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**KNOWLEDGE, PERCEPTION AND PRACTICES ASSOCIATED WITH RICKETS: A  
COMPARATIVE CASE STUDY OF RICKETS AND NON-RICKETS CASES IN  
NAIVASHA DISTRICT HOSPITAL**

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**A dissertation submitted in partial fulfillment of the requirements for the degree of Master  
of Science in Applied Human Nutrition in the Department of Food Science, Nutrition and  
Technology, Faculty of Agriculture, University of Nairobi**

**2013**

## DECLARATION

I hereby declare that this dissertation is my original work and it has not been submitted to any other institution of higher learning.

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## **DEDICATION**

This dissertation is dedicated to my parents who have given me the opportunity of an education from the best institutions and support throughout my life. God's blessings upon you!

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## **ABBREVIATIONS AND ACRONYMS**

AAP	American Academy of Pediatrics
ANC	Antenatal Care
CRSP	Collaborative Research Support Program
CSP	Child Survival Project
FGD	Focus Group Discussion
FP	Family Planning
GOK	Government of Kenya
HIV	Human Immuno deficiency Virus
IMCI	Integrated Management of Childhood Illnesses
IU	International Units
KAP	Knowledge, attitude and practices
KII	Key Informant Interview
MCH	Mother Child Health Clinic
MoMS	Ministry of Medical Services
MoPHS	Ministry of Public Health Service
NAS	National Academy of Sciences
OR	Odds Ratio
PEM	Protein Energy Malnutrition
POPC	Pediatric Outpatient Clinic
PTH	Parathyroid Hormone
SPSS	Statistical Package for Social Sciences
UVB	Ultra Violet Beta light

## OPERATIONAL DEFINITIONS

**Knowledge** - refers to the mothers understanding expressed as the correct responses of the mothers regarding causes and treatment of rickets.

**Practice**- refers to the ways in which the caregivers demonstrate the knowledge they have through their actions.

**Perception**- refers to the mothers feelings towards a subject, as well as any preconceived ideas that they have towards it. It also refers to a mental stance that is composed of different beliefs.

**Phosphaturia**- refers to the hyper excretion of phosphate in the urine.

**Hypophosphatemia**- refers to an electrolyte disturbance in which there is an abnormally low level of phosphate in the blood.

**Rickets**- refers to the softening of bones in children due to deficiency or impaired metabolism of vitamin D, phosphorus or calcium that potentially leads to fractures and deformity.

**Flats** – Type of a building that has several storeys and in each storey there are a number of houses. The building is built in such a way that it maximizes on space.

## **ABSTRACT**

Rickets is a disease that first appears in children at the age of six to twenty four months caused by a deficiency in vitamin D, calcium and phosphorus. It is characterized by bone pain, muscular tenderness, hypocalcemic tetany, delayed tooth eruptions, late closure of the fontanelle, enlargement of joints, bowed legs and knock knees. The purpose is to provide information that may be useful for designing intervention and policy making. The main objective is to determine the knowledge, perceptions and practices regarding rickets in rickets and non rickets cases.

A comparative cross sectional study was conducted that included 208 caregivers. Caregivers of children with rickets were 104 and caregivers of children without rickets were 104. Systematic and exhaustive sampling was conducted to select non rickets and rickets cases. A questionnaire consisting of socio demographic, knowledge, perceptions and practices was administered to the respondents. A focus group discussion and a key informant interview were conducted. The collected data were checked, validated, entered and analyzed using SPSS 16. Descriptive and inferential statistics were used. Statistical significance was tested at a p-value of  $< 0.05$ .

The study findings showed that caregivers of children with rickets had a higher mean age than the caregivers of children without rickets. Children with rickets had a higher mean age than the children without rickets. Households that depend on self employment, farmer and casual labor had a higher percentage of children with rickets. The mean knowledge scores of caregivers of children with rickets were higher than the caregivers of children without rickets. The mean practice score between caregivers of children with rickets and caregivers of children without rickets were not significant. The mean perception score of caregivers with children with rickets

and caregivers of children without rickets were not significant. There was a positive correlation in the knowledge and perception scores in the two groups.

Caregivers of children with and without rickets had their knowledge, perception and practice scores above average. Caregivers of children with and without rickets earned less than the recommended wage salary in Kenya.

There is need to create an understanding and awareness to the caregivers and in particular the mothers through maternal education. There is need to address the various issues that affect each region separately as opposed to addressing certain issues in all the regions where the problem is not significant. There is also a need to establish the prevalence of rickets in Naivasha and the country.



## **CHAPTER ONE: INTRODUCTION**

### **1.1 Background information**

Nutritional rickets has received considerable attention from public health specialists in a number of developed countries. In developing countries, attention has been focused on rickets because of its effect on bone growth and mineral homeostasis and because of its association with increased infant and childhood mortality especially when accompanying lower respiratory tract infections (Thacher et al, 2006).

Nutritional rickets is caused by a simple deficiency in vitamins and minerals and can be corrected if detected early (Allgrove, 2004). Dietary deficiencies of calcium or phosphorous have the same effect as deficiency of vitamin D (Diehl and Dalrymple, 1973). Rickets is viewed as having a spectrum of pathogenetic mechanism which include; those with classic vitamin D deficiency as found among infants who are exclusively breastfed and not supplemented with vitamin D ( Kreiter, 2000), those with pure calcium deficiency yet with normal vitamin D stores (Prentice, 2008) and those with marginal low vitamin D stores and a diet deficient in calcium or high in phytates which impair intestinal absorption of dietary calcium (DeLucia et al., 2003). Vitamin D stimulates intestinal calcium and phosphorus absorption, while inadequate calcium and phosphorus lead to demineralization on the surface of the bone tissue (Misra et al., 2008). Rickets can also be caused by renal diseases or the use of certain medication but inadequate nutrition is the most common cause (Thacher et al, 2006).

Rickets first appears in 6 to 24 month old children with the impaired mineralization of the growing bones leading to rickets and accompanying bone pain, muscular tenderness,

hypocalcemic tetany, delayed tooth eruptions, late closure of the fontanelle and enlargement of the joints particularly of the long bones (Combs, 1998).

Prevalence of rickets in the world has been reported in many countries during the past three decades. In some countries, nutritional rickets is reported sporadically (Thacher et al 2006). Other countries have up to 9 percent of their children clinically affected (Kabir et al, 2004).

Rickets and vitamin D deficiency are common in many countries including Middle Eastern countries, developing countries such as Ethiopia, Yemen, Asian countries such as China and Mongolia (Pettifor, 2008). One in every three Mongolian children suffers from rickets (Tsevegsuren and Douglass , 2007).

The prevalence of overt rickets among under five children is 2.4% and findings which indicate the presence of rickets is 14.9% in Nigeria. A study in an urban area of Algeria revealed a prevalence of 35-45% among children in 1963, 1973 and 1974; the prevalence was reduced to 18% in 1984-85 following a prophylaxis program. Hospital and community based studies from Tunisia, Libya and Egypt show that rickets is prevalent in all North African countries. Premature and low birth weight babies are at a higher risk for the development of rickets. Emerging evidence from hospital based studies in Kenya indicate that 58.8% of premature infants develop rickets by the age of 6 months (Bereket, 2003).

Rickets is caused by a deficiency of vitamin D which is a fat soluble vitamin required for the absorption of calcium (Diehl and Dalrymple, 1973). Low concentrations of vitamin D lead to decreased intestinal absorption of calcium which leads to a decrease in serum calcium concentrations which stimulates parathyroid hormone (PTH) secretion. PTH then mobilizes

calcium and phosphorus from bone to restore serum calcium concentrations to normal level (Weisberg et al, 2004).

Dietary deficiencies of calcium or phosphorus may have the same effect as deficiency of vitamin D. Vitamin D functions with PTH to maintain intracellular and extracellular calcium concentrations within a physiologically acceptable range (Weisberg et al, 2004). When these concentrations are no longer sufficient for normal bone mineralization, bone abnormalities develop (Fomon, 1993).

## **1.2 Statement of the problem**

Rickets is a disease thought to have been eradicated in Kenya. However, it is affecting young children between six to twenty four months old hence concerns have been towards the rickets menace. A study conducted in Kenyatta National Hospital showed that 58.8% of children aged six months develop rickets. However this is because they were born prematurely or with low birth weight. The study shows that by the time the children are six months of age they develop rickets (Oyatsi, 1999). A recent study conducted in Kiambu District Hospital states that the prevalence of rickets in children 0-59 months to be 3.4% (Theuri, 2012). There have also been concerns in Turkana regarding the high cases of rickets in the area. Since the mothers are the first care providers for their children, adequate knowledge about the reemergence of rickets is a point of concern.

## **1.3 Justification of the study**

Rickets is a condition caused by a combination of vitamin D deficiency and insufficient calcium intake. There is need to address the reemergence of rickets because its consequences are

associated with the increase in childhood morbidity and mortality. It is also associated with the increased cost of deliveries in mothers due to obstructed labor. There is need to develop guidelines such as rickets specific communication strategy or informative messages that will help eradicate the reemergence of rickets in order for the children to have a good and healthy life.

Mothers are the first care providers for their children; it is the mother's knowledge, practices and perceptions that greatly affect the nutrition and growth of the child.

Developing countries and Kenya in particular need to acknowledge rickets as a problem and devise ways of tackling the problem which can save the country resources used in treatment of rickets.

#### **1.4 Study aim**

To contribute to the sensitization of the reemergence of rickets in Naivasha to trigger concern for Kenya as a whole and stimulate inclusion of other nutrition communication outlets such as Malezi Bora campaigns that play a role in educating the nation.

#### **1.5 Study purpose**

The purpose is to provide information that will be useful in forming interventions (nutrition messages) and policy making.

#### **1.6 Objectives**

##### **1.6.1 Main objective**

To determine the knowledge, perceptions and practices regarding rickets in rickets and non rickets cases.

### **1.6.1.1 Specific objectives**

- To determine the socio-demographic characteristics of caregivers of children with rickets and those without rickets.
- To determine knowledge on rickets of caregivers of children with and without rickets.
- To determine the perceptions on causes of rickets of caregivers of children with and without rickets.
- To determine the child care practices of caregivers of children with and without rickets.
- To determine the correlation between knowledge versus practices, knowledge versus perceptions and perceptions versus practices scores of caregivers of children with and without rickets.

### **1.7 Null hypotheses**

There is no significant difference in the monthly income of caregivers of children with and without rickets.

There is no significant difference in the nutritional knowledge of caregivers of children with and without rickets.

There is no significant difference in the perceptions of caregivers of children with and without rickets.

There is no significant difference in the child care practices of caregivers of children with and without rickets.

## **1.8 Assumptions**

Caregivers have some knowledge regarding occurrence, prevention and treatment of rickets.

## **1.9 Limitation**

Reliance on medical records at the mother child health clinic (MCH) to establish a diagnosis of rickets may lead to a lot of cases with possible or undocumented rickets being left out.

## **1.10 Benefits**

The beneficiaries of this study will be policy makers, service providers, mothers and other researchers. The policy makers will be informed on the importance of addressing the burden of rickets. The service providers will be informed on the need for the sensitization on the etiology of rickets. The mothers will benefit from the sensitization process from the service providers and from better focused interventions that will enable them to be better equipped in terms of their knowledge, practices and perceptions.

## **CHAPTER TWO: LITERATURE REVIEW**

### **2.0 Introduction**

#### **2.1 History**

Rickets was first reported in the mid 1600s in Europe (Rajakumar, 2003). Descriptions of the disease were published in the mid 17<sup>th</sup> century by Francis Glisson and Daniel Whistler. It was known as the “English disease” because of the high prevalence among urban English children (Gibbs, 1994). The prevalence was high in children between 6 to 30 months and was common among children of the affluent. However with the development of inner city slums, rickets became more prevalent among children of the poor and destitute (Pettifor, 2008).

Trousseau, a French physician, noted the disease was common in damp and cold countries and that cod liver oil and fish oils were effective in its management. In the late 1800s a number of physicians concluded that sunlight was beneficial in preventing and treating the disease. In the 20<sup>th</sup> century, vitamin D was discovered and the role of ultra violet light in the formation of vitamin D was discovered (Rajakumar and Thomas, 2005). By the 1800s, ultra violet radiation and cod liver oil were found to be effective in the treatment of rickets and in the 1900s , vitamin D was isolated and found to be the essential ingredient of the cod liver oil (Combs, 1998). With the isolation of vitamin D, some countries introduced supplementation programs and food fortification especially infant milk formulas and cows milk in the US and Canada (Pettifor, 2008) .

Rickets became rare with the introduction of the supplementation and food fortification with vitamin D during the 20<sup>th</sup> century (Chesney, 2002). However, with the recent encouragement of

exclusive breastfeeding during the first months of life (MoPHS, 2010) and the immigration of darker skinned populations into many of these industrialized countries after World War 2 have seen a resurgence of the disease (Pettifor, 2008).

Until recently, little attention has been paid to the prevalence of rickets in other countries but it is clear that rickets has been and remains a problem in Northern Asian countries, Middle East, and in a number of countries in Africa (Pettifor, 2008) .

## **2.2 Overview of rickets**

Rickets is ranked among the most prevalent diseases of young children in developing countries such as Africa, Asia, Latin America and Middle East. It causes childhood morbidity and disability and contributes significantly to public health problem. In developing countries, rickets is among the five most common diseases in children. It is common in the 4 months to 3 year age group. It is incompletely understood why rickets occurs frequently in tropical countries with abundant sunlight which should prevent vitamin D deficiency (Bereket, 2003).

Clinical vitamin D deficiency, manifested as rickets, is a major public health problem in many parts of the world. Action is urgently needed to reduce the risk of clinical vitamin D deficiency worldwide among infants and young children. Effective ways to reduce the risk includes; promoting safe skin exposure to UVB sunlight, improving dietary intakes of vitamin D and increasing awareness among policy makers, health professionals and the general public about the importance of vitamin D (Prentice, 2008).

A study conducted on Rickets with special reference to Bangladesh, showed the emergence of rickets as a National health problem affecting up to 8 percent of children in some areas. The



study findings reveal that insufficiency of calcium intake is the underlying cause and treatment with calcium is curative (Craviari, 2006).

### **2.2.1 Factors linked to the occurrence of rickets:**

Inadequate dietary vitamin D intake, darker pigmented skin (Fuller and Casparian, 2001), inadequate sunlight exposure (Baroncelli et al, 2007), Primary deficiency is highly prevalent, even in countries with abundant sunshine, when skin exposure to UVB sunlight is limited by lifestyle and other factors (Prentice, 2008), remaining indoors due to seasonal, cultural or religious reasons, air pollution which limits sunlight exposure, dietary calcium deficiency which contributes to development of rickets (Bereket, 2003) are factors associated with the occurrence of rickets.

### **2.2.2 Consequences of rickets**

They include; Chronic protein energy malnutrition (PEM) can cause stunting or linear growth retardation. Vitamin D and calcium deficiency with rickets can also cause stunting (Neumann and Harrison, 1994). Impaired mobility, increased pneumonia prevalence and in girls, pelvic deformities that may later in life result in obstructed labour and deliveries during childbirth (Neumann et al, 2003).

