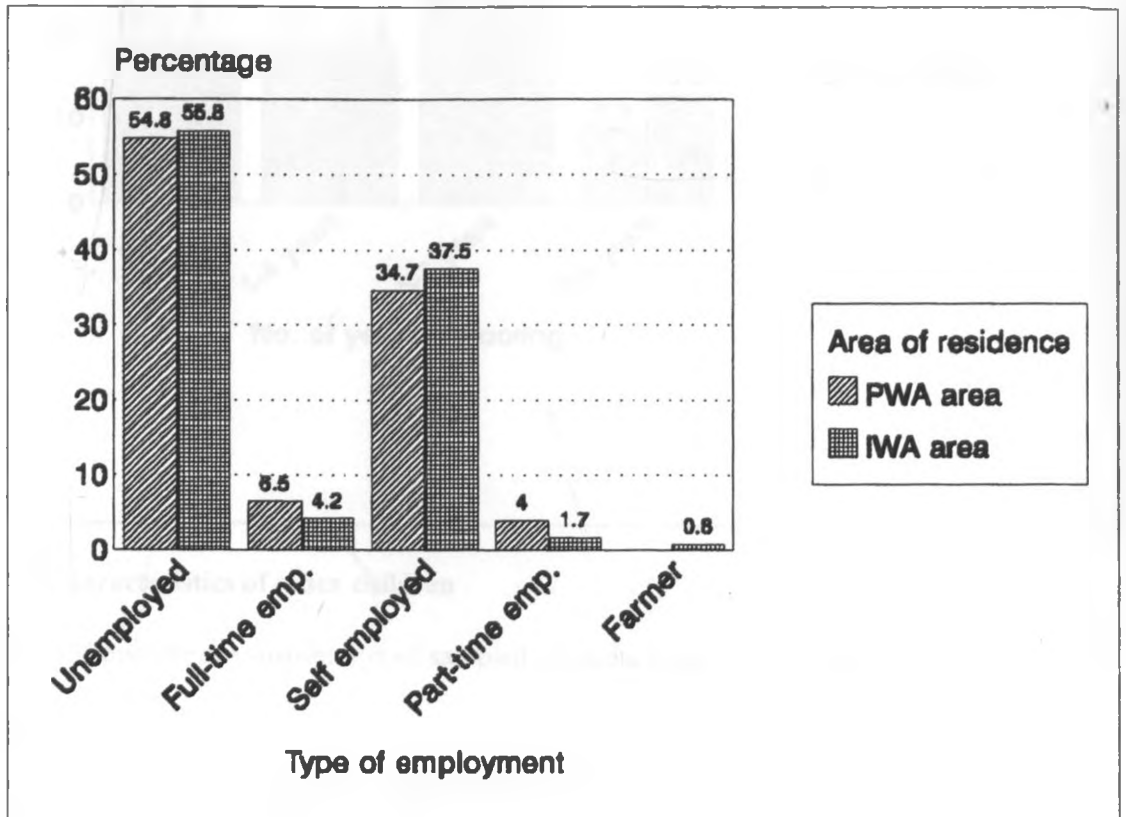
The mean number of years of education of mothers of index children in the IWA area (4.98 ± 3.1) and the PWA area (4.54 ± 3.1) were also not significantly different. It was, however, obvious, that in the PWA, there were fewer mothers with higher than 8 years of education, although the difference in proportion was not significantly different.

Figure 7: Education of mothers of index children by area
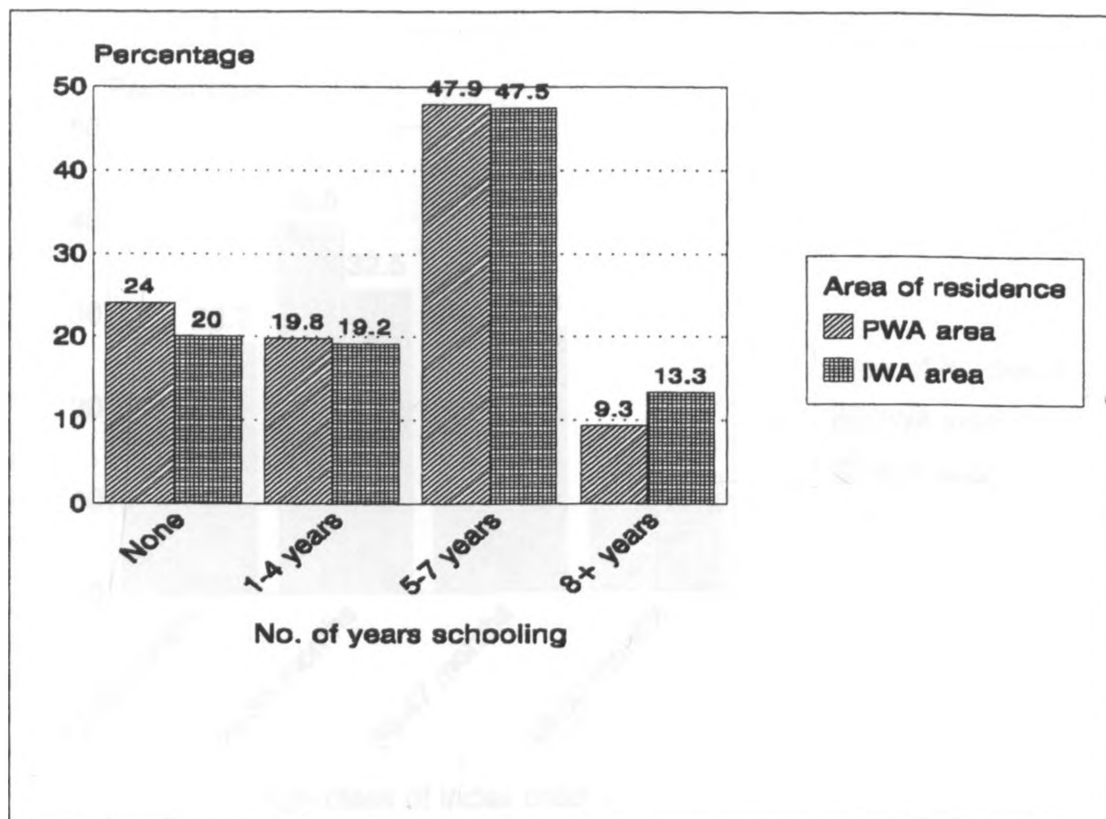
5.1.3 Characteristics of index children

Table 4 shows the sex distribution of sampled children, which was not significantly different in the two study areas.

Table 4: Sex distribution of index children by area

	Proportion of the population (%)		
Characteristic	IWA (N=120)	PWA (N=124)	Significance X^2)
Sex distribution: male	54.2	58.1	Not significant
female	45.8	41.9	Not significant

Children under five years of age made up 28% of the population in both compounds. Overall, slightly more male than female index children were sampled. The mean age of sampled children was more or less the same in the two study areas and similarly showed no significant difference (Figure 8).

