Assessment of Nutritional Status and Associated Factors
among Children under Five in Khartoum Locality, Khartoum
State, Sudan

Khalid Rassam M. Bajari
MBBS, Karachi University (1988)

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Assessment of Nutritional Status and Associated Factors among Children under Five in Khartoum Locality, Khartoum State, Sudan

Khalid Rassam M. Bajari

ABSTRACT

Nutritional status of children is an indicator of the level of development and future potential of the community. A well-nourished population have a capacity to be productive and to improve it standard of living through production. The study was conducted to assess the nutritional status of children under five years old and associated factors in Khartoum locality, Khartoum state (2017). A cross sectional study was applied and representative sample of 272 mothers with children under 5 years were selected using systematic random sampling. Nutritional status of children was assessed using anthropometric measurement. To identify the factors, semi structural questionnaire was used for the mothers. The finding revealed that, mothers are aware of best food for child that reflected positively on nutritional status of the children as shows that (3.3%) had severe wasting, (6.6%) had severe underweight, and (12.9%) had severe stunting, respectively. The main associated factors of nutritional status of children were mother age, employment and family monthly income (p < 0.05). child morbidity shows (35.7%) of the children had acute respiratory infection, (44.5%) had fever while (43%) have diarrhea. health seeking behavior was found high as majority of mothers (90.0%) treat the children at health facilities. Findings of this study is concluded that malnutrition is still an important problem among children under five years. Therefore, especial attention should be given on intervention of malnutrition.
تقييم الحالة التغذوية والعوامل المرتبطة بين الأطفال دون سن الخامسة بمحلية الخرطوم – ولاية الخرطوم – السودان
خالد رسام ميسر باجرى
ملخص الدراسة
تعتبر الحالة التغذوية للأطفال مؤشر لمستوى التنمية والإمكانيات المستقبلية للمجتمع. فالسكان ذوي التغذية الجيدة لديهم القدرة على الإنتاج وتحسين مستوى معيشتهم من خلال الإنتاج. أجريت هذه الدراسة لتقييم الحالة التغذوية للأطفال دون سن الخامسة والعوامل المرتبطة بها في محلية الخرطوم، ولاية الخرطوم (2017). طبقت الدراسة الرضية المقطعية لعينة تكون من 272 من الأمهات اللائي لديهن أطفال دون سن الخامسة، تم اختيار العينات باستخدام العينة العشوائية المنتظمة. وتم تقييم الحالة التغذوية للأطفال باستخدام القياسات الجسمية. استخدم الاستبيان لتحديد العوامل المرتبطة بالحالة التغذوية. أظهرت نتائج الدراسة وعلى الأمهات للغذاء المثلى للأطفال والذي عكست إيجابياً على الحالة التغذوية للأطفال حيث أوضحت أن (3.3%) يعانون من الهزال المزمن و(6.6%) يعانون من نقص الوزن المزمن و(12.9%) من الأطفال يعانون من التقدم المزمن. وجد أن هناك ارتباط بين عمر ومهنة الأم ودخل الاعتيدي المستوى التعليمي، المهنة ودخل الأسرة بالحالة التغذوية للأطفال (0.5<p>0.05) و ان (35.7% من الأطفال يعانون من عدوى الجهاز التنفسي الحاد، (44.5%) يعانون من الحمى و (43%) يعانون من الإسهال. وان للأمهات سلوك إيجابي تجاه الصحة حيث ان (90%) يعالجن أطفالهن بالمرافق الصحية. وخلصت
نتائج هذه الدراسة أن سوء التغذية لا يزال يمثل مشكلة هامة بين الأطفال دون سن الخامسة. ولذلك ينبغي إعطاء سوء التغذية اهتمام خاص للتدخل.
CHAPTER ONE

1.1 INTRODUCTION

Food is an important and basic biological need of man. It is essential for life, growth and repair of the human body, regulation of body mechanisms and production of energy for work. The nutrition of people on a global level is of great concern today particularly in developing nations. Fair sections of the population do not get enough food to eat and their diets are deficient in enough food to eat and there are deficient in calories in addition; the children in the developing countries suffer from malnutrition (Kasthuri, 2000).

Nutrition is a cornerstone that affects and defines the health of all people, rich and poor. Conversely, malnutrition makes all more vulnerable to disease and premature death. It is a devastating problem, particularly for the poor and unprivileged as poverty is a fundamental cause of household food insecurity and consequently malnutrition which continues to be one of the major and most pressing health problems affecting children and adults (Pinstrup, 2011).