### **2.2.3 Pathogenesis of rickets**

This is the manner in which the development of a disease occurs from its initial appearance through to its end stages. Rickets develops in three stages:

**First stage;** the active form of vitamin D is 1,25-dihydroxyvitamin D which stimulates intestinal calcium and phosphorus absorption (Misra et al., 2008). Absence of adequate body stores of vitamin D leads to decrease in the supply of 1,25-dihydroxyvitamin D resulting in a decreased

intestinal absorption of calcium and phosphorus and a consequent slight decrease in the plasma concentrations of ionized calcium (Fomon, 1993). Dietary calcium and phosphorous absorption is reduced to 10-15% and 50-60% respectively (Holick, 2006)

The decreased ionized calcium concentration stimulates the release of parathyroid hormone and although the concentration of 25-hydroxyvitamin D in circulation is low, the increased secretion of parathyroid hormone stimulates conversion of 25-hydroxyvitamin D to 1, 25-dihydroxyvitamin D in the kidney. The increased production of 1, 25-dihydroxyvitamin D in turn results in increased absorption of calcium and phosphorus from the bones (Fomon, 1993). In turn, inadequate serum levels of calcium and phosphorous decrease the mineralization on the surface of bone tissues (Misra et al., 2008)

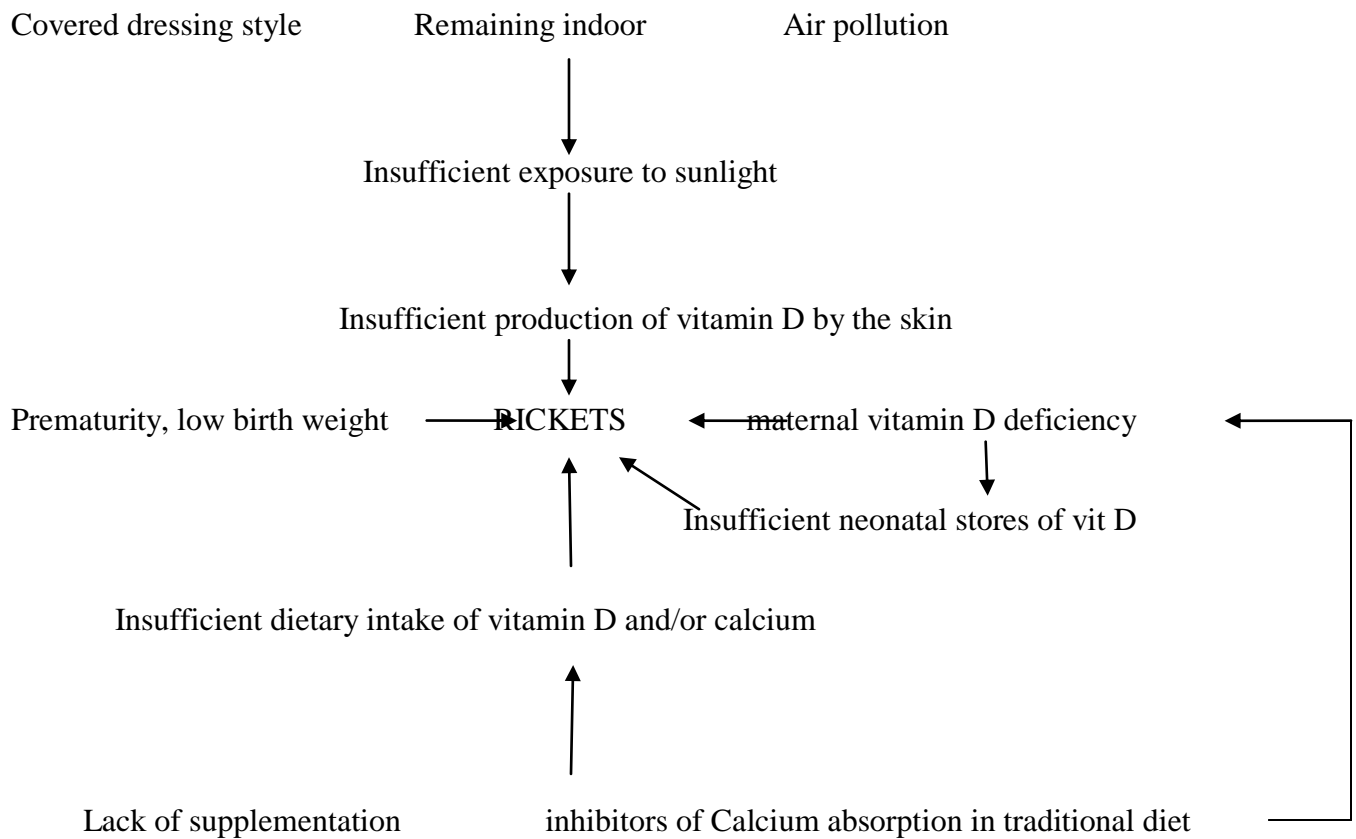
**Second stage;** the concentration of ionized calcium returns to normal, however, the phosphaturia caused by the relative hyperparathyroidism is responsible for negative phosphorus balance and eventually hypophosphatemia (Fomon, 1993)

**Third stage;** the supply of 25-hydroxyvitamin D is seriously depleted that even in the presence of hyperparathyroidism, adequate quantities of 1,25- dihydroxyvitamin D can no longer be produced. Intestinal absorption of calcium and phosphorus then decreases and the serum ionized calcium concentration decreases (Fomon, 1993). Low phosphate level and low 25-hydroxyvitamin D concentrations confirm diagnosis of rickets (Tsang, 2000) which is based on serum 25 hydroxyvitamin D concentrations (Munns, 2006).

### **2.3 Risk factors**

Rickets is associated with the following risk factors, air pollution leads to the filtering of sunlight of the necessary wavelengths so can lead to variations in the vitamin D status at the same

wavelength (Agarwal et al., 2002), remaining indoors decreases the duration of skin exposure to UVB sunlight which is a primary factor in determining vitamin D status (Holick, 2004), people who wear clothes that cover much or all of the body is associated with a low vitamin D status (Gannage, 2000), maternal vitamin D status influences the vitamin D status of her infant in the first months of life and hence the infant will have insufficient vitamin D if the mother is or was vitamin D deficient (Specker, 1994) and inhibitors such as phytates and oxalates prevent the absorption of calcium (Eyberg, 1986).



**Fig 1: Risk factors that lead to the development of rickets**

### **2.3.1 Recommended intake of vitamin D**

The new recommended adequate intake of vitamin D by the National Academy of Sciences (NAS) to prevent vitamin D deficiency in normal infants, children, and adolescents is 200 IU per day. The new NAS guidelines for infants are based on data primarily from the United States, Norway, and China, which show that an intake of at least 200 IU per day of vitamin D will prevent physical signs of vitamin D deficiency and maintain serum 25-hydroxy-vitamin D at or above 27.5 nmol/L (Gartner and Greer, 2003).

### **2.3.2 Role of diet in development of rickets**

Most African traditional diets are low in calcium and high in phytates (Eyberg, 1986) such include; maize, sorghum and millet (Bwibo, 2003) this is the case in many developing countries, cereal staples are the major constituent of the diet whereas dairy products are expensive or unobtainable. In South Africa children and adolescents with rickets were found to have calcium intakes of between 150-250 mg/d, which were significantly lower than those of age-matched controls living in the same community. The recommended intake of calcium is 500mg/d. In these children calcium supplements were shown to heal the disease without altering serum 25(OH)D concentrations (Eyberg et al., 1986).

Very few foods items (fish liver oil, fatty fish, egg yolk and milk) naturally contain vitamin D, and foods that are fortified with vitamin D are often inadequate to satisfy a child's vitamin D requirement (Holick et al., 2008). In Mongolia, traditional complementary foods for babies are nutrient poor, consisting of flour or rice based porridge made with water or occasionally milk, sugar and butter (Tsevegsuren and Douglass, 2007).

### **2.3.3 Role of sunlight exposure in the development of rickets**

The amount of vitamin D synthesized through sunlight exposure is affected by the time spent outside, amount of skin exposed, air pollution, cloud cover, time of day, latitude and skin pigmentation (Weisberg et al, 2004).

A potential source of vitamin D is synthesis in the skin from the ultraviolet B light fraction of sunlight. Lifestyles or cultural practices that decrease time spent outdoors or increase the amount of body surface area covered by clothing when outdoors further limit sunlight exposure. The effects of sunlight exposure on vitamin D synthesis are also decreased for individuals with darker skin pigmentation and by the use of sunscreens (Fuller, 2001). All of these factors make it very difficult to determine what adequate sunshine exposure for any given infant or child is.

Furthermore, the Centers for Disease Control and Prevention, with the support of many organizations including the American Association of Pediatrics (AAP) and the American Cancer Society, has recently launched a major public health campaign to decrease the incidence of skin cancer by urging people to limit exposure to ultraviolet light (Gartner and Greer, 2003).

The age at which direct sunlight exposure is initiated is even more important than the total sunlight exposure over a lifetime in determining the risk of skin cancer (Marks, 1990). Thus, guidelines for decreasing exposure include directives from the AAP that infants younger than 6 months should be kept out of direct sunlight, children's activities that minimize sunlight exposure should be selected, and protective clothing as well as sunscreens should be used (AAP, 1999). Yet, the daily requirement of vitamin D can be obtained by 30 – 60 minutes exposure to sunlight in the morning (Teotia and Teotia, 2008).

#### **2.3.4 Role of breast feeding in the development of rickets**

The reemergence of rickets has coincided with the resurgence of exclusive breast feeding (Welch et al, 2000). The promotion of breast feeding without emphasizing on the need for vitamin D supplementation for the prevention of rickets has led to the resurgence of nutritional rickets (Welch et al, 2000). Breast milk is a poor source of vitamin D. In the phase of no vitamin D supplementation, all the exclusively breast fed infants are vulnerable to the development of rickets if they cannot photosynthesize their required levels of vitamin D (Gartner and Greer, 2003). The risk of developing rickets is much greater among dark skinned infants because they require a six fold greater exposure to sunlight to elevate their vitamin D levels as compared to the white infants (Clemens, 1982).

The vitamin D content of breast milk from a mother with adequate vitamin D status is approximately 22IU/L and so cannot provide by itself the adequate intake of 200 IU/day recommended for children (Weisberg et al, 2004). Infants who are breastfed and do not receive supplemental vitamin D or adequate sunlight exposure are at increased risk of developing vitamin D deficiency or rickets. Although there is evidence that limited sunlight exposure prevents rickets in many breastfed infants, in light of growing concerns about sunlight and skin cancer and the various factors that negatively affect sunlight exposure. It seems prudent to recommend that all breastfed infants be given supplemental vitamin D. Supplementation should begin within the first 2 months of life. It is very difficult to determine what adequate sunlight exposure for an individually breastfed infant is (Gartner and Greer, 2003).

Breast milk is the best food for babies between birth and six months. Exclusively breastfed babies are more vulnerable to low vitamin D status thus may need infant formula fortified with

vitamin D to take into account the need to supplement this age-group. A Greek study on vitamin D status concluded that babies who are exclusively breastfed during the first six months are in need of vitamin D supplementation irrespective of the season, sunny countries and where foods are not supplemented (Challa et al, 2005).

### **2.3.5 Role of education as a preventive measure in the development of rickets**

In China, education about rickets (maternal awareness of how to prevent rickets) was effective in reducing the prevalence of rickets within two and a half years, although it is not clear if the recommended advice was actually implemented (Strand, 2002-2003). In rural areas, most young children grow up on diets devoid of commercial infant products. It is, thus, challenging to find a 'point source' at which vitamin D or calcium can be introduced in a way that would reach all children at risk in a developing country. Therefore, it makes sense to try to provide community-wide (or even nation-wide or region-wide) education to try to increase the habitual intake of calcium in areas where calcium is widely deficient in the diets of young children (Craviari et al, 2006).

A study conducted in Pakistan to determine the contributing factors of rickets among children at Hyderabad, indicated that maternal education and health seemed to be an important factor. Maternal education may play an important role as it is expected that a conscientized mother would adopt better and improved child-rearing practices (Majeed et al, 2007).

### **2.3.6 Calcium interactions with fluoride and the development of rickets**

Calcium is the strongest antagonist of fluoride toxicity. The toxic effects of fluoride on bones are more severe and complex in dietary calcium deficiency state. Calcium deficiency and fluoride

interaction syndrome of bone disease and deformities are more severe and complex in growing children because of the greater demands for calcium. However, adequate intakes of calcium to maintain the positive calcium balance to counteract the toxic effects of fluoride are essential (Teotia and Teotia, 2008).

### **2.3.7 Child care practices that contribute to the development of rickets**

A study conducted in Hyderabad showed the following child care practices as contributing factors for rickets; Inadequate exposure to sunlight, complete wrapping of children or heavy mode of dressing, exclusive breastfeeding (Majeed R, 2007). Exclusive breast feeding is also cited as a contributing factor (Gartner and Greer, 2003).

### **2.4 Rickets sensitive past programs**

In 2000, World Vision initiated a comprehensive nutrition program in Mongolia to address high levels of micronutrient malnutrition and in particular iron and vitamin D deficiency. The program strategy to address vitamin D deficiency included: Preventive doses of micronutrients to all children six to thirty five months, providing vitamin D capsules to children with rickets, social marketing by use of multimedia campaigns to raise awareness, capacity building through training ensured program sustainability and partnership with national government institutions, academia and world vision resulting in improved program quality (Tsevegsuren and Douglass, 2007).

The above strategies led to desirable results in Mongolia such as; the high acceptance of program interventions among families due to noticeable improvements in the children's health, the



prevalence of rickets in children six to thirty five months decreased from 31% to 29% (Tsevegsuren and Douglass, 2007).

In Kenya, The Nutrition Collaborative Research Support Program (CRSP) project did not find clinical evidence of rickets in the Embu children that were studied in the early 1980s. It was surprising that several cases of rickets were encountered in the 2000-2003 Child Survival Project (CSP), carried out in the same area in Embu. The toddlers were enrolled in a feeding intervention study from 2000–2003. 7.4% such cases were diagnosed clinically out of 324 children registered for the CSP project. The children with rickets shared the following risk factors: short breastfeeding duration, vegetable and cereal-based complementary foods with negligible cow or goat milk, and confinement indoors when the mothers were cultivating the fields. Multiple factors are at play here, including a low intake of milk and hence of calcium and phosphorus, no intakes of ocean fish hence a low vitamin D intake, and perhaps reduced exposure to sunshine and ultraviolet light. All these factors operate jointly, but the lack of milk in the diet was a major factor. The affected children were provided with milk supplements and vitamin D-3 for 1 month, which caused a noticeable regression of their rickets (Bwibo and Neumann, 2003).

### **2.5 Kenyan situation in regards to rickets**

The prevalence of rickets in Kenya is not known hence the need of conducting further research to establish the prevalence since the presence of the disease has received some attention from the medical practitioners and the public who are noticing its presence. Some of the areas that have received some attention due to rickets are; Kiambu, Mwea and Naivasha.

## 2.6 Interventions on Rickets in Kenya

Rickets due to calcium deficiency has been described recently in Kenya and individuals responded well to calcium supplements of 500 mg daily (Neumann et al, 2003) Provision of milk supplements and vitamin D-3 (Bwibo and Neumann,2003).

## 2.7 Role of Malezi Bora

The Malezi Bora Strategy was initiated in 2007 to provide a comprehensive package of services that include child immunization, Vitamin A supplementation, deworming of under fives and pregnant women, treatment of childhood illnesses, HIV Counseling and Testing, Use of Insecticide Treated Nets in Malaria prevention and improved antenatal care (ANC) and family planning services (FP). Malezi Bora provides an opportunity to provide children with a comprehensive and integrated package of services. At the moment, Malezi Bora does not address rickets (GOK, 2010).

## 2.8 Methodological issues for a knowledge, attitude and practice (KAP) study

*Table 1: Knowledge, perception and practices assessment*

	<b>Definitions</b>	<b>Observations</b>	<b>Analysis tools</b>	<b>Assessment criteria</b>
Knowledge	Body of information acquired by people on a given subject.	One can precisely measure the knowledge level regarding information acquired by a population, then compare (before– after).	<b>Quantitative data:</b> •Closed-ended questions (yes / no or multiple choice). •Statistical comparisons between two places or periods	Rates of correct answers according to the group.
Perceptions	People’s	Perceptions are the	<b>Quantitative</b>	Statistical trends,

	perceptions about the disease rickets, what they say about their intentions, understanding difficulties and obstacles to changing practices.	gaps between knowledge and practices, and results of various restrictions people are bound by. It is a question of understanding how people relate to the contamination.	<b>data:</b> <ul style="list-style-type: none"> <li>• Measurement scales for intentions, perceptions, obstacles.</li> </ul> <b>Qualitative data:</b> <ul style="list-style-type: none"> <li>• Elements of understanding by gathering information on what people say, adjustment and observation tools</li> </ul>	comparisons. Qualitative measures.
Practices	Real acts carried out by people in the situation, in their context.	Field of direct observation, facts seen by the observer.	<b>Qualitative data</b> <ul style="list-style-type: none"> <li>• Interviews, questioning and direct observation where possible.</li> </ul> <b>Quantitative data:</b> <ul style="list-style-type: none"> <li>• Via indirect measures: either speaking (what I say I do), or results</li> </ul>	Qualitative measures Statistical trends, comparisons.

(Goutille F, 2009)

### 2.8.1 Strengths and weaknesses of methodology

#### Strengths of questionnaires

A questionnaire is easy to standardize. For example, every respondent is asked the same question in the same way. The researcher, therefore, can be sure that everyone in the sample answers exactly the same questions, which makes this a very reliable method of research.