41

Figure 8: Age distribution of index children by area
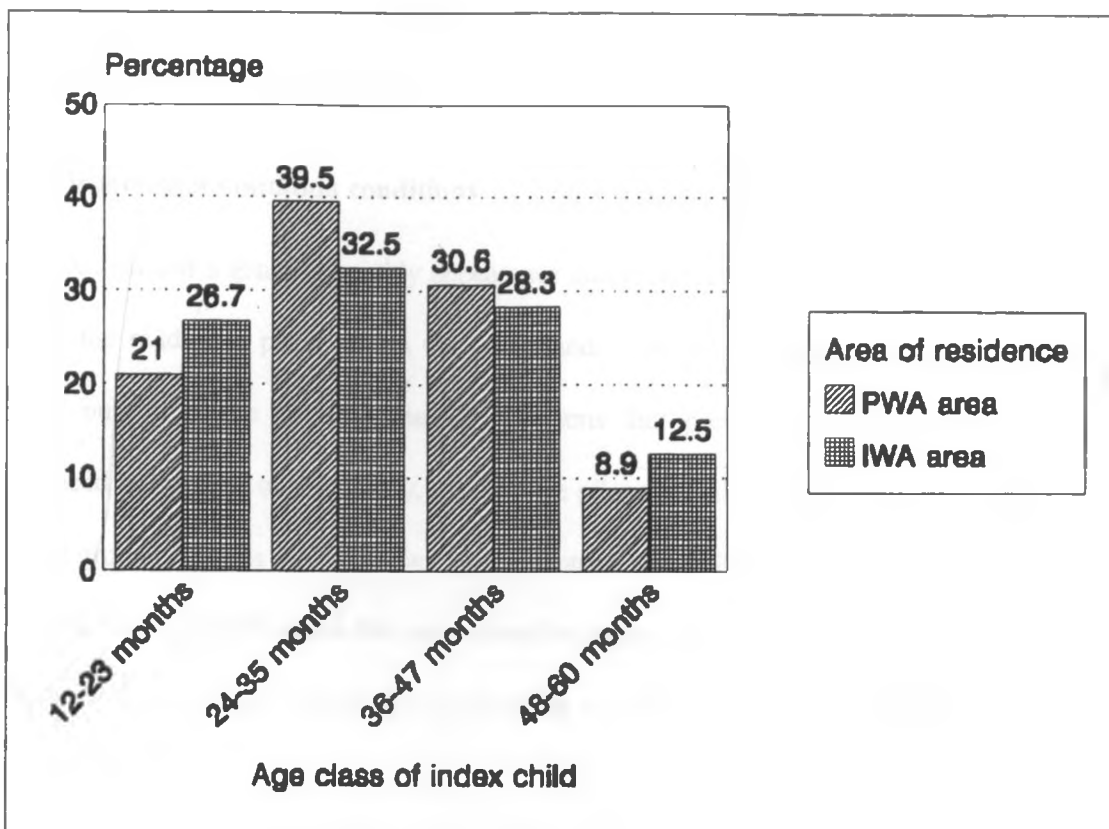
The birthweights of children in the two study areas were not significantly different (i.e. 3.12 and 3.21 kg in the IWA and PWA areas respectively). The immunisation coverage of Under Five children was high in both study areas (over 90%) and the majority of children in both study areas were still attending the Under Five clinic regularly (75% in the IWA and 72% in the PWA areas respectively).

The caloric and protein intake of children in both study areas were above the FAO/WHO recommended levels for children falling within the 12-60 month age group, which are 1550 kcal/day and 17.5 gms protein/day (Sehmi, 1994). However, although there was no significant difference between the dietary intake of children in the two study areas, children in the PWA

clearly had a higher calorie and protein intake than their counterparts in the IWA area (1774 kcal ± 663 and 39 gms of protein in the PWA area as compared to 1681 kcal ± 708 and 34.5 gms of protein intake in the IWA area).

5.2 Environmental sanitation conditions

The IWA area had a generally untidy appearance and residents tended to pile rubbish into pot-holes in the roads and paths within the compound. The piles of garbage were not only an eyesore, but given the hot and humid conditions that prevailed due to the rains being experienced at the time of the survey, the garbage piles were also a putrid mass providing rich breeding ground for flies and cockroaches. In contrast, in the PWA area, there were no visible piles of rubbish along the paths that criss-cross the compound or beside the houses, despite the fact that the Lusaka City Council (LCC) provides no refuse collection or disposal services to either area.

In both settlements, the natural drainage is poor and there is no constructed drainage system. Following a downpour, children can be seen playing in the accumulated pools of water which are found everywhere and remain that way for days, posing a danger to residents as they provide breeding grounds for mosquitoes and other water related vectors.

5.2.1 Excreta disposal facilities in the study areas

Pit latrines are the only available means of excreta disposal in both study areas. The distance between the houses and the toilets in the PWA area was between 6 and 10 metres, whereas in the IWA area, the average distance was most of the time no more than 3 metres. Table 5 below shows some of the characteristics of the excreta disposal facilities. A significantly higher

43

proportion of households in the PWA area had their own toilets (85.5%) than in the IWA area where 75% of households had a toilet facility (p<0.05). This is likely because the plot sizes are so much smaller in the IWA area and building toilets would only create extra structures in the already crowded compound. Residents who do not have their own toilets (25% and 14.5% in the IWA and PWA areas respectively) use the surrounding bush to relieve themselves or share their neighbours' facilities. Very few toilets have cement flooring (only 22.8% and 23.1% in the IWA and PWA areas respectively). The majority of toilet floors are earthen (i.e. 77.2% in the IWA area and 76.9% in the PWA area). There was however no statistically significant difference between the two areas in the proportion of toilets that had either cement or earth floors. although it should be noted that in both study areas, more than three times as many toilets had earth floors as had cement floors. More than 75% of the toilets in the study areas had no roofing (77.5% and 85% in the IWA and PWA areas respectively) and flies were able to move in and out of the toilets with ease. The number of un-roofed toilets was significantly higher in the IWA than the PWA area (p<0.001). Flies are common carriers of Bacillary dysentery, amoebic dysentery and diarrhoeal disease from the faeces of man to food or water that is then consumed by man and thereby resulting in disease (Rajagopalan, 1974). Overall, the quality of the toilets in the study areas was generally poor and their condition was very unhygienic. Not only were the floors soiled and wet, but also the area surrounding the toilets had a nasty odour.

Table 5: Proportion of households with toilets and types of floor surface and roofing of toilets.

Characteristic	Proportion of the households (%)		
	IWA (N=120)	PWA (N=124)	Significance (X^2)
Households with toilets	75.0	85.5	p<0.05
Households with no toilet	25.0	14.5	
Toilet surface: Earth floor	77.2	76.9	NS*
Cement floor	22.8	23.1	NS
Un-roofed toilets	77.5	85.0	p<0.001
Distance toilet to house	3 metres	6 - 10 metres	

*NS = Not significant

44

Over half the households in both study areas had cement flooring inside the house (58.3% and 74.2% in the IWA and PWA areas respectively), although the number was significantly higher in the PWA area (p<0.01).

Table 6: Type of floor surface in the house by area

Characteristic	Proportion of the households		Significance (X^2)
	IWA (N=120)	PWA (N=124)	
Earth	41.7%	25.8%	p<0.01
Cement	58.3%	74.2%	p<0.01

5.3 Levels of household water usage

By WHO (1973) definition, the households in the PWA have poor access to water with at least 80% living more than 200 metres from their regular water source (Table 7). Over 56.5% of the residents travel roundtrip distances of up to 1 kilometre to reach their regular water source, and about a quarter (23%) make journeys of more than one kilometre from their homes to find water. This is in striking contrast to the IWA area, where all the residents live within 200 metre radius of a water point.

Table 7: Distance to regular water source by area of residence

Characteristic	Proportion of the households (%)		
	IWA (N=120)	PWA (N=124)	Significance (X^2)
Distance to water source:0-200 metres	100	20.2	-
201 metres - 1 km		56.5	
> 1 km		23.4	

* NS = not significant

The water containers popularly used by residents in the two study areas are 20 litre plastic buckets. On average, any resident of the IWA area will take 20 minutes to draw one load of

water during the day (i.e. allowing for 5 minutes to reach the water point, another 5 minutes to draw water and possibly 10 minutes to walk back home with the water load). In contrast, their counterparts in the PWA area require up to 70 minutes to collect one water load, (i.e. an average 20 minute walk to reach a water point, up to 30 minutes waiting time to draw water because of the queues, and another minimum 20 minutes walk back home or slightly longer as the water container is now full).