Nutritional status of children is an indicator of the level of development and future potential of the community. A well-nourished population has a capacity to be productive and to improve its standard of living through hard work. Furthermore, in children malnutrition adversely affects their cognitive and learning performance. Adults, who as children suffered malnutrition, suffer functional impairments including reduced intellectual performance and working capacity (Ola et al., 2011).

Malnutrition describes a state of imbalance between the dietary needs of the body and the type of diet provided to the body. It’s commonly affects all groups in a community, but infants and young children are the most vulnerable because of their high nutritional requirements for growth and development (Blössner et al., 2005).

The World Health Organization (2013) estimates that there are 178 million children that are malnourished worldwide, and at any given moment, 20 million are suffering from the most severe form of malnutrition. Malnutrition contributes to between 3.5 and 5 million annual deaths among under-five children. UNICEF estimates that there are nearly 195 million children suffering from malnutrition across the globe. In 1997, the
World Health Organization had observed that 60% of the deaths occurring among all the under five children in developing countries were attributed to malnutrition (Murray and Lopez., 1997). Most of the damage caused by malnutrition occurs in children before they reach their second birthday, in the time when the quality of a child's diet has a profound impact on his or her physical and mental development.

Malnutrition among under five children is one of the most important public health problems in developing countries especially Sub-Saharan Africa (Gulati, 2010). An estimated 54% of under-five deaths are believed to be associated with malnutrition in developing countries.

1.2 PROBLEM STATEMENT

Malnutrition continues to be a major public health problem in developing countries. It is the most important risk factor for the burden of disease that cause about 300, 000 deaths annually and it is responsible directly and indirectly for more than half of all deaths in children (Müller and Krawinkel, 2005). Prolonged states of malnourishment among children have Health and physical consequences of including delay in their physical growth and motor development; lower intellectual quotient, behavioral problems and susceptibility to contracting diseases (Black et al., 2003).

Globally, an estimated 165 million children under-five years of age, or 26%, were stunted, 16%, were underweight, 8% were wasted and 7% were overweight. High prevalence levels of stunting among children under-five years of age in Africa (36%) and Asia (27%) remain a public health problem, one which often goes unrecognized. More than 90% of the world’s stunted children live in Africa and Asia (UNICEF et.al, 2012).

In Sub-Saharan Africa, 41% of under-five children are malnourished and deaths from malnutrition are increasing on daily basis in the region. Malnutrition continues to be a significant public health problem throughout the low income countries, particularly in Sub-Saharan Africa and South Asia (Kimokoti and Hamer, 2008).
In Sudan, 38 percent of children under five are stunted, while the proportion severely stunted is 18 percent, 33 % are underweight (low weight-for-age) and 12 % are severely underweight (CBS, 2016).

In Khartoum state Malnutrition in children under five years estimated at 21.9% stunting, 14.5% wasting and 23.2 % underweight (CBS, 2016).

Malnutrition is often caused by not eating the right food or not eating enough food. But it is also often related to recent or repeated illness, e.g. diarrhea, malaria, respiratory infection or measles. It can also be caused by underlining disease, like Tuberculosis. Such acute malnutrition can be measured by comparing the weight of the child with height or mid-upper arm circumstance (MUAC) or physical appearance assessment. In addition, inadequate household food security, limited access to adequate health services and/or inadequate environmental health conditions and inadequate care in the households and at community level especially with regards to women and children are the underlying causes of malnutrition (UNICEF, 1998).

To address malnutrition, the type of malnutrition and nutrition related risk factors need to be identified and evidence based intervention and policies implemented.

1.3 **JUSTIFICATION**

Globally, over 10 million children under the age of 5 years die every year from preventable and treatable illnesses. At least half of these deaths are caused by malnutrition. Malnourished children have lower resistance to infection; they are more likely to die from common childhood illness such as diarrheal diseases and respiratory infections and children that survive are likely to suffer from frequent illness, which adversely affects their nutritional status, faltering growth and diminished learning ability (Caulfield et al., 2004).