Questionnaires can be used to explore potentially embarrassing areas more easily than other methods. The questionnaire can, for example, be both anonymous and completed in privacy.

This increases the chances of people answering questions honestly because they are not intimidated by the presence of a researcher.

Questionnaires are relatively quick and easy to create, code and interpret (especially if closed questions are used). In addition, the respondent and not the researcher does the time consuming part of completing the questionnaire.

### **Weaknesses of questionnaires**

The researcher has to hope the questions asked mean the same to all the respondents as they do to the researcher. This is a problem that can to some extent be avoided by conducting a pilot study prior to conducting the real survey

Where the researcher is not present, it is always difficult to know whether or not a respondent has understood a question properly. ([www.sociology.org.uk/methodq.pdf](http://www.sociology.org.uk/methodq.pdf))

### **Strength and weakness of key informant interviews**

They enable the collection of basic information. They can be carried out with a few resources and provide a holistic and qualitative overview of the impact of a disaster on community members. The weakness is that it provides a subjective perspective on the impact of a disaster (ACAPS, 2011).

### **Strength and weakness of cross sectional study design**

They are generally quick and cheap since there is no follow up and little resources are required to run the study. Cross sectional studies are the best way to determine prevalence and are useful at identifying associations that can then be more rigorously studied using a cohort study or

randomized controlled study. The most important problem with this type of study is differentiating cause and effect from simple association (Mann 2003).

### **Example of a KAP study conducted in Nigeria**

#### **Methodology used**

A descriptive cross-sectional community-based study was carried out to assess the knowledge of mothers on the aetiology of rickets associated knee deformities and the cultural perception of its treatment. Data collection was done using interviewer based semi structured questionnaires. The sample size was determined using the Armitage and Perry formula of single proportion (Adegbehingbe et al, 2009)

### **2.9 Likert scale**

Likert scales are used to measure attitudes, providing a range of responses to a given question or a statement (Cohen et al., 2000). They are also known as summarized rating scales as the scale score is a simple sum of responses over items. Likert scales allow respondents to express degrees of agreement such as strongly agree, agree, disagree and strongly disagree (Bernstein, 2005).

### **2.10 Knowledge gap**

Rickets cases in Kenya are proving to be of great concern to the health practitioners. There is very little documentation on the extent of the disease in Kenya, its prevalence in Kenya as a whole and why the disease is appearing in some parts of the country. The study attempts to find out if the problem of rickets is attributed to the caregivers knowledge, perceptions and practices.

## **CHAPTER THREE: METHODOLOGY**

### **3.0 STUDY SETTING**

#### **3.1 Study Area and Study Site**

The study area was Naivasha District in Naivasha constituency in Nakuru County. The county is made up of four districts namely; Nakuru, Nakuru North, Naivasha and Molo districts.

The study site was Naivasha District Hospital in Naivasha District, Nakuru county which is a level four hospital. The hospital is owned by the Ministry of Health.

##### **3.1.1 Demographic profile**

Naivasha is a small town located about 70 km. North West of Nairobi, and sits on the floor of the Great Rift Valley. It lies at 0<sup>0</sup> 43' 0S latitude and 36<sup>0</sup> 25' 60E. Naivasha town is located on the shores of Lake Naivasha. Naivasha Constituency covers an area of about 2,300 sq. km and has a population of about 350,000 people. The number of households in Naivasha is approximately 105,318 households according to 2009 population census.

##### **3.1.2 Economic overview**

The main industry is agriculture especially horticulture thus making Naivasha the center of the multi-billion flower industry in Kenya. It has over 55 flower farms that employ over 50,000 workers i.e., World renown companies like Sher, Oserian, Van Den Berg, that export flowers and vegetables internationally are located within the larger Naivasha town. It also has popular tourist destinations such as Hell's Gate National Park that is famous for the hot water springs, Longonot National Park while Lake Naivasha is a major attraction with its fishing activities. Other

industries include Power generation (OlKaria Geothermal station) and many government institutions such as Naivasha Maximum Prison, National Youth Service, Kenya Wildlife Training Institute among others.

### **3.2 Study Design**

The study applied a comparative cross sectional study design with both descriptive and analytical components. Descriptive component involved observing and describing the behavior of a subject without influencing it in any way. Analytical component involved testing a hypothesized association between human and risk factors for specific attributes such as level of knowledge and the practices and perceptions.

The comparative groups included mothers of children with rickets and mothers of children without rickets. The rickets cases were selected from the Mother Child Health (MCH) clinic in the Integrated Management of Childhood Illnesses department (IMCI)

### **3.3 Subjects and Sampling frame**

#### **3.3.1 Study population**

The study population comprised of caregivers with children aged 6 – 24 months attending Naivasha District Hospital, Nakuru County. The caregivers of the children were involved in a focus group discussion (FGD) and questionnaires were administered to them. Key informant interviewees (KII) comprised of a nutritionist, doctor and an occupational therapist.

#### **3.3.2 Sample size determination**

The statistical formula for comparative studies by Fischer et al, (1991) was used to determine sample size with degrees of accuracy set at 0.05.

$$n = \frac{2Z^2pq}{d^2}$$

**n**= the desired sample size

**Z**= the standard normal deviate set at 1.96 which corresponds to 95%

**p**= prevalence of rickets estimated at 3.4% (Theuri, 2012)

**q**= 1-p

**d**<sup>2</sup>= the precision required for the estimate set at 5%

Hence  $n = (2 \times 1.96^2 \times 0.034 \times 0.966) / 0.05^2 = 100$

For a comparative study, the study had 100 children with rickets and 100 without rickets

Considering a 5% non-response rate the total sample size obtained was 210 children

### **3.3.3 Sampling Criteria**

#### **3.3.3.1 Inclusion Criteria**

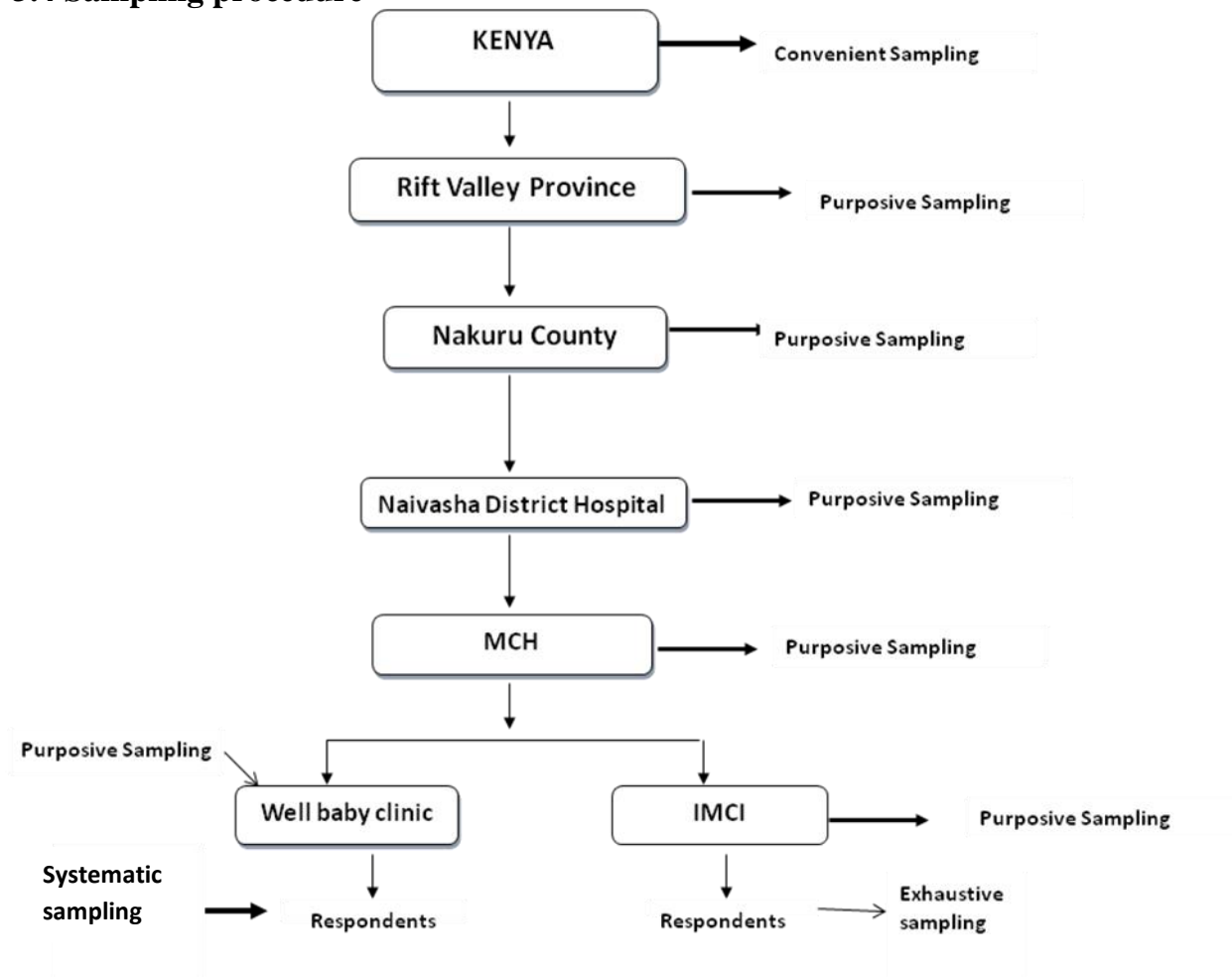
1. Caregivers with children aged 6 – 24 months attending Naivasha District Hospital.
2. Caregivers who were available during data collection.
3. Caregivers who were willing to participate in the study.

#### **3.3.3.2 Exclusion Criteria**

1. Caregivers who had children below six months and above 24 months of age.
2. Caregivers who declined to participate in the study.
3. Caregivers who did not attend Naivasha District Hospital.



### 3.4 Sampling procedure



**Fig 2: Sampling schema**

The study population of the caregivers was selected using purposive sampling. The respondents were selected from the MCH in the well baby clinic where respondents were subjected to a systematic sampling. The number of children attending the MCH in the well baby clinic in Naivasha District Hospital per day was established by perusing the mother child health clinic records. It was found that approximately seventy children attended the MCH per day (N). The target number of questionnaires to be administered per day was twenty questionnaires (n).

The number of children attending the hospital per day (N) was divided by the target number of questionnaires per day (n), (N/n). This gave the ratio for administering the questionnaire such that after every fourth caregiver, a questionnaire was administered. In the IMCI, where children with rickets were selected, the respondents were subjected to exhaustive sampling whereby every caregiver that came to the IMCI and had a child with rickets was interviewed.

### **Criteria for determining one as having rickets**

1. Any child whose medical hospital record stated that one had been diagnosed with rickets.
2. By physical examination by a qualified clinical officer to screen for clinical signs of rickets: bone pain, muscular tenderness, delayed tooth eruptions, late closure of the fontanele, enlargement of joints, bow legged and knocked knees.
3. By radiological analysis which was carried out by a qualified radiologist.

Two FGDs were conducted. One consisted of caregivers who had children who were six months and less than two years and did not have rickets and the other consisted of caregivers who had children who were six months and less than two years and had rickets. Each FGDs consisted of six caregivers.

KII was conducted and the three participants were selected based on those who had previously dealt with the rickets cases in the hospital i.e nutritionist, doctor, occupational therapist.

### **3.5 Data collection tools**

Data was collected using a semi structured questionnaire (refer to annex 3), question guide for focus group discussion (refer to annex four) and for key informant interview (refer to annex 5).

### **3.6 Recruitment and Training of Research Assistants**

A word of mouth advertisement was done at Laikipia University College which attracted sixteen people. Of the sixteen, only four were chosen based on their qualification. The criteria for qualification as a research assistant was; one must have at least attained a secondary education and must be knowledgeable in English, Kiswahili and Kikuyu languages. The other twelve were not knowledgeable in the Kikuyu language. The research assistants were trained for two days and the training program included; introduction and overview of the study, data collection techniques and pretest, ethics and conduct, actual pretest and revision of the tools based on the pretest results (refer to Annex 6).

### **3.7 Pretesting of the tools**

The questionnaire was pre-tested on twenty five caregivers with children below two years in Karagita dispensary in Naivasha District, Naivasha Constituency in Nakuru County. The question guide for the focus group discussion was pretested in Karagita Dispensary using a sample size of five caregivers. The question guide for the KII was also pretested at the same dispensary. The interview comprised of a nutritionist, nurse and two community health workers.

The purpose of pre testing the tools was to find out if the respondents understood the questions posed to them, to find out if the questions offended the respondents, to prevent unnecessary wastage of resources and to confirm that data was appropriate and was in line with the specific objectives.

### **3.8 Data collection procedures**

Specific objective 1: To determine the socio-demographic characteristics of caregivers who have children with rickets and those without rickets. Interviewing was used to collect data on the

socio-demographic characteristics of the caregivers which were conducted using a questionnaire containing nine questions. The data included; age, sex, relation to child, level of education, occupation, marital status and place of residence (refer to annex 3).

Specific objective 2: To determine knowledge on rickets of caregivers with children with and without rickets. The method that was used to collect data on the mother's knowledge on the causes and treatment of rickets was an interview which was conducted using a questionnaire which had seven questions which included; do you know of the disease rickets?, can it be cured?, what is the local name?, how do you know that a child has rickets?, which foods are rich in vitamin D?, which foods are rich in calcium? And what can you do to prevent a child from developing rickets? The variable is the level of knowledge (refer to annex 3).

Specific objective 3: To determine the perception on causes of rickets of caregivers with children with and without rickets. The method that was used to collect data on the mother's perception on the causes of rickets was an interview which was conducted using a questionnaire which had six perception attributes. The attributes included; obesity, early walking, consumption of local water, hereditary, inadequate diet, prematurity and low birth weight babies (refer to annex 3). Other perceptions added included; lack of sunbathing, lack of calcium, carrying the baby on your back, using napkins and pampers, curse from God and giving cold water and food. Total perceptions included were twelve.

Specific objective 4: To determine the child care practices of caregivers with children with and without rickets. The method that was used to collect the data was a questionnaire which had

twelve practices, nine of which were scored while the rest were handled individually. The practices included; sun bathing of the child, duration of sunbathing the child, age at which complementary feeding was introduced, intake of vitamin D supplements and cod liver oil, exposure of the child to sunlight in the last twenty four hours, body parts exposed to sunlight, where the sun exposure occurred and mode of dressing of the child (refer to annex 3).

Specific objective 5: To determine the correlation between knowledge versus practices, knowledge versus perception and perception versus practice scores of caregivers with children with and without rickets. A questionnaire was used to collect the data on knowledge, perceptions and practices (refer to annex 3)

Inadequate knowledge, practices and perceptions were used as an factors that influence the prevalence of rickets with the assumption that the caregivers of children with rickets have inadequate knowledge, practices and perceptions.

### **3.9 Data Analysis**

Data was entered and analyzed using statistical package for social sciences (SPSS 16). Descriptive statistics were used to analyze socio-demographic characteristics, mother's knowledge, mother's perceptions and mother's practices. Statistical procedures (independent t-test, fisher's exact test, chi-square and odds ratios) were used to establish associations between rickets status and other variables and also to determine the difference in the mean scores. Spearman's correlation was used to correlate knowledge, perceptions and practices in the two groups. A linear regression was used to predict the value of the dependent variable (perception) based upon the value of the independent variable (knowledge) T tests were used for comparisons and to test the hypothesis.