There was no significant difference in the average amount of water collected daily per household between the two study areas. This was despite the fact that the water sources were much further in the PWA area. Surprisingly, households in the PWA area fetched slightly (but not significantly) more water on average than their counterparts in the IWA area (101.45 litres and 98.92 litres respectively). Water in the two study areas is used for all regular household chores i.e. bathing, washing clothes, cooking, cleaning dishes and drinking. In a few cases water is used for cleaning houses, although often waste water from washing dishes or bathing children will be used for this purpose. The study did not attempt to determine to what extent and what quantity of water is used for hygiene purposes although discussions with mothers in the two study areas indicated that hands are not always washed before handling food or after changing a baby's soiled nappy. When this is done, it is usually no more than a rinsing of the hands with water alone. The hands of small children are also often not washed after the children have used the toilet. Soap is rarely used, largely because most families cannot afford it, but also because they are unaware that the use of water alone is not effective in removing pathogenic organisms from the hands. The litres of water used per capita per day (Lcd) values calculated

for both the IWA and PWA areas were practically the same (i.e. 17.5 and 18.02 respectively) and showed no significant difference.

Table 8: Amount of water used by area of residence

Characteristic	Proportion of the households		
	IWA (N=120)	PWA (N=124)	Significance (X^2)
Av. amount of water collected per HH per day (litres)	98.2 ± 45.32	101.45 ± 55.7	NS* (X^2)
Litres per capita per day** (Average amt. of water available per person)	17.5 ± 8.7	18.02 ± 9.9	NS (t-test)

* NS = not significant

** Calculated as   Lcd =   Amount of water collected/household/day
Household size

5.4 Water quality

Ideally, drinking water should not contain any organism known to be pathogenic, and should also be free from bacteria indicative of water pollution (WHO, 1984). It is therefore necessary for water samples to be regularly examined for indicators of pollution by these organisms. The primary bacterial indicator recommended for this purpose is the coliform group of organisms as a whole. WHO (1984) recommends that for untreated piped water supplies, there should be no faecal coliforms in a 100 ml water sample. The maximum limit of coliform organisms (total coliform count) allowable in a 100 ml sample is 10. Any water supplies failing to meet these requirements should be declared unfit for human consumption.

The total coliform count estimates the numbers of bacteria of the coli-aerogenes group in a sample, these being of both faecal and non-faecal origin. The faecal coliform count estimates the number of *Escherichia coli* in a sample. These are a particular strain of the coli-aerogenes

47

group, which are definitely of faecal origin. The presence of faecal material in water presents the most immediate hazard to health.

5.4.1 Standpipe water

Data obtained from the LWSC is presented in Table 9. This data relates to tests carried out by LWSC technicians on water samples drawn from standpipes in the two study areas during the period 11/01/95 and 08/02/95. During this period, all water samples drawn from the PWA area were found to be of acceptable quality as prescribed by WH0 (1984). In the IWA area, 50% of the water samples tested over the same period, had total coliform levels above the prescribed limits. On 14/01/95, there was even evidence of faecal contamination in the water sample. The water samples for the IWA area were taken only from standpipes supplied by the borehole that has been officially handed over to LWSC. The given data therefore, does not necessarily reflect the water quality of all the other boreholes/standpipes in the IWA area.

Table 9:Total and faecal coliform counts in a 100 ml sample of standpipe water by area of residence

Date of test	IWA	PWA	IWA	PWA
27/12/94	*23*	3	0	0
03/01/95	*11*	Water not sampled	0	Water not sampled
11/01/95	*38*	2	0	0
14/01/95	*50*	0	*6*	0
24/01/95	3	2	0	0
03/02/95	0	Water not sampled	0	Water not sampled
08/02/95	1	Water not sampled	1	Water not sampled
17/02/95	0	0	0	0

Source: Lusaka Water and Sewerage Company (1995)

Note that in the Table below, water samples that were declared unfit for human consumption are indicated in larger font and bolded numerals.

5.4.2 Household stored water

Among samples drawn from stored household water, the results as indicated by total and faecal coliform counts in a 100 ml water sample, reveal that the water was highly contaminated as seen in Table 10. In nearly all cases, the coliform colonies were too numerous to count and all the household water samples taken from both study areas were rated by the LWSC technician as unfit for human consumption. However, no faecal contamination was detected in any of the water samples.

Table 10:Total and faecal coliform counts in 100 ml samples of stored household water by area

	Total coliforms		Faecal coliforms		
	IWA	PWA	IWA	PWA	Comment
1	22	TNTC	0	0	UHC**
2	TNTC*	34	0	0	UHC
3	TNTC	TNTC	0	0	UHC
4	TNTC	TNTC	0	0	UHC
5	30	TNTC	0	0	UHC
6	TNTC	127	0	0	UHC
7	124	TNTC	0	0	UHC
8	TNTC	TNTC	0	0	UHC
9	TNTC	48	0	0	UHC
10	TNTC	TNTC	0	0	UHC
11	TNTC	TNTC	0	0	UHC

Source: Lusaka Water and Sewerage Company (1995)

* TNTC - Too numerous to count
** UHC - Unfit for human consumption

5.5 Parasitic infestation among index children

As indicated in Table 11, there was no significant difference in prevalence of Ascaris and Hookworm between the two study areas (41.2% and 11.8% of stool samples in the PWA area and 24.5% and 4.1% in the IWA area had Ascaris and Hookworm ova respectively), although there was a significant difference in overall parasitic infection (p<0.05). The proportion of

49

children who had been dewormed was higher in the IWA area (51.6%) than in the PWA area (32.3%) and this difference was significant (p<0.01).

Table 11: Prevalence of parasitic infection among index children by area

Characteristic	Proportion of children (%)		
	IWA (N=51)	PWA (N=49)	Significance (X^2)
Ascaris infection	24.5 (12)	41.2 (21)	p=0.07
Hookworm infection	4.1 (2)	11.8 (6)	p=0.16
Overall parasitic infection	11.7 (14)	21.8 (6)	P<0.05
Child de-wormed in the last three months*	51.6	32.3	p<0.01

* As a proportion of the total number of index children surveyed

During a focus group discussion, mothers in both study areas indicated that very young children (usually up to 24 months of age), do not use the pit latrines. A piece of newspaper if available is placed on the ground and the child defecates onto it. When there is no paper available, the mother allows the child to defecate onto the ground outside the house and the faeces are cleared up when the child is finished. Sometimes, if the mother is busy, she may not clear up the faeces immediately, and at other times she may forget to clear them up altogether. It is doubtful that the faeces can be completely cleared off the ground and any ova present in the faeces may find their way into the soil and remain there until they have matured. Young children are fond of eating soil, and the child may just swallow soil containing parasitic ova.

5.6 Prevalence of diarrhoeal disease among index children

The 7 day diarrhoea prevalence among index children in the two study areas (i.e. 53.3% and 50.8% in the IWA and PWA areas respectively) was not significantly different and diarrhoeal episodes in the two study areas were of about the same duration (i.e. 5.2 days ± 3.3 and 5.3 days ± 3.2 in the IWA and PWA areas respectively). Figure 9 shows dis-aggregation of the data by age group. In both study areas, over one third of the children in the 12-23 month age group had

experienced diarrhoea in the one week prior to the survey (i.e. 40.6% and 34.6% in the IWA and PWA areas respectively) and notably in both areas, diarrhoea prevalence levels peaked to almost 50% in the 24-35 month age group (51.3% and 46.9% in the IWA and PWA areas respectively). There was a sharp decline (over 50%) in the diarrhoea prevalence among the older age groups.