Therefore, this study was design to assess the prevalence of malnutrition and associated factors among children aged 6 - 59 months and it can be used as a reference in setting priority and designing effective nutritional intervention in Khartoum locality.
1.4. STUDY OBJECTIVES:

1.4.1. GENERAL OBJECTIVE

To assess the nutritional status of children under five years old and associated factors in Khartoum locality, Khartoum state - Sudan

1.4.2. SPECIFIC OBJECTIVES

1. To assess nutritional status of children under five years old.
2. To identify factors associated with nutritional status of Children under five years old
3. To assess the proportion trends of malnutrition among Children under five years old
CHAPTER TWO

Literature Review

2.1. Overview of Malnutrition

Malnutrition literally means “bad nutrition” and technically includes both over- and undernutrition. In the context of developing countries, under nutrition is generally the main issue of concern, though industrialization and changes in eating habits have increased the prevalence of over nutrition. Within the context of World Food Program (WFP), malnutrition refers to under nutrition unless otherwise specified (WFP, 2005).

Malnutrition is one of the common causes of morbidity and mortality among children under five children in the World. Malnutrition also leads to physical and mental impairment in children. Health and physical consequences of prolonged states of malnourishment among children were delay in their physical growth, lower intellectual quotient, poor cognitive ability, decreased economic productivity, decreased reproductive performance, poor school achievement and poor school performance, greater behavioral problems and deficient social skills, and susceptibility to contracting diseases (Dewey and Begum, 2011).

Currently, malnutrition is associated with more than 41% of the deaths that occur annually in children from 6 to 24 months of age in developing countries, which were approximately 2.3 million (Sandoval-Priego, 2000).

Worldwide, 165 million children below five years of age were affected with undernutrition, of which 26% were stunted. This figure reduced by 35% from 253 million in 1990.

In Africa and Asia the prevalence of stunting is 36% and 27% respectively. These remain a public health problem if unrecognized. More than 90% of stunted children in the world live in Africa and Asia. An estimated 80% of world’s stunted children lives in fourteen countries (India, Nigeria, China, Pakistan, Indonesia, Bangladesh, Ethiopia, Democratic Republic of Congo, Philippines, United Republic of Tanzania, Egypt, Kenya, Uganda, and Sudan).

Sub-Saharan Africa and South Asia is the home to three fourths of the world’s stunted children, 40% and 39%, respectively (Ohnson, 2010; De Onis et al., 2012). Globally, an estimated 101 million children under-five years of age are underweight. These accounted for 16% of children under five years of age (De Onis et al., 2012).

In Sudan, child malnutrition is one of the most serious public health problem about 38 percent of children under five are stunted, while the proportion severely stunted is 18 percent, 33 % are underweight (low weight-for-age) and 12 % are severely underweight (CBS, 2016). High prevalence of Malnutrition observed in children under five years in west Sudan where North Darfur is located high, estimated at 45.9% stunting, 27.9% wasting and 44.8 % underweight (CBS, 2016).


**Figure 2.1:** Status of Child Malnutrition in Sudan

![Graph showing status of child malnutrition in Sudan](image-url)
2.2. Malnutrition in children under five years

Under-five children constitute the most vulnerable segment of any community. Their nutritional status is a sensitive indicator of child’s health. Growth during childhood is widely used as a marker to assess adequate health, nutrition and development of children. It is well documented that chronic undernutrition is associated with serious health impairment later in life which has the significant impact on quality of life. Many children in the developing countries are exposed to multiple risks for poor development including poverty and poor health and nutrition (Grantham et al., 2007).

Malnutrition among under-five children is one of the most important public health problems in developing countries especially Sub-Saharan Africa (Gulati, 2010) and about 35% of under-five deaths in the world are associated with malnutrition. An estimated 230 million under-five children are believed to be chronically malnourished in developing countries.

In 2011 United Nations estimated that, 6.9 million deaths of under-five children and mortality rates are concentrated in sub-Saharan Africa (You et al., 2012). Malnutrition in children below five years of age remains a significant cause of mortality and is a development issue in the region. There are many causes of malnutrition. Children become malnourished if they suffer from diseases that cause under nutrition or if they are unable to eat sufficient nutritious food (WHO, 2006). These two causes often occur together and result from multiple underlying factors including inadequate access to food and health services (Akanbiemu, 2014). Other basic causes include poverty, illiteracy and social norms.