### 3.9.1 Quantification of knowledge, perception and practices

**Table 2: Attributes of knowledge**

	<b>Attributes of knowledge</b>	<b>Scores</b>
1	Do you know of the disease rickets?	1= correct response, 0= incorrect response
2	Can it be cured?	1= correct response, 0= incorrect response
3	What is the local name?	1= correct response, 0= incorrect response
4	How do you know a child has rickets?	1= correct response, 0= incorrect response
5	Which foods are rich in vitamin D?	1= correct response, 0= incorrect response
6	Which foods are rich in calcium?	1= correct response, 0= incorrect response
7	What can you do to prevent a child from developing rickets?	1= correct response, 0= incorrect response

**Table 3: Attributes of practices**

	<b>Attributes of practices</b>	<b>scores</b>
1	Do you sunbathe your child?	1= correct response, 0= incorrect response
2	For how many minutes a day?	1= correct response, 0= incorrect response
3	Do/did you breastfeed your child exclusively?	1= correct response, 0= incorrect response
4	Do you give your child cod liver oil?	1= correct response, 0= incorrect response
5	Did you expose your child to the sun in the last twenty four hours?	1= correct response, 0= incorrect response
6	Intake of vitamin D supplements?	1= correct response, 0= incorrect response

**Table 4: Attributes of perception**

		<b>scores</b>			
	<b>Attributes of perception What do you think causes rickets?</b>	<b>strongly agree</b>	<b>agree</b>	<b>disagree</b>	<b>strongly disagree</b>
1	Obesity	1	2	3	4
2	Early walking	1	2	3	4
3	Consumption of local water	4	3	2	1
4	Hereditary	1	2	3	4
5	Inadequate diet	4	3	2	1
6	Prematurity and low birth weight	4	3	2	1

The correct perceptions include; local water, inadequate diet and prematurity and low birth weight which are scored with 4 as the highest score and 1 as the lowest score, while the wrong perceptions include; obesity, hereditary and early walking which are scored with 4 as the highest score and 1 as the lowest score (refer to table 21). The wrong perceptions are reverse scored so that all of the individual perception scores lie on the same scale with regard to direction. Hence in reverse scoring the 4 becomes 1, 3 becomes 2, 2 becomes 3 and 1 becomes 4. This makes sure we obtain a single score reflecting the intensity in a single direction ([www.psychology.ucdavis.edu/sommerb/sommerede/scaling/attitude.htm](http://www.psychology.ucdavis.edu/sommerb/sommerede/scaling/attitude.htm)).

Knowledge and practices scores were determined by taking the number of correct responses out of the total number of questions and expressed as a percentage. Using the mean score and standard deviation, a knowledge Z score was computed and used to group the respondents into three knowledge groups. The formula used to compute the Z scores was *(population mean-individual mean)/standard deviation*. The percentages were graded to determine caregivers knowledge levels classified as inadequate, moderately adequate or adequate.

From the results, knowledge mean score of 65.8 and a standard deviation of 15.8 were found which gives the following knowledge classification.

**Table 5: Grading system for classifying knowledge levels of the results**

PERCENTAGES	LEVEL OF KNOWLEDGE
< 0 Z score	Inadequate knowledge
>0 to < 1 Z score	Moderate knowledge
> 1 Z score	Adequate knowledge

Using the mean score and standard deviation, a practice Z score was computed and used to group the respondents into three practice groups. From the results a practice mean score of 55.2% and a standard deviation of 13.3 was found which gives the following practice classification. The percentages were graded to determine caregivers practice levels classified as unsatisfactory, moderately satisfactory or satisfactory.

**Table 6: Grading system for classifying practice levels**

PERCENTAGES	LEVEL OF PRACTICES
< 55.2% (<0SD)	Unsatisfactory
55.2-68.5% (>0 to < 1SD)	Moderately satisfactory
>68.5% (> 1 SD)	Satisfactory

The total numbers of clothing that the children had were nine pieces of clothing. This clothing were later classified into three categories; lightly dressed, moderately dressed and heavily dressed based on the pieces of clothing that a child had on. Less than three pieces of clothing was considered as light dressing, four to five pieces of clothing was considered as moderate dressing and more than six pieces of clothing was considered as heavy dressing as the whole study period was sunny.

### **3.9.2 Interpretation of likert scale findings**

Likert scale measures the extent to which a person agrees or disagrees with a statement or a question. Perceptions were also scored as follow using a four point likert scale (Garland, 1991). The different levels of agreeing were handled as follows depending on whether the perception is right or wrong. Obesity is a wrong perception and inadequate diet is a right perception hence



reverse scoring was applied as shown in table 8; A wrong perception which has been ticked as strongly disagree is scored with the highest score of four and a right perception which has been ticked as strongly agree is scored with the highest score of four. A wrong perception which has been ticked as strongly agree is scored with the lowest score of 1 while a right perception which has been ticked as strongly disagree is scored with the lowest score of 1. The total expected perception score is twenty four which was expressed as a percent.

**Table 7: Perception scoring**

<b>Perception</b>	<b>Strongly agree</b>	<b>Agree</b>	<b>Disagree</b>	<b>Strongly disagree</b>
Obesity	1	2	3	4
Inadequate diet	4	3	2	1

**Table 8: Grading system for classifying perception levels**

<b>PERCENTAGES</b>	<b>LEVEL OF PERCEPTION</b>
<61.8 (<0 Z score)	Negative
61.8-75% (>0 to < 1 Z score)	Neutral
>75% (> 1 Z score)	Positive

**Level of significance**

A p-value of less than 0.05 was considered statistically significant

### **3.10 Data Quality Control**

The research assistants were well trained on how to administer the questionnaires. The questionnaire was pretested in order to validate that the questions complied with the specific objectives and the necessary changes were made. The research assistants were also supervised. Data that was collected was cleaned in the field and later entered in SPSS. The data was also checked for outliers.

### **3.11 Ethical considerations**

Authorization to conduct the study was sought from the Medical Superintendent of Naivasha District hospital. A research permit was also obtained from the Ethical Review Committee.

On confidentiality, the questionnaires were individually administered and respondents were asked not to indicate their names (See appendix 3). A client informed consent was also made available for the client to sign that of her free will she had agreed to participate (See appendix 2).

The research assistants were also trained on ethics in fieldwork such as confidentiality and professional conduct, which were highly upheld.

## CHAPTER FOUR: RESULTS

### 4.1 Socio-demographic and economic characteristics of the study population

#### 4.1.1 Location

The current study covered a total of 208 caregiver child pairs from 8 sub locations of Naivasha district. Lake View location had the highest number of study participants (51.4%) followed by Hells Gate (20.2%) and Mai mahiu (6.7%). Olkaria, Naivasha East, Biashara and Viwanda locations had 4.8% of the participants each. The rest of the participants (2.4%) came from Maiella location.

As shown in table 9, there was a significant difference in the proportions of children with rickets in regards to their location using the fishers exact test **P=0.000**. The number of rickets cases coming to the health facility was significantly higher in Hells gate, Maiella and Naivasha east location which had a higher proportion of children with rickets than those without rickets.

***Table 9: Distribution of rickets and non rickets children by location of origin***

Location	Rickets N=104	Non rickets N=104	Statistical Test
Hells gate	29.8%	10.6%	
Lakeview	40.4%	62.5%	
Mai mahiu	5.8%	7.7%	Fisher's exact test=26.882, <b>P=0.000</b>
Maiella	4.8%	0.0%	
Olkaria	4.8%	4.8%	
Naivasha east	7.7%	1.9%	
Viwanda	1.9%	7.7%	
Biashara	4.8%	4.8%	

#### 4.1.2 Place of residence

Among those included in the study, 60.1% (29.8% with rickets and 30.3% without rickets) live in slum areas, and 20.2% live in flats and only 19.7% live in their own compounds.

***Table 10: Distribution of rickets and non rickets children by place of residence***

Residence	Rickets N=104	Non rickets N=104	Statistical test
Slums	29.8%	30.3%	$\chi^2=3.507$ , df=2, P=0.173
Flats	8.2%	12.0%	
Own compound	12.0%	7.7%	

#### 4.1.3 Relation to the child

Of the caregivers interviewed, 96.2% were mothers of children with rickets while 97.1% were mothers of children with no rickets. The rest of the interviewees were distributed as follows: fathers (1%), grandmothers (1.9%) and aunts (1%).

#### 4.1.4 Gender of household head

Majority of the households were male headed at 88.5%. Of this, 89.4% were households with children with rickets and 87.5% were households with children without rickets. Only 11.5% households were female headed with 10.6 % having children with rickets while 12.5% had children with no rickets.

***Table 11: Distribution of rickets and non rickets children by gender of household head***

Gender of household head	Rickets N=104	Non rickets N=104	Statistical test
Male	89.4%	87.5%	$\chi^2=0.188$ , df=1, P=0.664
Female	10.6%	12.5%	

#### 4.1.5 Dependency ratio

The mean household size number was 4.0 (SD=1.3). The median was 4 while the minimum household number was 2 and the maximum household number was 10.0.

The dependency ratio of households with children with rickets (92:100) was slightly lower than those of families with children without rickets (95:100). The difference was not statistically significant when an independent t test was performed ( $t_{201}=-0.302$ ,  $P= 0.763$ ,  $CI= -0.21390, 0.15713$ ). Overall, the age dependency ratio of the study population was 94:100. Table 12 below describes the dependency status of the population under study.

*Table 12: Dependency status of the sample population in Naivasha District*

Age category (yrs)	Rickets N=436	Non rickets N=402
0-15 (dependent population)	46.3%	48.8%
15-64 (productive population)	52.0%	51.2%
65+ (dependent population)	1.6%	0.0%
<b>Age dependency ratio</b>	<b>92%</b>	<b>95%</b>

#### 4.1.6 Age of the caregivers

The mean age of the caregivers was 27.3 years (SD= 6.5). The youngest caregiver was aged 18years while the oldest was 65years old. Majority (66.3%) of the caregivers were aged 18 -27 years old.

The mean age ( $28.4 \pm 7.4$  years) of the caregivers of children with rickets was significantly higher than the mean age ( $26.1 \pm 5.3$  years) of caregivers of children without rickets ( $t_{206} = 2.531$ ,  $P = 0.012$ ,  $CI= 0.49968, 4.01955$ ).

Table 13 shows the age group 28-37 years having a higher percentage of caregivers with children who have rickets as compared to the caregivers of children without rickets.

**Table 13: Distribution of the study children by age of the caregivers**

Age of caregiver	Rickets n=104	Non rickets n=104	Statistical test
18-27	60.6%	72.1%	Fisher's exact test=5.879, P=0.118
28-37	32.7%	23.1%	
38-47	3.8%	4.8%	
48+	2.9%	0.0%	

#### 4.1.7 Education level of the caregivers

As shown in table 14, a greater percentage of caregivers with children who have rickets did not complete their primary education as compared to the caregivers with children without rickets. A slightly greater percentage of caregivers with children without rickets completed their secondary as compared to the caregivers with children with rickets, however the difference is not significant.

**Table 14: Distribution of the study children by education level of caregivers**

Education level	Rickets N=104	Non rickets N=104	Statistical test
No education	1.0%	0.0%	Fisher's exact test=2.019, P=0.847
Primary incomplete	17.3%	13.5%	
Primary complete	30.8%	30.8%	
Secondary incomplete	13.5%	17.3%	
Secondary complete	25.0%	26.0%	
College/university	12.5%	12.5%	

#### 4.1.8 Main source of income

Table 15 shows a higher percentage of children with rickets were from household whose main source of income was from self employment, farming and casual labor as compared to children without rickets. A higher percentage of children without rickets were from households whose

main source of income were salaried employee than those with rickets. The difference was significant.

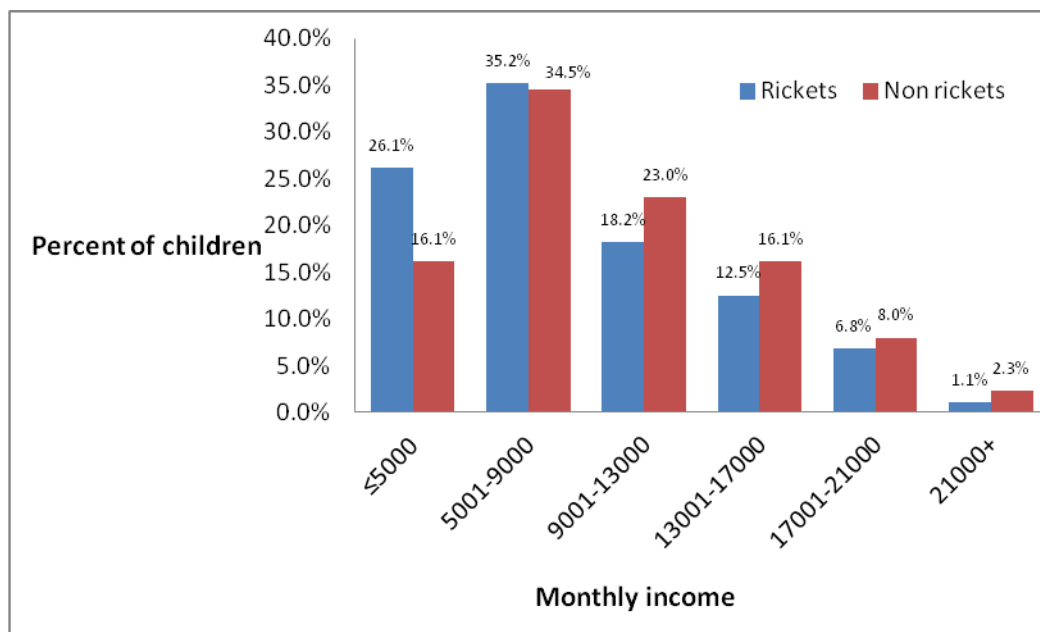
**Table 15: Distribution of the study children by source of income**

<b>Source of income</b>	<b>Rickets N=104</b>	<b>Non rickets N=104</b>	<b>Statistical test</b>
Self employment	37.5%	34.6%	Fisher's exact test=12.239, P=0.015
Farmer	8.7%	1.9%	
Casual Labor	33.7%	25.0%	
Salaried employee	18.3%	31.7%	
No occupation	1.9%	6.7%	
<b>Total</b>	<b>100.0%</b>	<b>100.0%</b>	

#### 4.1.9 Monthly income

An exploratory data analysis was conducted to remove the outliers. From the various income sources, the mean monthly household income of the study population was Ksh. 9,534.9 (SD= 5030.8). The minimum monthly income was Ksh.2, 000 while the maximum monthly income was Ksh. 60,000. There was no significant difference in the means of the average monthly incomes between those households with children with rickets and those without ( $t = -1.285$ ,  $P = 0.201$ ,  $CI = -2473.7, 523.2$ ). Therefore the hypothesis that there is no significant difference in the monthly income of caregivers' who have children with rickets and those who do not have is true.

Figure 3 shows the monthly income of both groups (rickets and non rickets) as being skewed to the left meaning that a higher proportion of the study population earns less than Kshs 9,000. This can also be an indication that most of the study population were below the poverty line.



**Fig 3: Distribution of the study households by their average monthly income category**

#### **4.1.10 Marital status of the caregiver**

By marital status of the caregivers', majority were married (89.4% had children with rickets while 88.5% had children with no rickets). 9.6% of the caregivers' from both groups (with children with rickets and those without) were single while the rest (1.4%) were divorced (1.0% had children with rickets while 1.9% had children with no rickets). A higher percentage of children with rickets were found among the married caregivers' however the difference was not significant.

**Table 16: Distribution of the study children by marital status**

<b>Marital status</b>	<b>Rickets N=104</b>	<b>Non rickets N=104</b>	<b>Statistical Test</b>
Single	9.6%	9.6%	Fisher's exact test=0.442, P=1.000
Married	89.4%	88.5%	
Divorced	1.0%	1.9%	



#### 4.1.11 Age of the study children

Of the 208 children included in the study, half (104) had rickets while the rest did not have, 42.8% of the children were males while the rest (57.2%) were females. Of the 104 children that have rickets, a higher percentage of children with rickets were female (57.7%) while the rest were males (42.3%). The mean age of the sampled children was  $13.27 \pm 5.0$  months. The youngest child was 6.23 months old while the oldest was 23.98 months old. An independent student t-test of the differences in means showed that children with rickets to had a significantly higher mean age (mean=  $14.1 \pm 4.8$ ) compared to children without rickets ( $12.5 \pm 5.2$ ) ( $t_{206}=2.276$ , **P=0.024**, CI= 0.21012, 2.93584).

*Table 17: Distribution of the study children by age groups*

Age group(months)	Rickets N=104	Non rickets N=104	Statistical test
6-10	29.8%	53.9%	$\chi^2=15.597$ , df=4, <b>P=0.004</b>
11-16	37.5%	25.0%	
17-20	24.0%	10.6%	
21+	8.7%	10.6%	

#### 4.1.11 Study sites

The interviews were carried out in different sections of the hospital as shown in Table 18. A significantly higher proportion of children with rickets were found in occupational therapy clinic, pediatric outpatient clinic (POPC) and pediatric ward than those without rickets ( $p =0.000$ ). This is expected since children diagnosed with rickets are referred to those areas.