Figure 9: Distribution of 7-day diarrhoea prevalence among index children by age class and area of residence
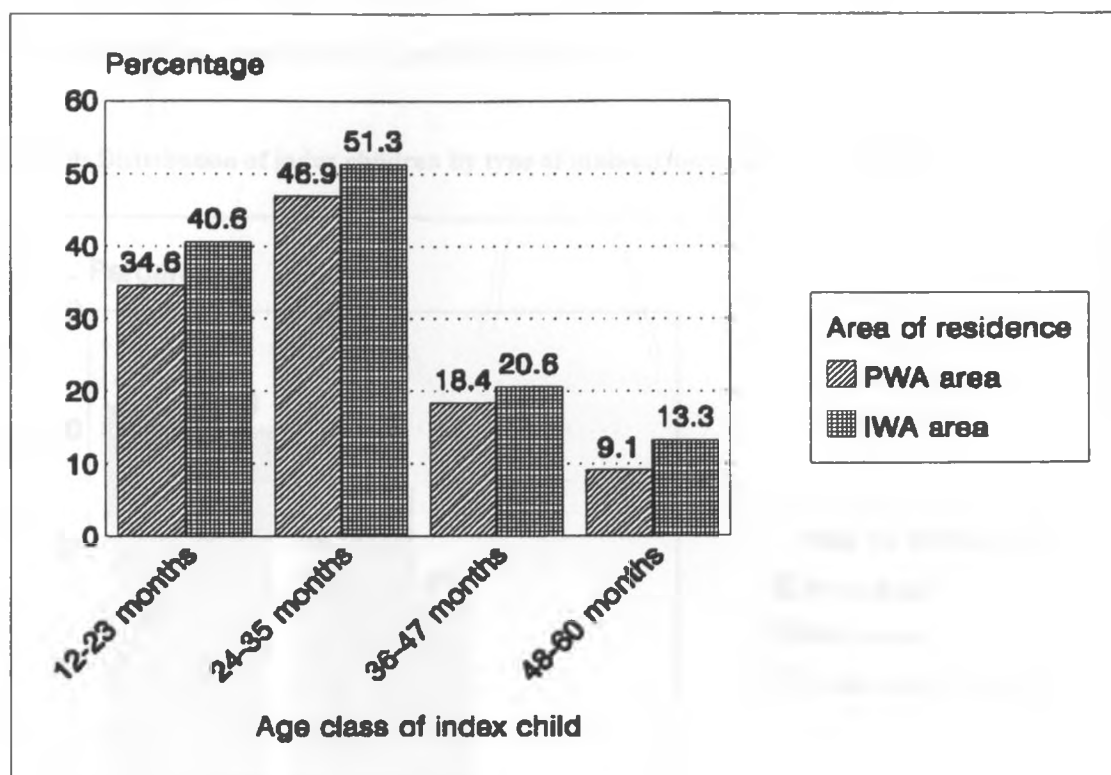
5.7 Nutritional status of sampled children

Three indicators were used to assess the nutritional status of the study children, namely; Height-for-age (stunting), weight-for age (underweight) and weight-for-height (wasting). As shown in Figure 10, the IWA area had a higher proportion of index children falling below -2 SD of

accepted international standards for each of the above indicators than the PWA area. The difference in prevalence was however not statistically significant between the two study areas. Approximately equal numbers (i.e. nearly half of the children, 44.2% and 42% in the IWA and PWA areas respectively) were stunted, while about one third in both areas (i.e. 35% and 28.2% in the IWA and PWA areas respectively) were underweight. The proportion of wasted children in both areas was practically similar (4.8% and 5.0% in the PWA and IWA areas respectively). It should however be noted that the prevalence of stunting and underweight among the study children was found to be higher than the average national levels which show that 40% and 25% of children living in urban areas of Zambia are stunted and underweight respectively.

Figure 10: Distribution of index children by type of malnutrition and area of residence

52
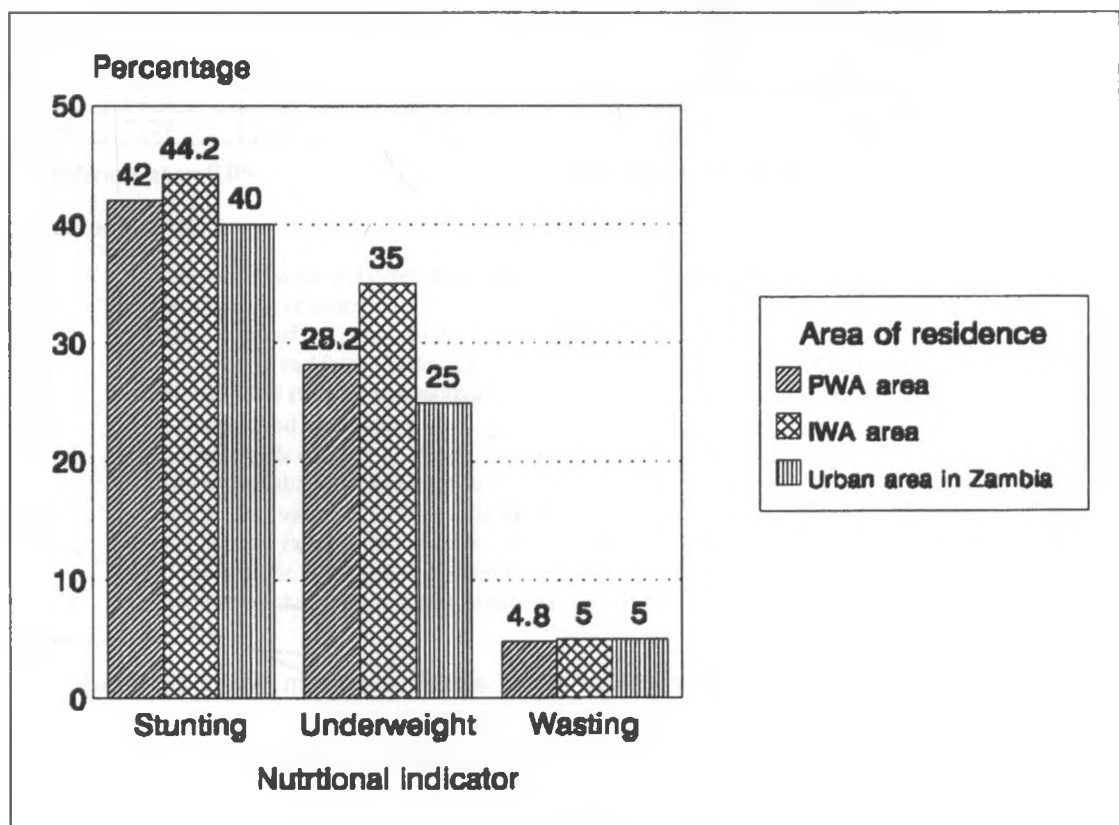
5.8 Correlation results

The Pearson 'r' correlation matrices given in Table 12 below, show the relationship between independent variables and nutritional status indicators as dependent variables. Although they give the relationship between the independent variables with nutritional indicators used in the study, they do not automatically imply a causal relationship.

Table 12: Correlation matrix of independent variables and nutritional status indicators

Variables	Improved Water Availability area			Poor water availability area		
	HAZ	WAZ	WHZ	HAZ	WAZ	WHZ
Amtwtr	.0591	.0940	.0292	.1576	.1437	.0722
Birthwt	.2404**	.2640*	.1052	.0966	.1496	.0964
BOrder	.0909	.0363	.1124	-.0537	.0203	.0940
DD7days	-.0631	-.0615	-.1878	-.0357	-.0670	-.1553
Edlevel	.0486	.0246	.0551	.0316	.0118	.1032
Foodexp	.0938	.0440	.0392	-.1347	-.0685	-.1376
Fullimm	.1292	.0910	.1413	-.0274	.0031	-.0710
Gounder5	.0017	.0651	.0296	.0288	.1664	.0581
Lcd	.0726	.0496	.0204	.1126	.1840*	.0642
Parasite	-.2328	-.0913	.1305	.1023	.3082*	
Sex	.0168	.0445	-.0557	-.0697	.0596	-.0111
Typeflr	.1272	.0985	.0905	.0374	.0592	.0378
Withfood	.0327	.0727	.1467	-.1651	-.0550	.0278

* **Significant at p=0.05** ** **Significant at p=0.01**

VARIABLE NAMES

Amtwtr	Amount of water collected daily by the household
Birthwt	Birthweight of index child
BOrder	Birth order of the index child
DD7days	0,1 dummy variable; 1 if the child had DD in the 7 days prior to the survey, 0 if not
Edlevel	No. of years education of mother
Foodexp	Monthly food expenditure
Gounder5	Child attends under five: Yes=1, No=0
Lcd	Litres available per capita per day
Parasite	0,1 dummy variable; 0 if the child had any parasite, 1 if not
Sex	0,1 dummy variable; 0 if child is a girl, 1 if child is a boy
Typeflr	Type of floor in the house: Cement=1, Earth=0
Withfood	Mother withholds food during diarrhoea Yes=1 No=0

The factors influencing nutritional status differ by study area. In the PWA area, parasitic infection and amount of water available daily per capita were significant, whereas in the IWA area, birthweight and diarrhoeal experience appeared to affect the nutritional status of children.