Chronic malnutrition has been a persistent problem for young children in Sub-Saharan Africa. A high percentage of these children fail to reach the normal international standard height for their age; that is, they are “stunted” In contrast, the percentage of children stunted in Southeast Asia dropped from 52% to 42% between 1990 and 2006. The number of undernourished (low weight for age) people of all ages in sub-Saharan Africa increased from about 90 million in 1970 to 225 million in 2008 (Armstrong et al., 2003)
A study conducted in Nigeria on influence of socio-economic factors on nutritional status revealed that the prevalence rates of underweight, wasting and stunting were 23.1%, 9% and 26.7% respectively (Babatunde et al., 2011). Other Study done on malnutrition among under-five children in Bangladesh revealed that, the high prevalence of stunting and underweight, is 42% and 40% of under-five children were stunted and underweighted, respectively (Siddiqi et al., 2011). Also study conducted nutritional status of under-five children in Mongolia also showed that, the prevalence of stunting, wasting and underweight were 15.6%, 1.7% and 4.7%, respectively (Otgonjargal et al., 2012).

In Southern Sudan the prevalence of children under five years with acute malnutrition in is one of the highest in the world approximately one out of every five children 22% suffers from moderate to severe acute malnutrition wasting. The prevalence of acute malnutrition among this age population in Southern Sudan is almost twice as high as in other parts of Sudan and also study conducted in a decertified of Sudan revealed that the prevalence of malnutrition among these children is very high 27.5% were severely malnourished and 35% suffered from either mild or moderate malnutrition (Ola et al., 2011). Study conducted Tigray region of Ethiopia also revealed that, the levels of stunting, underweight and wasting are 42.7%, 38.3% and 13.4%, respectively and also the overall prevalence of stunting, underweight and wasting were 45.7%, 43.1% and 7.1%, respectively (Mulugeta et al., 2005).

### 2.3. Causes of malnutrition

According to UNICEF 1998 framework the causes of malnutrition are classified as immediate (individual level), underlying (household or family level) and basic (societal level), whereby factors at one level influence other levels.

#### 2.3.1. Immediate causes of malnutrition

The immediate causes of malnutrition act at individual level. They include inadequate dietary intake and diseases, which lead to child malnutrition, disability, and death. Malnutrition lowers the body's ability to resist infection resulting to longer, more severe
and more frequent episodes of illness. Therefore, inadequate food intake and diseases must be both addressed to support recovery from malnutrition (UNICEF, 1998).

2.3.2. Underlying causes of malnutrition

The underlying causes of malnutrition are the causes that are visible from the community and household level. Factors such as income poverty, employment, food security, care, available health services and hygiene and sanitation, all contribute to the prevalence of malnutrition.

The underlying causes of malnutrition act at household and family level. They include inadequate or inappropriate dietary intake, inadequate disease knowledge, and discriminatory attitudes, which limit household access to quality and quantity economic and organizational resources.

The underlying causes are the direct causes to immediate causes of malnutrition. The three major underlying causes of malnutrition include inadequate household food security, limited access to adequate health services and/or inadequate environmental health conditions and inadequate care in the households and at community level especially with regards to women and children (UNICEF, 1998).

2.3.3. Basic causes of malnutrition

The basic causes of malnutrition act at societal level. The basic causes of malnutrition in a community originate at the regional and national level where strategies and policies that affect the allocation of resources (human and, economic, political and cultural) influence what happens at community level. Geographical isolation and lack of access to market due to poor infrastructure can have a negative impact on food security, access to healthcare services as well as healthy environment (UNICEF 2009).
Inadequate and/or inappropriate dietary intake and disease knowledge and discriminatory attitude limit household access to actual resources.

Political, cultural religious, economic and social system including the status of women limit the utilization of potential resource.

Quality of actual resources (human, economic, and organizational) and the way they are controlled.

Potential resources: the environment, technology, people.

Source: UNICEF 1998

Figure 2.2: causes of malnutrition in society adopted from UNICEF
2.4. Methods of Assessing Nutritional Status

Nutritional assessment is the initial step in the malnutrition intervention that aims at identification of individuals who have, or are at risk of developing malnutrition, to quantify the level of malnutrition and to monitor the adequacy of nutrition therapy. The methods of assessment are based on series of anthropometric, dietary, laboratory and clinical observations used either alone or in combination. Correct interpretations of the results often require consideration of other factors such as socio economic status, cultural practices, and health and vital statistics (Gibson, 2005).

2.4.1. Anthropometric method

Anthropometry involves measurement of physical dimension variation and gross composition of human body at different age level and degree of nutrition. Anthropometry is useful when there is chronic imbalance between intake of protein and energy (Gibson, 2005). Anthropometric indices are derived from combination of raw measurement. These include height, weight, and age of the individuals whose nutritional status is being determined.