**Table 18: Distribution of the study children by site of interview**

<b>Site of interview</b>	<b>Rickets n=104</b>	<b>Non rickets n=104</b>	<b>Statistical test</b>
Occupational therapy	48.1%	0.0%	Fisher's exact test=162.209, <b>P=0.000</b>
POPC	14.4%	0.0%	
Under five clinic	18.3%	55.8%	
Pediatric ward	15.4%	0.0%	
Well baby clinic	3.8%	44.2%	

#### **4.2 Caregivers knowledge of rickets**

Exploratory data analysis was conducted in order to remove the outliers from the data. The lowest score was 0% while the highest was 100%. The mean knowledge score of the care givers was 63.9% ( $\pm 19$ ). There was a significant difference in the mean knowledge scores between caregivers' of children with rickets and the caregivers' of children without rickets ( $t_{200} = 2.035$ , **P= 0.043**, CI = 0.16677, 10.62135). Caregivers' who had children with rickets had a higher mean score than the caregivers' who had children with no rickets. The median score was 66.7%. Therefore, the hypothesis that there is no significant difference in the nutritional knowledge of caregivers' who have children with rickets and those who do not have is false.

In this study, knowledge was classified into three groups; inadequate, moderate and adequate knowledge as shown in table 6. A unit change in the variable knowledge score further classifies to inadequate and adequate knowledge.

Caregivers who scored averagely (65.8-81.6%) were 45.5%. Those with inadequate knowledge (0-65.8%) were 39.3% while those with high knowledge score were 15.2%.

**Table 19: Distribution of rickets and non rickets children by caregiver's knowledge status**

<b>Knowledge status</b>	<b>Rickets n=101</b>	<b>Non rickets n=101</b>	<b>Statistical test</b>
<0 Z score	63.4%	54.5%	$\chi^2=2,870$ , df=2, P=0.239
>0 to <1 Z score	22.8%	22.8%	
>1 Z score	13.9%	22.8%	

A higher percentage of caregivers' who had children with rickets had inadequate knowledge than the caregivers' who had children without rickets; however, it was not statistically significant.

A one unit change in the independent variable knowledge score (inadequate knowledge to adequate knowledge) reduces the odds of developing rickets by a factor of 0.748 (OR = 0.748, 95% CI: 0.418, 1.339).

Table 20 shows the statistically significant questions posed to the caregivers. There was a significant difference in the knowledge attribute of whether rickets is curable or not (P=0.000), knowledge attribute of whether rickets can be treated (P=0.020) and knowledge attribute of how one can detect that a child has rickets (P=0.000) between caregivers with children who had rickets and caregivers' with children who had no rickets. This implied that there was an association between a child having rickets and the knowledge attribute of whether rickets is curable, treatable or detection of rickets.

The correct responses are that rickets is curable by following the doctor's advice, early detection of the disease hence earlier treatment, undergoing therapy, having an adequate diet and sunbathing. However, rickets is not a disease that a child outgrows hence it requires immediate attention. Neither is injection a method of treating it. Late closure of the fontanel, late tooth eruptions, bowing of legs, enlargement of joints, knock knees and weak legs are all ways in which rickets can be detected.

**Table 20: Knowledge responses on rickets of caregivers with and without rickets**

<b>Knowledge attribute</b>	<b>Rickets n=104</b>	<b>Non rickets n=102</b>	<b>Statistical test</b>
<b>Curable</b>			
Yes	45.6%	31.2%	Fisher's exact test, <b>P=0.000</b>
No	4.9%	14.6%	
Don't know	0.0%	3.9%	
<b>Treatable</b>			
	<b>n=93</b>	<b>n=64</b>	
Follow doctors advice	15.9%	13.4%	Fisher's exact test, <b>P=0.020</b>
Early detection	3.8%	8.9%	
Therapy	16.6%	5.1%	
Adequate diet	11.5%	5.1%	
Sunbathing	5.7%	2.5%	
Injection	1.3%	0.6%	
Child outgrows disease	2.5%	1.3%	
Don't know	1.9%	3.8%	
<b>Detection</b>			
	<b>n=104</b>	<b>n=104</b>	
Late closure of fontanelle	1.4%	0.0%	Fisher's exact test, <b>P=0.000</b>
Late tooth eruptions	1.0%	0.5%	
Bowing of legs	17.3%	33.2%	
Enlargement of joints	2.4%	2.4%	
Knock knees	7.2%	2.9%	
Weak legs	16.8%	7.2%	
Don't know	3.8%	3.8%	

Fisher's exact test has been used in cells that have values less than 5

Of the caregivers interviewed, 98.1% have heard or know about rickets. The rest (1.9%) did not know anything about rickets.

### **4.3 Perception of the caregivers on the causes of rickets in children**

A total of six perceptions were posed to the respondents and an additional six were added by the respondents. They included; obesity, early walking, local water, hereditary, inadequate diet, prematurity and low birth weight, lack of sunbathing, lack of calcium, carrying the baby on your back, using napkins and pampers, curse from God and giving cold water and food. From the

twelve perceptions, some are right and some are wrong. Table 21 shows the right and wrong perceptions.

**Table 21: Classifications of perceptions**

	<b>Rickets</b>	<b>Non rickets</b>		<b>Rickets</b>	<b>Non rickets</b>
<b>Right perception</b>	N(%)	N(%)	<b>Wrong perception</b>	N(%)	N(%)
Local water	84(35.7%)	88(56.9%)	Obesity	89(66.2%)	87(69.0%)
Inadequate diet	96(17.7%)	93(25.9%)	Early walking	89(56.2%)	90(64.4%)
Prematurity and low birth weight	85(41.2%)	79(55.7%)	Hereditary	90(65.6%)	90(60.0%)
Lack of sun exposure	66(58.4%)	47(41.6%)			
Lack of calcium	18(81.8%)	4(18.2%)			

Perceptions were classified into three groups; negative, neutral and positive perceptions. The caregivers had different opinions on the possible causes of rickets in children. Inadequate diet was responded to by 189 respondents, 17.7% were the caregivers' of children with rickets and 25.9% were caregivers of children without rickets. Obesity got 176 responses, 66.2% caregivers of children with rickets and 69.0% caregivers of children without rickets correctly disagreed that it is not a cause of rickets. A small number of caregivers wrongly perceived the causes of rickets as; giving cold water and food, carrying baby on your back, using pampers and napkins and curse from God. The lowest perception score was 12.5% while the highest perception score was 100%. The mean perception score was 61.8% ( $\pm 13.2$ ) while the median score was 62.5%. There was no significant difference in the mean perception scores between caregivers' of children with rickets and the caregivers' of children without rickets ( $t_{186} = 1.492$ ,  $p = 0.138$ ,  $CI = -0.92495, 6.65789$ ). Hence the hypothesis that there is no significant difference in the perceptions of caregivers' who have children with rickets and those who do not have is true.

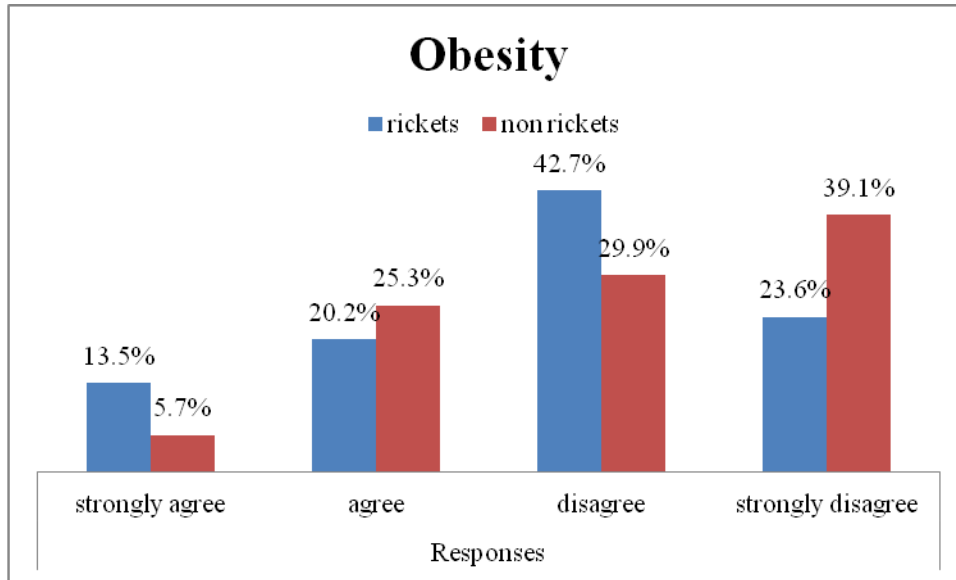
As shown in table 22, higher percentage of caregivers who had children with rickets had a positive perception on the causes of rickets than the caregivers with children who had no rickets. The difference was not significant.

**Table 22: Distribution of rickets and non rickets children by caregivers perception status**

<b>Perception status</b>	<b>Rickets</b> N=96	<b>Non rickets</b> N=92	<b>Statistical test</b>
Negative	12.5%	18.5%	$\chi^2=4.643,df=2, P=0.104$
Neutral	61.5%	67.4%	
Positive	26.0%	14.1%	

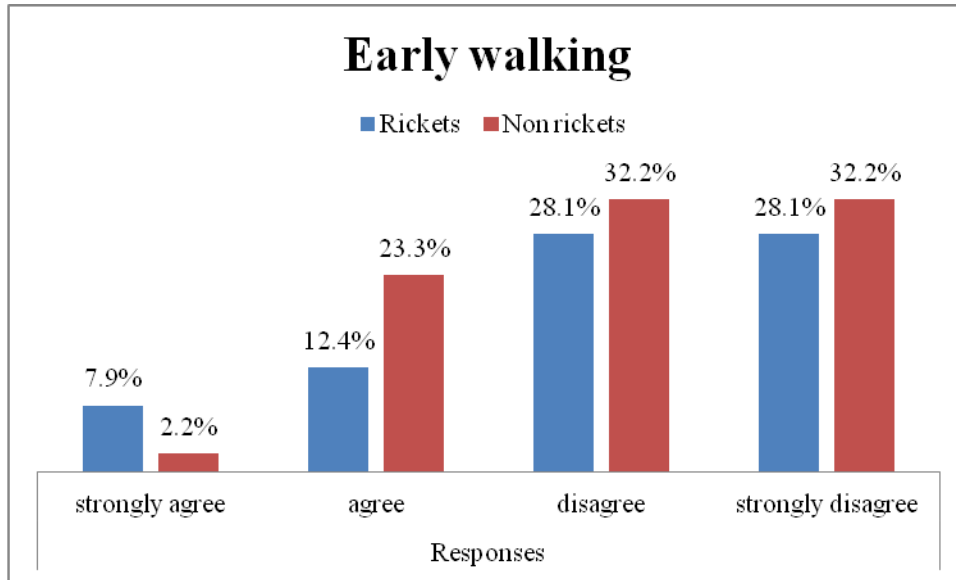
#### **4.3.1 Perception by response and group (rickets and non rickets) of the caregivers on the causes of rickets in children**

Obesity is a wrong perception and it does not cause rickets. Figure 4 shows the responses as being skewed to the right hence most of the caregivers disagreed that obesity does not cause rickets. A higher percentage of caregivers with children with rickets correctly disagreed that obesity does not cause rickets as compared to the caregivers with children without rickets, the difference is significant ( $\chi^2 = 8.583,df=3, P=0.034$ )



***Fig 4: Perception of caregivers on the cause of rickets with regards to obesity***

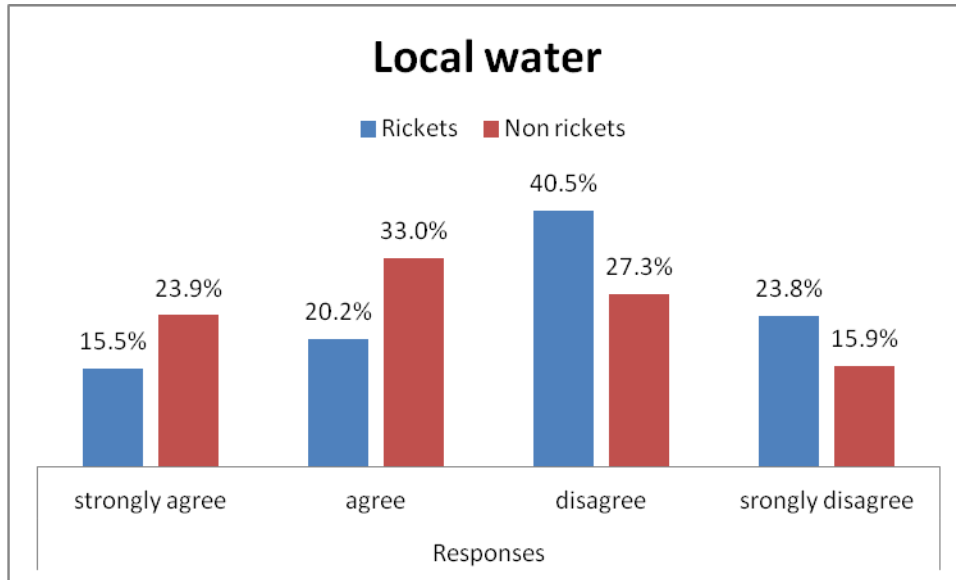
Early walking is not a cause of rickets although it is perceived to be a cause of rickets. Figure 5 shows that the responses are skewed to the right hence the caregiver correctly disagreed that early walking of babies does not cause rickets. however, a higher percentage of caregivers of children without rickets correctly disagreed and correctly disagreed that early walking does not cause rickets as compared to the caregivers of children with rickets, the difference is not significant.



***Fig 5: Perception of caregivers on the cause of rickets with regards to early walking***

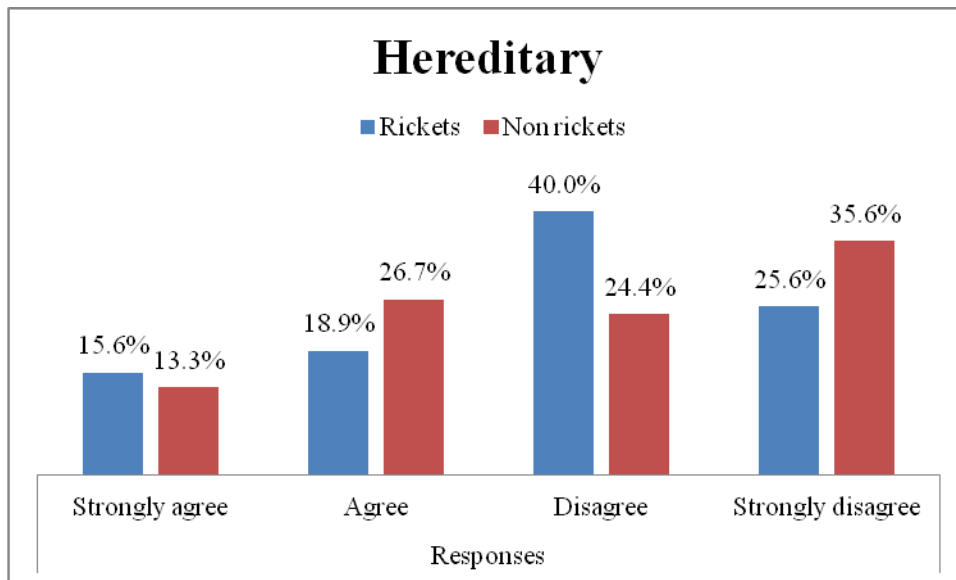
The local water causes rickets as it contains high amounts of flouride which prevents the absorption of calcium when in high amounts. Figure 6 shows that a higher percentage of caregivers with children with rickets wrongly disagreed and strongly disagreed that local water causes rickets as compared to the caregivers with children without rickets.