CHAPTER SIX

DISCUSSION

6.1 Social demographic characteristics

There was no significant difference in the socio-demographic characteristics of households. The similarities are mainly because as explained earlier, these settlements have the same history and similar patterns of distribution of ethnic groups. .As a result, family size, age distribution and dependency ratios, employment patterns, proportion of female headed households, literacy rates and calorie consumption and birthweights were practically the same.

6.2 Sanitary conditions, diarrhoeal prevalence and parasitic infestations

Many of the families in the two study areas were observed to cook and eat in outside kitchens, mainly due to the small size of the houses, which only allow for sleeping rooms. The short distance between the houses and the pit latrines in both areas would be expected to increase incidences of food contamination. The risk would further be increased by the unhygienic disposal of faeces of young children who are too young to use the toilet and therefore allowed to defecate in the open.

Diarrhoeal disease incidence caused by rotaviruses and enterotoxigenic E.Coli shed in the faeces of infected persons were most probably the cause of high prevalence of diarrhoea observed in the study areas. The prevailing environmental conditions such as dirty, unroofed pit latrines, poor garbage disposal and open air defecation practices, could aggravate or increase incidences of diarrhoea. The very high diarrhoeal prevalence rates were observed to peak in the 24-35

54

month age group with nearly half of the children in both study areas having had a diarrhoea experience in the previous one week. This could be due to the fact that by the time the child is reaching this age, the mother is often pregnant again, or there is already a new baby in the home such that little attention is paid to the toddler who has now to go to the toilet alone. He/she is further weaned away from the mother's breast. Children in Zambia eat with their hands and if the child's hands are already contaminated with faecal material or with other dirt that has been picked up while playing, all of this would be ingested with the food, which would of course increase the risk of contracting diarrhoea.

The duration of a diarrhoea episode has a negative effect on the nutritional status of the child – the more prolonged the episode, the more severe the effect on the child's nutritional status, especially if the mother has negative practices of withholding food and drink for the duration of a diarrhoea episode (Ministry of Health, 1993). The mean duration of a diarrhoea episode in the study areas (5 days), was higher than the national average of 4 days (Ministry of Health, 1993). The negative and statistically significant relationship between wasting and diarrhoea experience among children in the IWA would imply that among children in this community, the higher the number of diarrhoea experiences, the more the child becomes wasted. The null hypothesis which stated that there was no significant difference in the diarrhoea prevalence between the two study areas, was therefore accepted.

The high level of Ascaris infection found in both study areas is suggestive of defective sanitation. In the PWA area, correlation results indicated a statistically significant relationship

55

between underweight and parasitic infection. This implies that children who had intestinal parasites were more likely to be underweight than those who did not.

6.3 Water accessibility, use and quality

The amount of water drawn and used by households was not significantly different in the IWA area despite improved access and infact was slightly lower than in the PWA area. This may be explained by the fact that water is one of the basic needs and receives top priority amongst households. White (1986) and Cairncross et al (1991), have noted that regardless of the level of accessibility to water in a given environment, per capita consumption remains low among communities that rely on communal standpipes. According to White (1986), and IRC (1988), per capita use in such communities usually falls within the range of 10-50 Lcd. McJunkin (1982), has argued that it is only when water use increases beyond 50 Lcd, that the use of water for personal hygiene (this includes hand washing) increases. Feachem (1977), has also shown that the reported incidence of diarrhoea, decreases only if there is a corresponding increase in the quantity of water used per capita.

Water accessibility would probably affect the time allocation of mothers/care givers. Although no study on time allocation to childcare was done, it is likely that mothers in the PWA area sacrifice some of their time to water collection at the expense of child care. The quality of water drawn from the standpipes met WHO criteria for acceptable water quality in the case of all samples of standpipe water drawn from the PWA area. In the IWA area, only 50% of the water samples of standpipe water met WHO quality criteria. However, it is evident that household water storage practices are poor because all of the household water samples drawn from the IWA and PWA areas, were highly contaminated and did not meet WHO criteria. This implies

56

that water is being contaminated post collection. Possible routes of water contamination may be dirty water collection vessels and poor water handling practices such as dipping hands into the water vessel when drawing water for use.

When collecting samples of stored household water for testing, the principal researcher observed that mothers did not wash either their hands or the cup they picked up to use for drawing water. In some cases, the mother sent a small child into the house to bring a sample of water from the storage container. Obviously as the majority of households do not boil their drinking water, it is evident that both children and adults are drinking grossly contaminated water and therefore have increased risk of contracting diarrhoea.

6.4 Calorie and protein consumption

When socio-demographic factors are similar and sanitation conditions, hygiene practices and by extension morbidity practices are the same, the next factor to be considered if not the most important is dietary intake. The high levels of morbidity and malnutrition observed in the two study areas are characteristic of many peri-urban populations in the developing world (Harpham et al., 1988). The observation that there is no significant difference in the levels of calorie and protein consumption among index children in the two study areas can likely explain why there was practically no difference in the nutritional status of children in both areas. The null hypothesis which states that there is no significant difference in the dietary intake of index children is accepted.

The diet of the average Zambia child consists of the staple food "nshima", which is a thick porridge cooked out of maize flour. Nshima is often eaten for lunch and supper accompanied by relish of vegetables, meat fish or pulses. Most mothers tended to give their children large

57

helpings of nshima and a smaller helping of the accompanying dish, which is mainly vegetables boiled in salt water for the majority of people living in these communities. Children in the sampled age group usually find it difficult to eat large portions of vegetables because these are bulky and make the child feel full very quickly. The mothers tended to give the child more of the "soup" even when the family was eating meat, because most families bought cheaper cuts which were too tough for the child to chew. This implies that the child's diet was likely deficient in some vital nutrients such as Vitamin A. It is a well known fact that children with Vitamin A deficiency are more prone to diarrhoea attacks. In the already poor environmental and sanitary conditions, such a deficiency would aggravate infections of the child.

6.5 Nutritional status

In both study areas, there were still high levels of malnutrition, despite the fact that calorie and protein consumption levels were above the recommended daily average (RDA) for children in Zambia. This apart from being explained by the high prevalence of diarrhoea and parasitic infection which decrease utilisation and absorption of nutrients in the diet of the child, could also be partially explained by the imbalance of nutrients in the diet. It must be noted that although caloric and protein intake appeared high, 70% of the protein intake and 65% of the total energy intake of Zambian children is contributed by the cereal component of the meal, which is mainly maize flour (Kaite et al, 1992).

CHAPTER SEVEN

CONCLUSION

7.1 Conclusions

Despite increased water availability in Kamanga, water use is low and similar to Chainda. The prevalence of diarrhoeal disease and Ascaris infection is the same. Despite improved water availability and access, the nutritional status of children in Kamanga is poor. Water availability has no effect on nutritional status.