**Fig 6: Perception of caregivers on the cause of rickets with regards to local water**

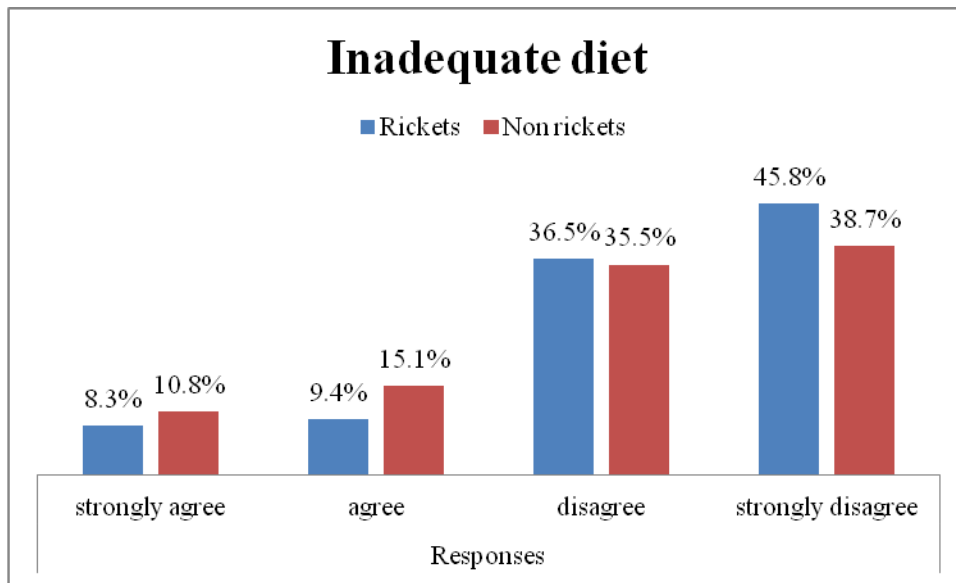
Figure 7 shows that a higher percentage of caregivers of children with rickets correctly disagreed that rickets is not a hereditary disease as compared to the caregivers of children without rickets.



**Fig 7: Perception of caregivers on the cause of rickets with regard to hereditary**

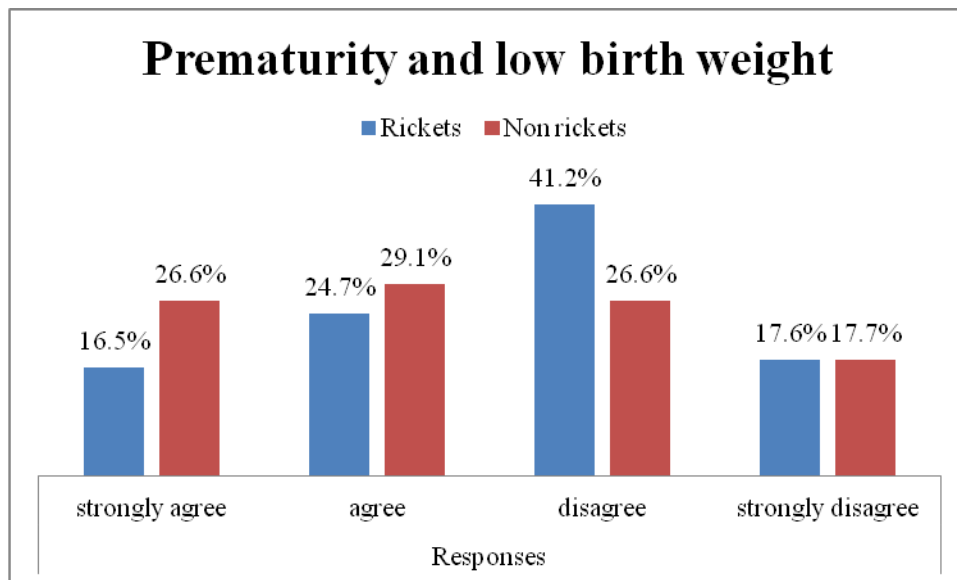
Figure 8 shows the responses as being skewed to the right meaning that most of the caregivers wrongly disagreed that inadequate diet does not cause rickets, a higher percentage of caregivers

with children with rickets wrongly disagreed and strongly disagreed that inadequate diet does not cause rickets as compared to the caregivers of children without rickets, the difference is not significant.



**Fig 8: Perception of caregivers on the cause of rickets with regard to inadequate diet**

As shown in figure 9, a higher percentage of caregivers with children with rickets wrongly disagreed that prematurity and low birth weigh does not cause rickets as compared to the caregivers of children without rickets.



**Fig 9: Perception of caregivers on the cause of rickets with regards to prematurity and low birth weight**

#### **4.4 Maternal Child Care Practices**

The child care practices included in this study were exclusive breastfeeding, complementary feeding, daily sunlight exposure, body parts exposed to sunlight and administration of cod liver oil (Refer to table 28).

##### **4.4.1 Complementary feeding**

Exploratory data analysis was conducted to remove the outliers which gave the following results.

The mean age at which children with rickets were introduced to complementary foods was  $5.2 \pm 1.08$  months while the mean age at which children without rickets were introduced to complementary foods was  $5.6 \pm 1.05$  months. The median age for both groups was 6 months.

The minimum age at which children both the children with rickets and those with no rickets were introduced to complementary foods was 2 weeks and the maximum age for both groups was 9

months. Beyond six months is wrong and hence outliers were removed in the calculation of the mean age.

An independent t-test was conducted for the mean age between the two groups and a significant difference was found between the mean ages, children with rickets had a lower mean age at which complementary foods were introduced ( $t_{191} = -2.633$ , **P= 0.009**, CI = -0.70656, -0.10130).

At 5% confidence level, the relative frequencies of the complementary feeding age (before 6 months, at six months and after six months) differed significantly between children with rickets and those without (Fisher's exact test= 11.981, **P = 0.002**).

Introduction of complementary foods past six months means that a child was exclusively breastfed beyond six months which is a wrong infant and young child feeding practice. Those with rickets, only 3.2% were introduced to complementary food past the age of six months while those without rickets, 9.1% were introduced to complementary foods past the age of six months

**Table 23: Distribution of rickets and non rickets children by age of complementary feeding**

<b>Complementary feeding</b>	<b>Rickets N=94</b>	<b>Non rickets N=99</b>	<b>Statistical test</b>
Before six Months	45.7%	23.2%	Fisher's exact test=11.981, P=0.002
At six months	51.1%	67.7%	
Past six months	3.2%	9.1%	

#### **4.4.2 Exclusive breastfeeding**

Odds ratio analysis was conducted to find the odds of getting rickets for children who were exclusively breastfed and those that were not exclusively breastfed. The resulting odds ratio was 2.8 with a 95% confidence interval ranging from 1.501 to 5.170. Therefore, there is a 2.8 fold

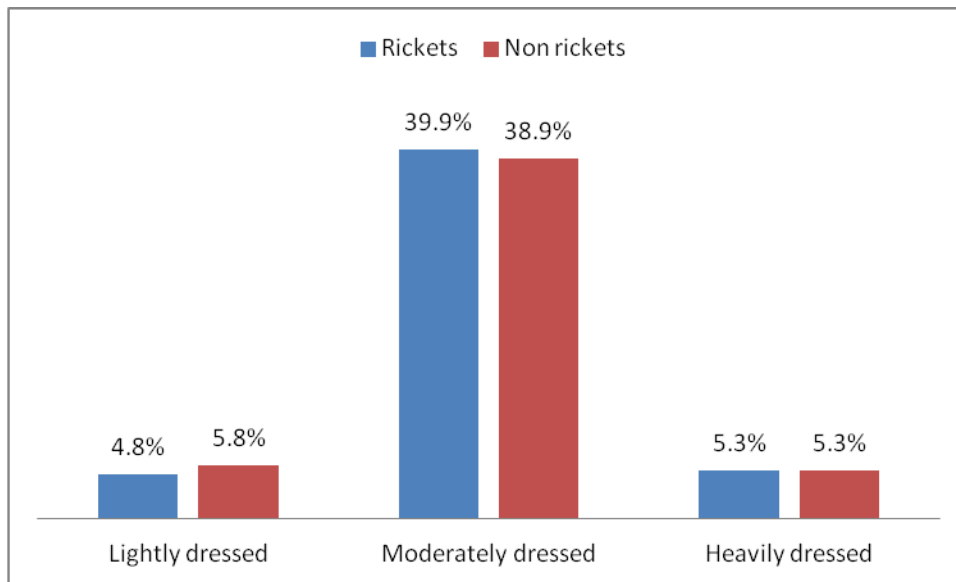
increased odds of getting rickets for children who are not exclusively breastfed. This increase is statistically significant ( $X= 10.860$ ,  $df = 1$ ,  $P= 0.001$  at 5% confidence level).

**Table 24: Distribution of rickets and non rickets children by practice of breastfeeding**

Practice	Rickets N=94	Non rickets N=99	Statistical test
Not exclusively breastfed	45.7%	23.2%	$\chi^2=10.860,df=1, P=0.001$
Exclusively breastfed	54.3%	76.8%	

#### 4.4.2 Child clothing

The mode of dressing of a child affects the amount of sunlight that reaches the skin and hence exposure to the sun may be compromised with the mode of dressing. A vast majority (78.8%) of the study children were moderately dressed at the time of the survey. There was no significant difference in the type of clothing a child wore between those with rickets and those without ( $\chi^2 =0.206$ ,  $df = 2$ ,  $p =0.902$ ).



**Fig 10: Prevalence of rickets among the study children by mode of dressing**

Children with light dressing had a reduced risk of developing rickets than those with heavy dressing (OR = 0.702).

**Table 25: Distribution of the study children by type of dressing**

<b>Type of dressing</b>	<b>Rickets N=104</b>	<b>Non rickets N=104</b>	<b>Odds ratio (95% CI)</b>
Lightly dressed	26.4%	30.8%	0.702
Heavily dressed	23.6%	19.2%	(0.404, 1.218)

#### 4.4.3 Amount of time spent in the sun

The average amount of time a child spent in the sun was 27.03 ( $\pm 17.51$ ) minutes. The mean exposure time to the sun of children with rickets (34.01 minutes) was significantly higher than that of children without rickets (18.06 minutes) ( $t_{142} = 6.059$ , **P = 0.000**). At 5% confidence level, the proportions of children who were exposed to the sun for less than 30 minutes, 30-60 minutes and more than 60 minutes differed significantly between the rickets and non rickets children ( $\chi^2 = 28.159$ ,  $df = 2$ , **P = 0.000**). A greater proportion of children without rickets were sunbathed for less than 30 minutes compared with children with rickets. More of the children with rickets were exposed to sun for 30-60 minutes compared with those children without rickets.

**Table 26: Distribution of the rickets and non rickets children by exposure time to sunlight**

<b>Exposure time</b>	<b>Rickets N=88</b>	<b>Non rickets N=66</b>
<30minutes	19.3%	60.6%
30-60 minutes	51.1%	21.2%
>60 minutes	29.5%	18.2%

Table 27 shows that caregivers with children who have rickets have higher satisfactory practice scores than the caregivers with children who have no rickets. The lowest practice score was 14.3% while the highest practice score was 85.7%. The mean practice score was 55.2% ( $\pm 13.3$ ) while the median score was 57.1%. There was no significant difference in the mean practice score between caregivers' of children with rickets and caregivers' of children without rickets ( $t_{182} = 1.302$ ,  $P = 0.195$ ,  $CI = -1.31491, 6.41869$ ). Hence the null hypothesis that states that there is no significant difference in the child care practices of caregivers' who have children with rickets and those who do not have is true.

**Table 27: Distribution of rickets and non rickets children by caregivers' practice status**

Practice status	Rickets	Non rickets	Statistical test
	N=90	N=94	
Unsatisfactory	30.0%	37.2%	$\chi^2=2.837$ , $df=2$ , $P=0.235$
Moderately satisfactory	35.6%	39.4%	
Satisfactory	34.4%	23.4%	

#### 4.4.4 Other practices

Table 28 shows the distribution of the children with rickets and those without rickets by selected practices. There was no significant difference in the proportions of children who were given cod liver oil among those with rickets and those without ( $P = 0.777$ ).

**Table 28: Prevalence of Rickets in relation to selected practices**

Practices	Rickets		Statistical test
	Yes	No	
<b>Do you sunbathe your child</b>			
<b>Sunbathed</b>	N=104	N=104	
Yes	89.4%	70.2%	$\chi^2=11.933$ $df=1$ $P=0.001$
No	10.6%	29.8%	

<b>Exposure to the sun in the last 24 hours</b>			
	N=104	N=104	
Yes	77.9%	88.5%	$\chi^2 = 4.157$
No	22.1%	11.5%	df=1
			P=0.041
<b>Do you give your child cod liver oil?</b>			
	N=104	N=104	$\chi^2 = 0.080$
Yes	41.3%	39.4%	df=1
No	58.7%	60.6%	P=0.777
<b>Expose the face to sunlight</b>			
	N=82	N=92	
Yes	91.5%	73.9%	$\chi^2 = 9.121$
No	8.5%	26.1%	df=1
			P=0.003
<b>Expose arms to sunlight</b>			
	N=82	N=92	
Yes	81.7%	68.5%	$\chi^2 = 4.016$
No	18.3%	31.5%	df=1
			P=0.045
<b>Expose the legs to sunlight</b>			
	N=82	N=92	
Yes	84.1%	68.5%	$\chi^2 = 6.734$
No	15.9%	31.5%	df=1
			P=0.034
<b>Expose the whole body to sunlight</b>			
	N=82	N=92	
Yes	4.9%	23.9%	Fishers exact
No	95.1%	76.1%	df=1
			P=0.000

#### **4.5 Correlations between knowledge, perception and practices of caregivers who have children with rickets and those without rickets**

Table 29 shows a significant positive correlation between knowledge and perceptions score of the caregivers with children who have rickets at  $P < 0.05$  ( $r = 0.242$ ,  $P = 0.020$ ), the higher the knowledge scores the higher the perception scores. There was also a significant positive correlation between knowledge and perception score of the caregivers' with children who have



no rickets at  $P < 0.05$  ( $r = 0.386$ ,  $P = 0.000$ ), the higher the knowledge scores the higher the perception scores.

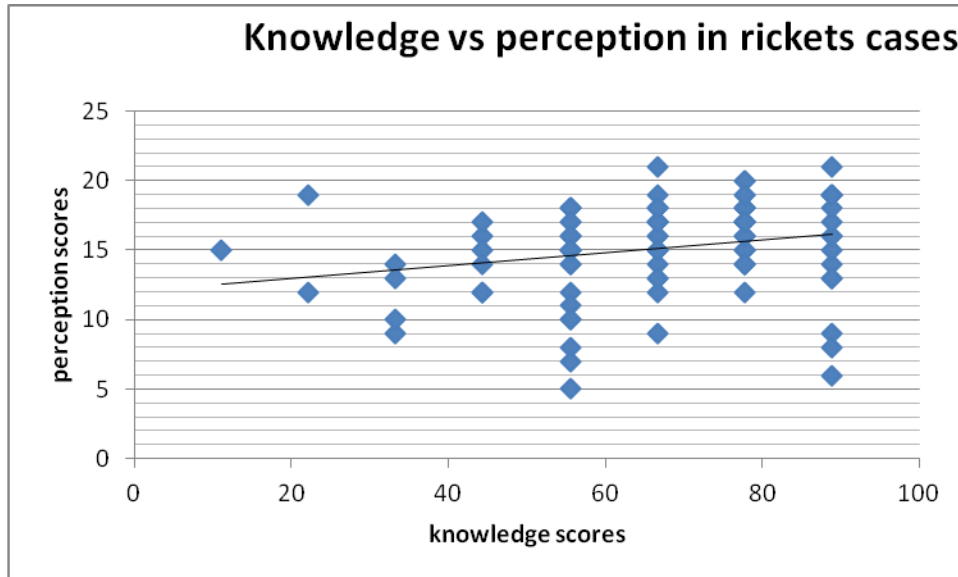
A correlation between knowledge and practice exist in caregivers of children with rickets ( $r = 0.177$ ,  $P = 0.101$ ) and without rickets ( $r = 0.157$ ,  $P = 0.138$ ) hence an increase in knowledge leads to an increase in practices, though not significant.

**Table 29: Correlations of knowledge, perceptions and practices**

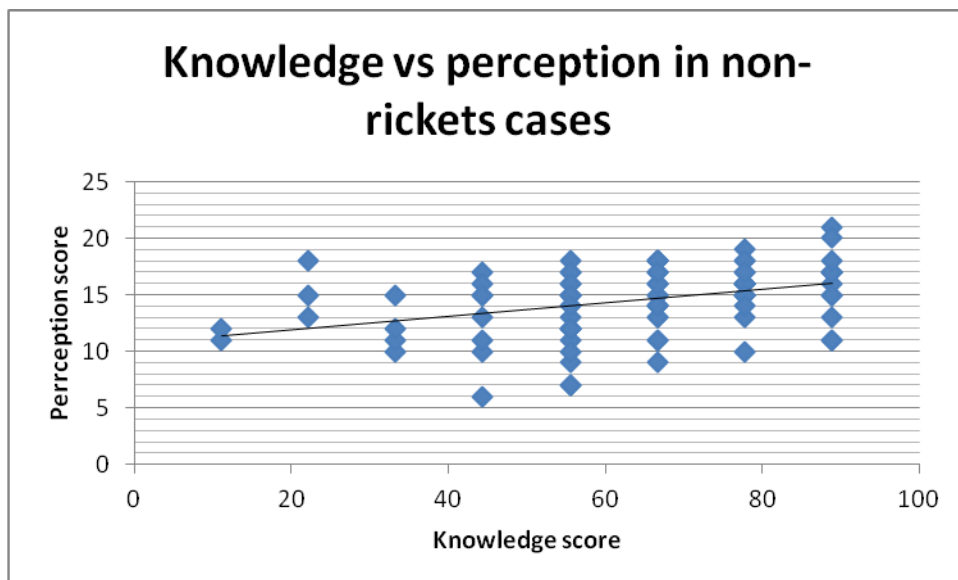
	<b>Rickets</b>	
<b>Variables</b>	<b>r</b>	<b>P</b>
Knowledge versus practices	0.177	0.101
Knowledge versus perception	0.242	<b>0.020</b>
Practices versus perception	0.146	0.190
	<b>No rickets</b>	
	<b>r</b>	<b>P</b>
Knowledge versus practices	0.157	0.138
Knowledge versus perception	0.386	<b>0.000</b>
Practices versus perception	0.142	0.201

However, the positive correlation cannot be attributed to the two variables because maybe a third force may be responsible to the positive correlation. A linear regression analysis was conducted to predict the value of the dependent variable (perception scores) based upon the value of the value of the independent variable (knowledge scores).

Figures 11 and 12 show a linear relationship between knowledge and perception in rickets and non rickets cases



*Fig 11: Relationship between perception and knowledge in rickets cases*



*Fig 12: Relationship between perception and knowledge in non-rickets cases*

From table 30, a prediction on perception scores can be computed from knowledge scores using the following equation.

$$\text{Perception score} = 0.059(\text{knowledge score}) + 10.767 \dots \text{equation 1}$$

This equation can be used to predict the perception scores of the caregivers' who had children with no rickets without even interviewing them again.

**Table 30: Linear regression of knowledge and perceptions scores for non rickets cases**

Variable	B	SE	r	Sign	95% CI for B	
					Lower	Upper
Constant	10.767	1.059		0.000	8.663	12.871
Knowledge	0.059	0.016	0.363	0.000	0.027	0.091
B-Regression coefficient						
SE- Standard error						
r-correlation coefficient						
Sign-Significant level						

From table 31, a prediction on perception scores can be computed from knowledge scores using the following equation.

$$\text{Perception score} = 0.047(\text{knowledge score}) + 12.017 \dots \text{equation 2}$$

This equation can be used to predict the perception scores of the caregivers' who had children with rickets without even interviewing them again.

**Table 31: Linear regression of knowledge and perceptions scores for rickets cases**

Variable	B	SE	r	Sign	95% CI for B	
					Lower	Upper
Constant	12.017	1.348		0.000	9.340	14.694
Knowledge	0.047	0.020	0.242	0.020	0.008	0.086
B-Regression coefficient						
SE- Standard error						
r-correlation coefficient						
Sign-Significant level						

Linear regression test confirmed positive significant relationship between knowledge and perception scores for both groups (rickets and non rickets cases)

#### **4.6 Summary of key findings**

Specific objective one; The dependency ratio of households with children with rickets was slightly lower than those of families with children without rickets. Children with rickets had a significantly higher mean age compared to children without rickets. The mean age of the caregivers of children with rickets was significantly higher than the mean age of caregivers of children without rickets. There was no significant difference in the means of the average monthly incomes between those households with children with rickets and those without. Therefore the hypothesis that there is no significant difference in the monthly income of caregivers who have children with rickets and those who do not have is true.

Specific objective two; There was a significant difference in the mean knowledge scores between caregivers of children with rickets and the caregivers of children without rickets. Caregivers who

had children with rickets had a higher mean score than the caregivers who had children without rickets. Therefore, the hypothesis that there is no significant difference in the nutritional knowledge of caregivers who have children with rickets and those who do not have is false.

Specific objective three; There was no significant difference in the mean perception scores between caregivers of children with rickets and the caregivers of children without rickets. Hence the hypothesis that there is no significant difference in the perceptions of caregivers who have children with rickets and those who do not have is true.

Specific objective four; Children with rickets had a lower mean age at which complementary foods were introduced than children without rickets. There is a 2.8 fold increased odds of getting rickets for children who are not exclusively breastfed than the exclusively breastfed. The mean exposure time to the sun of children with rickets was significantly higher than that of children without rickets. A greater proportion of children without rickets were sunbathed for less than 30 minutes compared with children with rickets. More of the children with rickets were exposed to sun for 30-60 minutes compared with those children without rickets. There was no significance difference in the mean practice score between caregivers of children with rickets and caregivers of children without rickets; hence the hypothesis that states that there is no significant difference in the child care practices of caregivers who have children with rickets and those who do not have is true.

Specific objective five; There is a positive correlation between knowledge and practice, knowledge and perception, perception and knowledge between the rickets and non rickets cases.

## **CHAPTER FIVE: DISCUSSION**

### **5.1 Socio-demographic and economic characteristics**

From the study, in relation to the socio-demographic and economic data, there was no significant difference in relation to the child, marital status, level of education of the mother, gender of the household head and monthly income between those households with children with rickets and those without rickets. These results differed from a study conducted in Egypt at Abu El Rish Hospital which showed a statistical significant difference between the rickets cases and controls as with regards to their socio demographic data such as place of residence, education of the mother and source of income (Bakeit, 2012).

#### **5.1.1 Dependency ratio**

The dependency ratio of the population was 94:100 with the productive population surpassing the dependant population. The dependency ratio in this study is almost at par with the KDHS 2008-2009 one which is 96:100 (KNBS, 2010). The households with children with rickets had a slightly lower dependency ratio (92:100) than the household with children who had no rickets (95:100). This is contrary to expectation since we expect the households with children who have rickets to have more mouths to feed than the households with children who have no rickets, but in this case it is not.

#### **5.1.2 Age of the caregiver**

From this study, it shows that older caregivers have children with rickets compared to the younger caregivers. This can be attributed to the fact that the older caregivers might have other young children or have many children hence their attention is divided amongst the other children

or due to the fact that resources are strained and maybe due to the fact that the children did not get proper nourishment during infancy. A study conducted in Gaza strip found that cases of rickets were more prevalent in households where there were more children (Yasssin and Lubbad, 2010).

### **5.1.3 Monthly income**

The average monthly income of both groups was negatively skewed an indication of low monthly income and hence a poor economic status. Most of the respondents earned less than the minimum wage in Kenya (Kshs 13,674). Poor socio economic status was a reason stated in the key informant interview.

### **5.1.4 Age of children**

From the results, children with rickets were older than those without rickets. This can be an indication that detection of rickets was not done at an early stage. This can also be an indication that caregivers' were staying with rachitic children at home without their knowledge or rickets develops later in the life of a child. A study conducted in Denmark shows that age of diagnosis occurs in two incidence peaks, among infants and young children aged four years or less and in older children above the age of four which reflects the high demand of phosphorus and calcium used in bone mineralization during the periods of rapid growth in children (Beck, 2009).

### **5.1.5 Main source of income**

From the results, a higher percentage of children with rickets were from caregivers who were self employed, engaged in farming or casual laborers. This is true since casual labor and farming involves working in the flower farms where the conditions are harsh and the pay is meager.

Farming in Naivasha is also dependent on rain and so most farmers depend on rain to grow their food hence an inadequate diet. Self employment, Farming and Casual labor had higher percentages of children with rickets than those without rickets the difference was significant (**P=0.015**). This can be confirmed by the key informant interview where the concern was the high number of caregivers' who are casual laborers in the flower farms. This leads to an absentee mother and the children are left in day care centers where the care is sufficient.

## **5.2 Knowledge**

Rickets is a condition caused by multiple factors such as vitamin D deficiency, calcium deficiency (Prentice 2008), prolonged breastfeeding without supplementation (Gartner and Greer 2003), lack of sunlight exposure and inadequate diet (DeLucia 2003).

From the study, caregivers were subjected to questions regarding rickets such as; (foods rich in vitamin D, foods rich in calcium, how to prevent rickets, if the disease is curable and at what age rickets starts developing in children) caregivers of children with rickets had a significantly higher mean knowledge score compared to the caregivers of children without rickets ( $t_{200} = 2.035$ ,  $P = 0.043$ ,  $CI = 0.16677, 10.62135$ ) which is ironical because the opposite is expected. However, this can be explained by the fact that people tend to find out more of what they are suffering from or maybe the higher knowledge mean score may be due to the health talks usually offered in the hospitals to the people suffering from certain conditions. Increased communication on rickets in the health facility may reduce or even reverse the rickets status. There is a tendency of people to ignore things that do not affect them and only become interested when they are affected. This is why ignorance was given as a reason why rickets is still affecting children. There is also a reduced chance of developing rickets for children whose caregivers have adequate knowledge.



Results from the focus group discussion corroborated the findings since the caregivers who had children with rickets also portrayed a higher knowledge of the disease rickets in general as compared to the caregivers of children without rickets. This is a clear indication that the public needs to be educated about rickets in order to eradicate the disease.

The Kenya National Clinical Nutrition and Dietetics Reference Manual, states that management of rickets in children as; recommending foods rich in calcium and vitamin D, exposure of children to the sun and exercise as it promotes calcium metabolism. It is worth noting that the reference manual does not recognize the supplementation of children with vitamin D yet breast milk is insufficient in the vitamin and also very few foods contain the vitamin naturally (MoMs, 2010).

### **5.3 Perceptions**

A higher percentage (26.0%) of caregivers' who had children with rickets had a positive perception on the causes of rickets than the caregivers with children who had no rickets (14.1%).

We expect the caregivers' who have children with rickets to have a lower percentage of the positive perception but in this case it is not true. This can be attributed to the fact that the caregivers' with children with rickets have a higher knowledge mean score than those with children who have no rickets and also from the nutrition and health education given to those affected by rickets in the hospital.

### **5.4 Maternal child care practices**

#### **5.4.1 Exclusive breastfeeding**

A 2.8 fold increased odds of getting rickets for children who are not exclusively breastfed was recorded. However, studies have indicated that children who are exclusively breastfed are at an

increased risk of developing rickets and should be supplemented with vitamin D (200IU/L) (IOM 1997) since breast milk does not contain sufficient amounts of vitamin D (25IU/L or less) (Reeve et al., 1982) and that children who are exclusively breastfed and not supplemented with vitamin D had an increased chance of getting rickets (Gartner and Greer 2003). Data from a study conducted in Denmark does not support breastfeeding as an independent risk factor in the development of rickets (Beck, 2009)

In Kenya, exclusive breastfeeding is recommended because breast milk alone is adequate to meet the child's nutritional requirements (MoMs, 2010). Since studies have shown breast milk to be insufficient in vitamin D, plans to cater for the insufficiency should be considered. A study conducted in Al-Shatea Medical Clinic in Gaza City showed that rickets was more prevalent among children who were breast fed. It also showed that prolonged breastfeeding contributed to the development of rickets (Mushtaha, 2006).

#### **5.4.2 Complementary feeding**

Children with rickets had a lower mean age at which complementary foods were introduced. Hence early introduction of complementary foods to children could be a contributing factor to a child getting rickets.

Children who were introduced to complementary foods before the age of six months were at a higher risk of developing rickets than children who were introduced to complementary foods after the age of six. This can be attributed to the poor choice of foods given to the children as complementary foods as there are basically very few foods that contain vitamin D naturally and the foods that are fortified with the vitamin are too expensive to purchase for most households. Results in this study are supported by a study conducted in Gaza strip that showed that early

introduction of complementary feeding at less than six month of age increased the exposure to the infections, such as gastrointestinal infections, respiratory illness and rickets (Kanoa et al, 2011). Vitamin D is required by the body in order to help in calcium absorption. So a deficiency in vitamin D leads to deficiency in calcium. However, results in this study were not in line with a study conducted in Al-Shatea Medical Clinic in Gaza City which indicated that early introduction of complementary food has protective effects against rickets (Mushtaha, 2006). This is only possible if the complementary foods are adequate in vitamin D and calcium. From the key informant interview, poor feeding by the children due to an inadequate diet was given as a reason for the presence of rickets in Naivasha.

#### **5.4.3 Mode of dressing**

Lightly dressed children had a decreased chance of developing rickets than the heavily dressed children. Lightly dressed children have more skin exposed to the sun hence giving way to the production of vitamin D by the body. Exposing children to sunlight with minimal clothing is a strategy for preventing vitamin D deficiency (GOK<sub>2</sub>, 2009) Children who wear clothes that cover most of the body, including the face, head, legs and arms, have minimal skin sunshine exposure (Holick, 1994). Heavy dressing that covers much or all of the body is associated with a high prevalence of low vitamin D status, even in sun rich countries (Gannage, 2001).

The findings in this study were in line with a study conducted in Al-Shatea Medical Clinic in Gaza City where a statistical significant difference was found between those children who were fully dressed and those who were exposing certain areas during the time of exposure. Therefore the study revealed that the duration of exposure to sunlight combined with being lightly dressed is an important factor in the prevention of rickets (Mushtaha, 2006).

#### **5.4.4 Sunlight exposure**

In general, prevalence of rickets among children increased with decreasing exposure frequency to sunlight according to a study conducted in Gaza City (Mushtaha, 2006). From this study, in relation to frequent sun exposure and exposure in the last 24 hours, there was a significant difference between the two groups. Those with rickets were sunbathed for a longer period according to this study hence the sunbathing of the children at that stage can be viewed as being curative rather than preventive. However, sunbathing of children is also a preventive measure. The statistical significance between the two groups can be attributed to the health talks given to the mother when they attend the hospital.

From the study, a greater proportion of children without rickets were sunbathed for less than 30 minutes compared to those with rickets. The main source of vitamin D is through synthesis in the skin from cholesterol after exposure to UV-B light. Full-body exposure for 10 to 15 minutes for people with light skin pigmentation is adequate to yield enough vitamin D<sub>3</sub> within 24 hours. However, individuals with darker pigmentation require 5 to 10 times more exposure to generate similar amounts of vitamin D<sub>3</sub> (Kimlin et al., 2004). The required minimum weekly period of sun exposure for infants is two hours when only the face is exposed or 30 minutes if the face, arms and legs are exposed (Specker et al., 1985).

From the results, a greater proportion of children with rickets were exposed to the sun for 30-60 minutes as compared to those children without. This shows that the caregivers of the children with rickets were practicing what they were instructed to do so as to prevent further development of rickets and also as a curative measure. The Clinical Management and Referral Guidelines state that exposing children to sunlight for 30-60 minutes is a strategy for preventing vitamin D

deficiency (GOK<sub>2</sub>, 2009). Also a greater proportion of children without rickets were sunbathed for less than 30 minutes daily. This shows that there is need to educate the mothers on the importance of sunlight exposure before the children are affected by rickets.

### **5.5 Correlations of knowledge and perception of the two groups**

The correlations of knowledge and perceptions were positive and significant for both the caregivers who had children with rickets and the caregivers who had children without rickets. On further analysis using linear regression showed positive significant relationship between knowledge and perception scores. This means that the knowledge that a person has greatly affects the perceptions of a person positively hence if the knowledge is high the perceptions will also be positive.

The correlations of knowledge and practices for both group were positive but not significant. This proves that knowledge and practice go hand in hand such that an increase in knowledge leads to an increase in practices for the both groups, hence the application of practices can be influenced by the knowledge that a person has.

## **CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS**

### **6.1 Conclusions**

From the findings of this study, the following can be concluded,

1. The socio demographic characteristics of the both groups are the same
2. The overall knowledge of the caregivers is above average. However, the caregivers who have children with rickets have higher knowledge than the caregivers who have children with no rickets.
3. The overall perceptions of the caregivers are above average. However, the caregivers who have children with rickets have better perceptions than the caregivers who have children with no rickets.
4. The overall practices of the caregivers are above average. However, the caregivers who have children with rickets have better practices than the caregivers who have children with no rickets.
5. Inadequate researched literature on rickets in Kenya.