7.2 Recommendations

The foregoing suggests that increase in water supply and availability alone will not result in an improvement in health and nutritional status. Other parallel interventions are recommended, particularly:

- There is need for residents and NGOs to work together to improve garbage and waste disposal facilities in the community
- All the pit latrines in the study areas should at a minimum be roofed to minimise the transfer of disease from them by vectors such as flies
- Positive behavioural change needs to be promoted in conjunction with water supply improvements
- Whereas traditional water supply programmes to low income communities have focussed on the provision of communal standpipes consideration should be given to

59

providing incentives for residents to install yard connections in order to boost the levels of water use

- Legislation should be enacted mandating minimum standards of pit latrine construction for such areas

- The council should strictly enforce the already legislated standards relating to distance between households, water points and pit latrines

- Public flush toilets should be constructed considering the limited space available in these settlements, especially if a cost sharing agreement is reached with the community

REFERENCES

Bradley D. (1986), Health Aspects of Water Supplies In Tropical Countries. From: Water, Wastes And Health In Hot Climates. Edited by Feachem R. et al. John Wiley and Sons. Reprinted 1986.

Cairncross S., Carruthers I, Curtis D, Feachem R, Bradley D, Baldwin G. (1991), Evaluation For Village Water Supply And Planning. IRC, Technical Paper Series, No. 15. Reprinted 1991. John Wiley And Sons.

CDG/DESWOS (1983), Self Help Housing In Squatter Settlements Of Zambia - Legal Aspects. Cologne, Germany.

Central Statistics Office - Zambia (1993), Social Dimensions Of Adjustment:
Priority Survey II.

Cook R. (1991), Child Health in The Tropics.
Edited by Jeliffe D. Edward Arnold Publ. Ltd.

Djukanovic V., Mach E. (1975), Alternative Approaches To Meeting Basic Health Needs In Developing Countries: A joint WHO/UNICEF study. WHO, Geneva (1975).

Feachem R., Burns E., Curtis D., Cairncross S., Khalid Khan M., Cronin A., Lamb D., Cross P., Southall H. (1977), Water, Health And Development: An Interdisciplinary Evaluation. London, Tri-Med Books Ltd.

Feachem R. (1986), Water Supplies For Low Income Communities: Resource Allocation, Planning And Design For A Crisis Situation. From: Water, Wastes And Health In Hot Climates. Edited by Feachem R. et al. John Wiley and Sons. Reprinted 1986.

Fischer A., Lang J., Stoeckel J. (1991), Handbook for Family Planning Operations Research Design, 2nd Ed. The Population Council.

Guzman M., Scrimshaw N., Bruch H., Gordon J. (1968), Nutrition And Infection Field Study In Guatemalan Villages, 1959-1964. VII: Physical Growth And Development Of Pre-school Children. Arch. Env. Health, 17:107.

Harpham T., Lusty T., Vaugham T, (1988), In The Shadow Of The City: Urbanisation And The Growth Of The Urban Poor. Oxford University Press.

Hoyle B,, Yunus M., Chen L. et al (1980), Breastfeeding And Food Intake Among Children With Acute Diarrhoeal Disease. Am J Clin Nutr 1980:33.

IRC (1988), Small Community Water Supplies: Technology Of Small Water Supply Systems In Developing Countries. Technical Paper Series, No. 18. John Wiley And Sons.

Kaite C. et al (1992), Nutrition And Health Status Of Infants And Young Children In Zambia: Findings From The 1992 Zambia Demographic And Health Survey.

Kawata K. (1978), Water And Other Environmental Interventions - The Minimum Investment Concept. Amer J Clin Nutr, 31:2114 - 2123, 1978.

Keutsch G. (1978), Ecological Control Of The Bacterial Diarrhoeas: A Scientific Strategy. Am J Clin Nutr 31 (1978). pp 2205.

Kirkwood B. (1991), Diarrhoea. From: Disease And Mortality in Sub-saharan Africa. World Bank Publications. Eds. Feachem R. and Jamison D. Oxford University Press.

Kourany M., Vasquez M. (1969), Housing And Certain Socio-Environmental Factors And Prevalence Of Enteropathogenic Bacteria Among Infants And Diarrhoeal Disease in Panama. Am J Trop. Med. Hyg. 18:963, 1969. (Quoted by Schneider et al).

Laike S. (1992), The Quality Of Drinking Water In Gondar, Ethiopia. Tampere University Publications 90.

Mandle P. (1982), Social Planning With The Urban Poor: New Government Strategies In The Making. Assignment Children, 57-58:13-18. UNICEF.

63

Mata L., Fernandez R., Urrutia J. (1969), Infeccion del intestino por bacterias enterpatogenas en ninis de una aldea de Guatemala durante los pimeros tres anos de vida. Rev Lat. Am. Microbiol. Parasitol. 11:102, 1969 (Quoted by Schneider et al).

Mata L., Urrutia J., Albetazzi C., Pellecer O., Arellano E. (1972), Influence of Recurrent Infection On Nutrition And Growth Of Children In Guatemala. Am J Clin Nutr, 25:1267.

McGregor et al (1961), Growth And Mortality In Children In An African Village. British Medical Journal, 12/23:1661.

McJunkin (1982), Water And Human Health. USAID, Washington DC.

Ministry of Health (1993), Diarrhoeal Diseases Household Case Management Survey - Zambia, Oct to Dec 1992. Govt. Printers.

Mukuka L. and Masiye G. (1993), Kamanga Community Profile Analysis - Final Report.
Pan American Health Organisation (1964), Control of Gastro-intestinal diseases. Scientific Publ. No. 100. Washington D.C. (Quoted by Schneider et al).

Rajagopalan S. and Schiffman M. (1974), Guide To Simple Sanitary Measures For The Control Of Enteric Diseases. WHO, Geneva.

Sack R., Pierce N., Hurschorn N. et al (1978), The Current Status Of Oral Therapy In The Treatment Of Acute Diarrhoeal Illness. Am J Clin Nutr 31 (1978). pp 2252.

Schneider R., Shiffman M., Faigenblum J. (1978), The Potential Effect Of Water On Gastro-intestinal Infections Prevalent In Developing Countries. Am J Clin Nutr 31 (1978). pp 2252.

Tebbut T. (1988), Principles Of Water Quality Control. Pergammon Press.

Tomkins A. and Watson F. (1983), Malnutrition And Infection: A Review ACC/SCN State Of The Art Series, Nutrition Policy Discussion Paper No.5. United Nations.

United Nations (1994), Update On The Nutrition Situation. ACC/SCN State Of The Art Series.

West C., Pepping F., Scholte I., Jansen W., Albers H. (1987), ECSA/CTA Food Composition Tables. Wageningen, Netherlands: Wageningen University of Agriculture.

White A. (1986), Patterns Of Domestic Water Use In Low Income Communities. From: Water Wastes And Health In Hot Climates, Edited By Feachem et al. John Wiley And Sons. Reprinted 1986.

WHO (1984), Guidelines For Drinking Water Quality: Vol 3: Drinking Water Quality Control In Small-Community Supplies. WHO, Geneva.

WHO/UNICEF (1985), The Management Of Diarrhoea And Use Of Oral Rehydration Therapy. WHO, Geneva.

WHO (1991), Infant Feeding - The Physiological basis. Supplement to Volume 67 (1989) of WHO Bull. Ed. J. Akre.

World Bank (1971), Trends in Developing Countries.

World Bank (1984), Population Change And Economic Development. Reprinted From World Development Report 1984. Oxford University Press.

World Bank (1985), Technical Paper No. 36.

World Vision (1993), Chainda Socio-Economic Analysis (Draft Report).

A1   Pre-survey census questionnaire

KAMANGA/CHAINDA

Date of interview:__/__/__   Name of mother:_____
Household number:_____   Occupation of HHH:_____
Interviewer:_____   Name of respondent:_____
===

1.   Are there any children aged below five years living in your household? Yes/No _____
      [If no, terminate interview, **do not proceed**]

2.   [If yes], Please give me the following information about them

Children in the household:

Individual code	Name:	Length of stay in compound	Sex	Date of birth	Age
1.					
2.					
3.					
4.					

A2 Study questionnaire
KAMANGA/CHAINDA

Date of interview: __/__/__   Name of mother:_____
Household number:_____   Occupation of HHH:_____
Interviewer:_____   Name of respondent:_____

[Collect the following information from the head of the household or the mother of the index child and fill in the table below.]

SECTION A: CENSUS

(Household profile: Record all the members of the household)

Serial no.	Name	01 R/ship to mother	02 Sex	03 Age	04 Marital status	05 Ed. Level	06 Occup
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
11.							

Codes:
01:     Relationship to mother: 1=Self (Mother), 2=Husband, 3=Daughter/Son, 4=Parent, 5=In-Law, 6=Niece/Nephew, 7=Grandchild, 8=Grandparents, 9=Sister/Brother
02:     Sex: 1=Male, 2=Female
03:     Age: Record date of birth also
04:     Marital status: 1=Single, 2=Married, 3=Widowed, 4=Separated/Divorced
05:     Education level: Ask for the grade level completed
06:     Occupation: 0=None, 1=Student, 2=Part-time labourer, 3=Full time employed, 4=Small scale business, 5=Works family land

Children in the household:

Individual code	Name:	R/ship to mother	Sex	Date of birth	Age
15.					
16.					
17.					
18.					

SECTION B: WATER AND SANITATION

1. Where do you get water for your household from?
    1=Public standpipe, 2=Well with pump, 3=Own tap in the yard 4=Dam, 5=River, 6=Stream, 7=Other

2. How far is your water source from your house? _____ metres

3. Do you pay for the water you use? Yes=1 No=2

4. [If yes], How much do you pay per month? K_____

5. How big is the container that you use to fetch water? __lts
    [Interviewer to verify capacity of container in litres]

6. How many times do you fill it each day? _____ times.

7. What purposes do you use the water for?
    1=Bathing, 2=Washing clothes, 3=Cooking, 4=Drinking, 5=Washing the dishes, 6=Cleaning the house, 7=Other (specify)_____

8. Do you treat the water in any way before using it for any purpose? Yes=1 No=2

9. [If yes], What treatment?
    1=Boiling, 2=Filtering, 3=Chlorination,
    4=Other (specify) _____

10. Does your household have a toilet available for it's use?
    Yes=1 No=2

11. [If yes]. What type of toilet is it?
    1=Pit, 2=Flush

12.   [Interviewer, observe and record the type of construction material of the toilet]_____

13.   [If no}, What facilities do you use?
       1. Communal toilet, 2= Neighbours toilet, 3=Bush

14.   What is the material from which the floor of your house is made? [Interviewer to verify by observation]
       1=Earth/Sand, 2=Cement

15.   How many rooms does you house have? _____ rooms

SECTION C: SOCIO-ECONOMIC

Serial No	Salary	Other income	Fuel	Food exp.	Medical exp.	Rent	Educ	Tran. Exp
1.								
2.								
3.								
4.								

SECTION D: ATTITUDES AND PRACTICES

1.   Has _____[Index child], suffered from diarrhoea in the previous seven days?
       Yes=1 No=2

2.   What symptoms did you notice when your child had diarrhoea?
       _____

3.   How many days did the diarrhoea last? _____

4.   What treatment did you give the child?
       1=ORS, 2=Herbs, 3=Other (specify) _____

5.   Did the diarrhoea stop following the treatment?
       Yes=1 No=2

6.   Are these the methods that you normally use to treat diarrhoea? Yes=1 No=2

7.   [If no], Why have you changed your methods?_____
       _____

70

8.   When _____[Index child] has diarrhoea, are there any food that you withhold from him/her? Yes=1 No=2

9.   [If yes], What foods are these? (specify)_____

_____

10. When _____[Index child] has diarrhoea are there any drinks that you withhold from him/her? Yes=1 No=2

11. [If yes], What drinks are these? (specify) _____

_____

12. When _____[Index child] has diarrhoea, what do you think is the cause?_____

_____

13. Has _____[Index child] been treated for worms in the past three months? Yes=1 No=2

14. Is there a traditional medicine for diarrhoea? Yes=1 No=2

15. [If yes], What is the medicine?

16. How is it administered? _____

17. Have you heard/attended any talks on diarrhoea from the programme? Yes=1 No=2

18. [If yes], When was this? _____

19. Is _____[Index child] a twin? Yes=1 No=2

20. What is the birth order of _____[Index child]? _____

21. What was the weight of _____[Index child] at birth?
     _____ kg.

22. Is the child currently bottle fed? Yes=1 No=2

23. At what age did you give _____[Index child] the bottle first? _____
     months

24. Has your child [Index], had all it's immunisations?
     Yes=1 No=2

25. [If not], Why not? (Give reasons) _____

26. Please show me your under five card for _____ [Index child]

71

[Interviewer tick all immunisations completed in the table below

Immunisation	At birth	1st dose	2nd dose	3rd dose
BCG				
DPT				
OPV				
Measles				

27. Do you attend the under five clinic in Chelston/Chainda?
Yes=1 No=2

28. [If yes], How often do you attend? _____

29. [If no], Do you attend any other under five clinic?
Yes=1 No=2

30. Is your child currently breasted? Yes=1 No=2

31. Would you continue to breastfeed when the child has diarrhoea?

SECTION E:KNOWLEDGE

1. Do you think that diarrhoea is a disease? Yes=1 No=2

2. Do you think that water can cause diarrhoea? Yes=1 No=2

3. [If yes], How do you think that water can cause diarrhoea?
_____

4. How do you think that you can prevent water from causing diarrhoea?_____

5. Do you think that food can cause diarrhoea? Yes=1 No=2

6. [If yes], How do you think that food can cause diarrhoea?
_____

7. How do you think that you can prevent food from causing diarrhoea?_____

SECTION F: ANTHROPOMETRIC MEASUREMENTS

Please allow me to take weight and height measurements of _____ [Mention the name of the index child]
now.

Anthropometric measurements

Measurements	Observation 1	Observation 2	Average
Weight (0.1kg)			
Height/Length (0.1cm)			

KAMANGA/CHAINDA

Date of interview: __/__/__   Name of mother:_____
Household number:_____   Occupation of HHH:_____
Interviewer:_____   Name of respondent:_____

SECTION G: SPECIMEN REQUEST FORM

To accompany each separate stool sample

Name	1	2	3
Parasites found			

1=Hookworm 2=Ascaris 3=H.nana

TWENTY FOUR HOUR DIETARY RECALL QUESTIONNAIRE

KAMANGA/CHAINDA

Date of interview: __/__/__   Name of mother:_____
Household number:_____   Occupation of HHH:_____
Interviewer:_____   Name of respondent:_____

Please ask the mother or caregiver the following questions and fill up the following table.

1)   Starting from yesterday, what did you feed your child with?
2)   What was the amount of the dish cooked?
3)   What were the raw ingredients used in the dish? (include amounts)
4)   How much did you serve the child?
5)   Did the child leave any of the food? (include amount left over if any)

Time	Dish	Amt. served	Ingred.	Source	Amt. Ingred.	Amt. served	Amt. left over	Total eaten

A3 Focus group discussion with mothers of index children - Kamanga

Focus group meeting with mothers on index children in Kamanga compound:

The mothers said that water was made available in the compound in 1992 with the help of Irish Aid. Before that time, there was a big problem of where to get water. There were water standpipes in the compound which had been installed by the Lusaka City Council. Unfortunately, water only ran from these taps at night. During the day, residents had to trek to Chelston Police camp to draw water.

When Irish Aid came into the area, they had a meeting with residents at which development priorities were discussed, and it was agreed that water was the most pressing problem. It was then that Irish Aid supplied the funds to sink 5 boreholes in the compound and install the water standpipes.