### **6.2 Recommendations**

There is need to create an understanding and awareness to the caregivers and in particular the mothers through maternal education as an educated mother will have better and improved child care practices. This would best be spearheaded by the service providers in the hospitals and community such as community health workers.

There is need to address the various issues that affect each region separately as opposed to addressing certain issues in all the regions where the problem is not significant. From these findings, a total of 104 children were found to have rickets. These are the cases that are being handled in the hospital only meaning that there could be other cases in the community. The policy makers in Naivasha should incorporate the sensitization of rickets in its program or the hospital should take the initiative and educate the people of Naivasha when the hospital campaigns are on.

There is also a need to know exactly the extent of the disease in Naivasha and the country so that the prevalence of rickets can be known. Further research on rickets in Naivasha and other areas affected by the diseases should be conducted on. Other researchers can use information from these findings as a stepping stone to further researches.

There is also the need to determine the root cause of rickets in Naivasha through further research.

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## Annex 1: Field assistants training program

DAY	TIME	SUBJECT MATTER	LEARNING METHOD	TOOLS
1	9.00-10.30 am	<b>Introduction and Overview of the study</b> ○ General objectives ○ Specific objectives	○ Lecture	○ Sample questionnaire
	10.30-11.00 am	Tea Break		
	11.00-1.00 pm	<b>Data collection techniques</b> ○ Questionnaire filling (all sections), translating to Kiswahili and kikuyu	○ Demonstration	○ Sample questionnaire
	1.00-2.00 pm	Lunch Break		
	2.00-4.00 pm	<b>Data collection techniques (cont')</b>	○ Demonstration ○ Role play	○ Sample questionnaire
	4.00-5.00 pm	<b>Ethics and conduct</b> ○ Professional conduct in the field ○ Confidentiality ○ Working hours ○ Allowances ○ Q & A	○ Lecture ○ Discussion	
2	9.00-9.30 am	<b>Recap of the previous day</b>	○ Discussion	
	9.30-1.30 pm	<b>Pre-test questionnaire</b>		○ Questionnaire
	2.30- 3.30 pm	Lunch Break		
	3.30-5.00 pm	Revision of the questionnaire based on the results of pretest Conclusions and closing	○ Discussion	○ Filled questionnaire

## **Annex 2: Consent forms**

### **2.1 For the questionnaire**

**Study Title:** *Knowledge, perception and practices influencing the prevalence of rickets: a comparative case study of rickets and non rickets in Naivasha District Hospital*

Hello. My name is Irene Mwaura and I am from The University of Nairobi, Department of Food Science, Nutrition and Technology, Applied Human Nutrition Programme. I am conducting research survey that seeks to find the Knowledge, Perception and Practices influencing the prevalence of rickets. I would very much appreciate your participation in this survey.

#### **Study Procedures**

My six research assistants and I will ask you demographic, knowledge, perception and practices questions that you will be required to answer as correctly as possible. Duration of about one hour will be required to complete the questions. A qualified clinical officer will examine your child for any clinical signs of rickets. Your child will also be required to undergo a medical x ray which will show if your child has rickets. The procedure will be done by a qualified radiologist.

#### **Risks**

There are no serious risks involved. The process of examining for any clinical signs and the medical x ray procedure will have no serious risks to your child. Necessary care will be taken while examining the child.

#### **Benefits**

There are no direct benefits to you for participating. However, the findings from the study will be submitted to the hospital which will respond accordingly. Also the information that will be collected could be important in addressing the rickets burden.

#### **Ethical issues and confidentiality**

Information given will be kept confidential and used to prepare a dissertation which will not include any specific name. Reference numbers will be used to connect your name and your answers without identifying you.

Participation in this study is voluntary, you can choose to participate or not.

(Do you have any pressing question about the study?)

You can contact the Health Research Ethics committee at the addresses provided below if you have any concerns or complaints that have not been adequately addressed by the researcher.

**Kenyatta National Hospital/University of Nairobi - Ethics & Research Committee**

**Telephone number :-** +2542726300-19 Ext.44355

**E-mail:** uonknh\_erc@uonbii.ac.ke

**Post address:** P O BOX 20723-00202, Nairobi, Kenya

By Signing or approving to this consent indicates that you understand what will be expected of you and are willing to participate in this survey.

.....

Signature /Thumb Print of respondent:

Date: .....

.....

Date: .....

Signature of investigator

.....

Signature /Thumb Print of witness:

Date: .....

This study has been ethically approved by KNH/UON-ERC, Email: [uonknh\\_erc@unobi.ac.ke](mailto:uonknh_erc@unobi.ac.ke)  
The study will run for duration of three months.

Contact of researcher: Mwaura Irene Njeri

Mobile phone: 0721872121. Email: i.mwaura@yahoo.com

## **2.2 For Focus Group Discussion**

**Study Title:** *Knowledge, perception and practices influencing the prevalence of rickets: a comparative case study of rickets and non rickets in Naivasha District Hospital*

### **Introduction:**

Hello. My name is Irene Mwaura and I am from The University of Nairobi, Department of Food Science, Nutrition and Technology, Applied Human Nutrition Programme. I am conducting research discussion that seeks to find the Knowledge, Perception and Practices influencing the prevalence of rickets. I would very much appreciate your participation in this discussion. Thank you for finding time to take part in this discussion.

### **Study Procedures**

My two research assistants and I will ask you some questions regarding rickets which will then be discussed amongst us. I believe that we will learn a lot from each other. Duration of about 45-60 minutes will be required for the discussion.

### **Risks**

There are no serious risks involved in taking part in the discussion.

### **Benefits**

There are no direct benefits to you for participating in the discussion. However, the findings from the study will be submitted to the hospital which will respond accordingly. Also the information that will be collected could be important in addressing the rickets burden.

### **Ethical issues and confidentiality**

Information given will be kept confidential and used to prepare a dissertation which will not include any specific name.

Participation in this study is voluntary, you can choose to participate or not.

(Do you have any pressing question about the study?)

You can contact the Health Research Ethics committee at the addresses provided below if you have any concerns or complaints that have not been adequately addressed by the researcher.

**Kenyatta National Hospital/University of Nairobi - Ethics & Research Committee**

**Telephone number :-** +2542726300 Ext.44355



**E-mail:** uonknh\_erc@uonbi.ac.ke

**Post address:** P O BOX 20723-00202, Nairobi, Kenya

By Signing or approving to this consent indicates that you understand what will be expected of you and are willing to participate in this discussion.

s/no	Name of participant	Signature/thumbprint of participant
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		

..... Date.....

Signature of investigator

..... Date.....

Name and Signature /Thumb Print of witness:

This study has been ethically approved by KNH/UON-ERC, Email: [uonknh\\_erc@unobi.ac.ke](mailto:uonknh_erc@unobi.ac.ke)

The study will run for duration of three months.

Contact of researcher: Mwaura Irene Njeri- 0721872121. Email: i.mwaura@yahoo.com

## **2.3 For Key Informant Interview**

**Study Title:** *Knowledge, perception and practices influencing the prevalence of rickets: a comparative case study of rickets and non rickets in Naivasha District Hospital*

Hello. My name is Irene Mwaura and I am from The University of Nairobi, Department of Food Science, Nutrition and Technology, Applied Human Nutrition Programme. I am conducting research survey that seeks to find the Knowledge, Perception and Practices influencing the prevalence of rickets. Part of the research involves conducting a key informant interview and I would very much appreciate your participation in this survey. Your cooperation is important as it will help in the collection of the information I require that will in turn complement the information gathered from questionnaires and focus group discussions.

### **Study Procedures**

My two research assistants will be assisting me with the interview, one will be the note taker and the other an observer and I will be the one facilitating the interview. Duration of about one hour will be required to complete the interview.

### **Risks**

There are no risks involved.

### **Benefits**

There are no direct benefits to you for participating. However, the findings from the interview will be used in drafting a report which will be submitted to the hospital which will respond accordingly. Also the information that will be collected could be important in addressing the rickets burden.

### **Ethical issues and confidentiality**

Information given will be kept confidential and used to prepare a dissertation which will not include any specific name.

Participation in this study is voluntary, you can choose to participate or not.

(Does anyone have any pressing question about the interview?)

You can contact the Health Research Ethics committee at the addresses provided below if you have any concerns or complaints that have not been adequately addressed by the researcher.

**Kenyatta National Hospital/University of Nairobi - Ethics & Research Committee**

**Telephone number :- +2542726300 Ext.44355**

**E-mail:** uonknh\_erc@uonbi.ac.ke

**Post address:** P O BOX 20723-00202, Nairobi, Kenya

By Signing or approving to this consent indicates that you understand what will be expected of you and are willing to participate in this survey.

Occupation	Name of participant	Signature of participant

.....Date.....

Signature of investigator

.....Date.....

Name and signature of witness

This study has been ethically approved by KNH/UON-ERC, Email: [uonknh\\_erc@unobi.ac.ke](mailto:uonknh_erc@unobi.ac.ke)  
The study will run for duration of three months.

Contact of researcher: Mwaura Irene Njeri

Mobile phone: 0721872121. Email: i.mwaura@yahoo.com

### Annex 3: Study questionnaire

## KNOWLEDGE, PERCEPTION AND PRACTICES INFLUENCING THE PREVALENCE OF RICKETS: A COMPARATIVE CASE STUDY OF RICKETS AND NON RICKETS IN NAIVASHA DISTRICT HOSPITAL

### Identification

Location .....Sub-location.....

Name of Interviewer..... Date of interview...../...../2013

Site of Interview.....

Sex: Male  Female

### Translation of terms

Ricket- matege, mbogoro, nyongea

Calcium- Kalisi, kalsium

Vitamin D- vitamini D

### Section A: SOCIO DEMOGRAPHIC INFORMATION

1. What is your relation to the child?

1. Mother
2. Father
3. Others (specify)

2. Age in years of the mother\_\_\_\_\_

3. Date of birth of the child\_\_\_\_\_

4. What is the level of education of the caregiver?

Level	Number of years spent in school
Primary	
Secondary	
College/University	
Never went to school	

5. What is the gender of the household head?

1. Male
2. Female

6. What is the size of your household?

No. <5 yrs\_\_\_\_\_ No. 5-15 yrs\_\_\_\_\_ No. 15-65 yrs\_\_\_\_\_ No>65 yrs\_\_\_\_\_

7. What is your **main** source of income for the household?

1. Self employment
2. Farmer
3. Casual laborer
4. Student
5. Salaried employee
6. No occupation

8. How much do you earn every month? \_\_\_\_\_

9. What is your marital status?

1. Single
2. Married
3. Divorced
4. Widowed
5. Other (Specify)

10. Where do you live?

1. Slums
2. Flats
3. Own compound

**Section B: CHECKLIST ON PRACTICES**

s/no	Question	Answer (Yes/No)
1	Do you sun bathe your child?	
2	If yes, for how many minutes a day	
3	At what age did you start giving your child other foods/drinks including water, milk, and porridge?	
4	If your child was exclusively breastfed did the child receive vitamin D supplements?	
5	Do you give your child cod liver oil?	
6	Did you expose your child to sunlight in the last 24hours?	
7	If no, explain why	
8	If yes which parts of the body were exposed? 1.Face 2.Arms 3.Legs 4.Whole body	
9	Where did the sun exposure occur?	
10	Which type of oil or fat do you use for cooking?	
11	Is the day sunny?(observation to be done by the interviewer)	
12	Observe the dressing of the child and list the clothes (to be done by the interviewer) .....	

**Section C: PERCEPTIONS**

**Show a picture of a child who has rickets to the respondent**

s/no	Question: what do you think causes rickets?	Strongly agree	Agree	Disagree	Strongly disagree
1	Obesity				
2	Early walking				
3	Consumption of the local water				
4	Hereditary				
5	Inadequate diet				
6	Prematurity and low birth weight				
7	Others (specify)				

**Section D: KNOWLEDGE (show a picture of a child who has rickets to the respondent)**

1. Do you know of the disease rickets?

1. Yes

2. No

2. Can the disease be cured?

1. Yes

2. No

If yes, how \_\_\_\_\_

If no, why not \_\_\_\_\_

3. What is the local or commonly used name? \_\_\_\_\_

4. At what age does rickets start developing in a child?

5. How do you know a child has rickets?

1. Late closure of fontanel
2. Late tooth eruptions
3. Bowing of the legs
4. Enlargement of the joints
5. Knock knees
6. Don't know

6. Which foods are rich in vitamin D?

1. Eggs
2. Fish
3. Cod liver oil
4. Dairy products

5. Blue band
6. Fortified oil or fat
7. Which foods are rich in calcium?
  1. Milk
  2. Fish
  3. Liver
  4. Dark green leafy vegetables
  5. Sesame seeds
8. What can you do to prevent your child from developing rickets?
  1. Sunbathing the child
  2. Appropriate diet
  3. Others (specify)

**Annex 4: Question Guide for Focus Group Discussion (For the Facilitator)**  
**Study title: Knowledge, perception and practices influencing the prevalence of rickets: a comparative case study of rickets and non rickets in Naivasha District Hospital**

(A picture of a child who has rickets will be shown to the participants)

Name of Moderator.....

Name of Note Taker.....

Name of Observer.....

Venue.....

1. What is rickets?
2. What is the local name for rickets?
3. What causes rickets?
4. How does one tell that a child has rickets?
5. At what age does rickets occur most in children?
6. Is the disease new or has it been there before or is the disease occurring? (how far back is the disease?)
7. If the disease has been there for a long time, how was it treated?
8. How is/was the disease prevented
9. Which foods are rich in vitamin D and calcium?
10. How is the disease treated?
11. Are there any myths about the disease here in Naivasha?
12. What are the bad or good things associated with rickets
13. What are you told about the disease at the health facility?



## **Annex 5: Question Guide for Key Informant Interview**

### **Knowledge, perception and practices influencing the prevalence of rickets: A comparative case study of rickets and non rickets in Naivasha District Hospital**

Name of Moderator.....Venue.....

Name of Note taker.....

Date of interview.....

1. Why are the cases of rickets on the increase in Naivasha?
2. What are the child care practices that could be associated with rickets?
3. Are there dietary practices that could have an influence on rickets development?
4. Are there some medical conditions that could be predisposing children to rickets?
5. What can be done to prevent rickets cases from increasing?

## Annex 6: Field assistants training program

DAY	TIME	SUBJECT MATTER	LEARNING METHOD	TOOLS
1	9.00-10.30 am	<b>Introduction and Overview of the study</b> <ul style="list-style-type: none"> <li>○ Title</li> <li>○ General objective</li> <li>○ Specific objectives</li> </ul>	○ Lecture	○ Sample questionnaire
	10.30-11.00 am	Tea Break		
	11.00-1.00 pm	<b>Data collection techniques</b> <ul style="list-style-type: none"> <li>○ Questionnaire filling (all sections), translating to Kiswahili and kikuyu</li> </ul>	○ Demonstration	○ Sample questionnaire
	1.00-2.00 pm	Lunch Break		
	2.00-4.00 pm	<b>Data collection techniques (cont')</b> <ul style="list-style-type: none"> <li>○ Practicing questionnaire filling</li> </ul>	<ul style="list-style-type: none"> <li>○ Demonstration</li> <li>○ Role play</li> </ul>	○ Sample questionnaire
	4.00-5.00 pm	<b>Ethics and conduct</b> <ul style="list-style-type: none"> <li>○ Professional conduct in the field</li> <li>○ Confidentiality</li> <li>○ Working hours</li> <li>○ Allowances</li> <li>○ Q &amp; A</li> </ul>	<ul style="list-style-type: none"> <li>○ Lecture</li> <li>○ Discussion</li> </ul>	
2	9.00-9.30 am	<b>Recap of the previous day</b>	○ Discussion	
	9.30-1.30 pm	<b>Pre-test questionnaire</b>		○ Questionnaire
	2.30- 3.30 pm	Lunch Break		
	3.30-5.00 pm	Revision of the questionnaire based on the results of pretest Conclusions and closing	○ Discussion	○ Filled questionnaire

## Annex 7: Pictures of children with rickets



Knock knee deformity



bowleg deformity



Wrist enlargement

Picture source: Craviari T. et al., 2008