The major health problems as prioritised by the mothers:

Diarrhoea

Malaria

Cough

Worm infestation

Mothers were generally dissatisfied with the condition of the toilets. When asked why they had not tried to improve the standards of the toilets in terms of quality of building materials, mothers said that material were expensive and they could not afford. On cleanliness of the toilets, they said this was due to mere carelessness on the part of some people, where they do not care to ensure cleanliness of the toilets.

The poor state of the toilets was felt to be a great contributor to the spread of diarrhoea in the compound. mothers said this was because flies sit in the dirty toilets and then move from there to the food. The problem is made worse because some people who do not have toilets use the surrounding area to defecate and this leads to an increase in the fly population.

Small babies do not use the pit latrine. Instead the mother allows the child to defecate on the ground and throws the faeces into the pit latrine later. Some mothers are careless and take too long to clear the faeces up, leading to inconvenience to their neighbours. Mothers said that when the child is getting to two years of age or slightly older, some of them not all, will then begin to teach the child how to use the toilet and following toilet use to wash their hands in a separate container. Soap is not used because it is expensive and not necessary unless you are bathing.

Several of the women present at the meeting said that they believed their children had worms. The mothers generally seemed perplexed as to the source of worms, but ventured to say that they had heard that vegetables if not properly cooked could cause worms. Other mothers said they had been told by their friends that there were worms in the bread they feed their children.

The practice of eating soil was also mentioned as another way in which the children possibly got worms.

Mothers lamented about the small size of their plots saying that this made it very difficult to site toilets. If the household wants to build a toilet, they are forced to put it very close to the house, because of limited space. This has caused many people to opt out of building toilets for their households.

The toilets are not built very deep because of the stones underground. You dig a short distance and you have to blast if you want to dig any further. Most people therefore dig very shallow pits which quickly fill up, especially if they are used by many households. The majority of the toilets do not have cement on the floors.

Possible solutions to the problems:

1.   Mothers indicated that they would like to see something done about the small plot sizes, although they were not very clear what should be done, since the majority of them said they would be reluctant to move from their present plots.

2.   The roads within the compound should be tarred to reduce the level of dust in the compound.

3.   The toilets should all be roofed.

4.   The toilets should be built far from the houses.

5.   Mothers should take responsibility to ensure that the toilets are kept clean at all times and free of flies.

Most of the mothers said they give ORS in combination with herbal preparations, capsules or kaolin. Few of the mothers had ever made home made sugar and salt solution. The majority felt that it is inferior to commercially packaged ORS. Generally, mothers were not very happy with ORS as a treatment although they do give it to their children if it is available. Most times they said that the clinic is out of stocks. When a child is taken into the clinic suffering from diarrhoea, the nurses will give ORS at the clinic, but none for the mother to take home. Mothers say that usually the child will vomit the ORS, so even having gone to the clinic in the first place becomes a waste of time. Mothers said that they would prefer if their children were given injections to treat the diarrhoea instead of ORS as these are more effective.

Mothers complained of not having nutritious foods to feed their children. They felt that because of constantly eating vegetables and beans, diarrhoeal prevalence would not easily decline. Beans was identified as a food that takes long to be digested by the system and also if in addition it is not properly cooked it causes diarrhoea.

The attitude of health staff at the clinic was generally felt to be poor and this discourages mothers from going to the clinic. Many felt that the health workers do not give priority to mothers coming in with sick children and instead the nurses concentrate on completing their paper work before attending to waiting patients.

The mothers in Chainda complained about the difficulties that they face in obtaining water for their daily household use. While there is a water supply system in their compound, the mothers said they found it to be 'useless' because it does not provide them with a reliable supply of water. They have to wake up as early as 4am and queue up for water. The water stops flowing around 7am. If one is late in waking up, then she will fail to draw water because there are many people waiting to be served and the water might finish before her turn comes.

Sometimes, mothers have to go the nearby farms to draw water. Many of these farms are between 3 and 5 km away. In the past, the mothers said the farmers used to be 'kind' and allow one to draw water free of charge. Nowadays, because of the drought, many of the farmers have little water and they do not freely allow us to draw from their taps. At times, the farmer may ask you to do some manual work for him or pay for the water. If you have money you pay, but most of the mothers said they are poor and they end up doing some work for the farmer.

Mothers complained that by the time they have done the farmers chores and then drawn the water that they need for their households, they are already tired and yet they still face a long walk home with their water load. There are also other household chores waiting for them. In most cases therefore, mothers try to ensure that they draw water from within the compound or nearby high cost residential areas. Water is used for cooking, bathing, washing clothes and utensils. In the past when water was plentiful, many residents used to have backyard gardens. Nowadays, only few people grow vegetables within the compound, due to the scarcity of water.

None of the mothers present boiled their drinking water. When asked why, they said it was due to laziness on their part. Asked whether cooking fuel was a limiting factor, the mothers said they did not believe so, because they could always collect firewood if they did not have charcoal or paraffin to use.

The most common illnesses in the compound in the mothers view are listed below in order of priority:

Diarrhoea

Malaria

Coughs

Sores in the eyes

Asked why some households do not have pit latrines, the mothers said that usually it is just laziness on the part of the householders. In a few cases, some landlords are too stingy to build toilets for their tenants. They collect rent and promise that they will construct toilets, but they never do. Residents said that if they had money, they would build toilets of good quality i.e. roofed and having a cement floor. Only 'few rich people' can afford to build good quality toilets. Many of the householders dig a new toilet every year. This is because the toilets fill up very quickly because of many people using the same toilet and toilets are not dug very deep. It is impossible to dig deep because of the large boulders underground which are not easy to break manually.

Small children generally do not like to use the pit latrines, because they are scared. Mothers also fear that the child will mess up the toilet. The child is therefore allowed to defecate in the open, usually behind the house. The mothers later clear up the faeces and throw them in the pit latrine. Some of the older children (school going), tend to defecate in the nearby farms.

In relation to handwashing, mothers were asked when they feel it is necessary to wash their hands. All mothers said they wash their hands after using the toilet. Asked if their children also do the same, mothers said they would not know as they may not always be around when the child has a toilet call. One mother asked if it was necessary to wash one's hands after changing a baby's nappy. After some debate, the other mothers agreed that if the child has only wet the nappy it is not necessary. However, if the child had defecated, then the mother should wash her hands and the babies after changing the nappy.

As to how hands are washed, mothers will usually use a cup or other container to draw a little water from the container of water set aside for washing utensils. She will then pour this water over her hands one at a time. A few of the mothers said that they pour a little water into a basin or pot and then wash their hands in that. In the majority of cases, soap is not used. The reason is that many mothers felt that the use of water alone was sufficient. In addition, they said that the soap is usually kept inside the house. If you were to use soap each time you wash your hands, you would have to keep going into the house to collect it, and when you have finished washing your hands you take it back again. If you or the children happen to forget the soap outside the house, you will find it has been stolen. It is therefore easier to just use water when washing your hands.

Very few of the mothers take their children to the clinic for a 'normal' diarrhoea episode. A normal diarrhoea episode was described as one in which there is no blood in the stool and the diarrhoea begins to improve by the third or fourth day. Reasons for not going to the clinic were that the current cost sharing policy introduced by the government has made it difficult for many families to afford medical are. Mothers complained that often they cannot even afford to give their children more than one meal a day, and therefore how can they keep up the monthly medical insurance fees. Some mothers noted that in any case even when they do pay the required fees, many of the necessary drugs are out of stock at the clinic. Often one will be given a prescription to go and but the medicine in town and this is expensive. In addition, the nurses were said to be rude and unhelpful.

Asked what their biggest problem was in relation to their environment, mothers in Chainda said that it was the water. They however also mentioned that they do not have enough food to feed their families and especially the children. Asked why they do not engage in any small scale businesses. the majority of the mothers said that their husbands are unwilling/too jealous to allow their wives to go out and earn money. Many men feel that their wives will become proud if they are allowed to earn their own money. The mothers noted that the children are the ones who suffer, because many husbands are earning very little money. As a result, children sometimes go without eating for the whole day or they just have one meal in the evening.

81