Anthropometric methods of assessments are preferred in most study for its advantages. The equipment used is portable and inexpensive. Measurements can be performed relatively quickly and with ease hence do not require highly skilled staff to perform them. (Gibson, 2005).

The main imprecision errors in anthropometric are random imperfection in measuring instruments or in the measuring and recording techniques.

2.4.2. Biochemical or Laboratory methods

The assessment of nutritional status by laboratory tests offers a reproducible quantitative means of measuring specific nutrients that can be of great use to clinicians, nutritionists, and researchers. It can provide objective confirmation of nutritional deficiencies.
Laboratory tests is used to monitor nutritional therapy with greater precision compared to separate use of dietary, anthropometric, or clinical assessment techniques. They may be used to determine quantitative alterations in biochemical levels of nutrients, their metabolites, or dependent enzyme activities that are often not detected by anthropometric methods (Falcão, 2000).

2.4.3. Clinical methods

Clinical method involves getting good nutritional history and general clinical examination with special attention to organs like hair, nail, and angle of the mouth, eyes, skin, tongue, muscles, bones and thyroid glands. Detection of relevant sign helps in establishing a nutritional diagnosis. The method is fast and easy to perform, inexpensive and non-invasive. However it has a limitation in ascertaining early diagnosis (Gibson, 2005)

2.4.4. Dietary assessment method

Diet is the prime determinants of health and nutritional status. An inadequate diet, poor in both quality and quantity has been one of the reasons for high levels of malnutrition in children. Dietary surveys are therefore one of the essential components of nutritional assessment. (Prakash et al., 2008). The appropriate tool for dietary assessment will depend on the purpose for which it is needed. The purpose may be to measure nutrients, foods or eating habits. Different methods have been developed for the purpose of assessing dietary intake. These range from detailed individual weighed records collected over a period of 7 days or more to food frequency questionnaires, household survey methods and simple food lists (Wendy et al, 2003). Dietary assessment can be done at household level or individual level depending on the objective of the study.

2.5. Measurement of Children Nutritional Status

Child malnutrition is usually analyzed using different dimensions. Many studies used the standard anthropometric measurements of the child’s height, weight and age as
indicators of malnutrition. The commonly used measures are height-for-age, weight-for-height and height-for-weight.

### 2.5.1. Height for age

Height for age indicates the prevalence of stunting which can arise as a result of past growth. It gives information on the nutritional situation in the past and indicates whether a child suffers from chronic malnutrition (is “stunted”) or not. Failure that is children may have stilted growth due to long term inadequate care. Moreover, the height for age index provides an indicator of linear growth retardation and cumulative growth deficits in children. Children whose height for age Z score is below minus two standard deviations (−2 SD) from the median of the WHO reference population are considered short for their age (stunted), or chronically malnourished. Children who are below minus three standard deviations (−3 SD) are considered severely stunted. Stunting reflects failure to receive adequate nutrition over a long period of time and is affected by recurrent and chronic illness. Height for age, therefore, represents the long term effects of malnutrition in a population and is not sensitive to recent, short term changes in dietary intake (WHO, 2006).

### 2.5.2. Weight for height

Weight for height is used to indicate the problem of muscle wasting may have risen from recent and acute constraints whether a child from acute malnutrition (is “wasted”) or not. The weight for height index measures body mass in relation to body height or length; it describes current nutritional status. Children with Z scores below minus two standard deviations (−2 SD) of nutrition are considered thin (wasted) or acutely malnourished. Wasting represents the failure to receive adequate nutrition in the period immediately preceding the survey and may be the result of inadequate food intake or a recent episode of illness causing loss of weight and the onset of malnutrition. Children with a weight for height index below minus three standard deviations (−3 SD) are considered severely wasted. The weight for height index also provides data on overweight and obesity.
Children more than two standard deviations (+2 SD) above the median weight for height are considered overweight, or obese (WHO, 2006).

### 2.5.3. Weight for Age

Weight for Age is an indicator used to detect malnutrition that could occur due to both the current and past constraints of life, it is mainly used to monitor the growth of children. If a child is “underweight” the causes can be “chronic” or “acute” malnutrition. Rapidly changing Weight for Age can be assumed to be the result of changing Weight for height, while low Weight for Age among older children is more likely to be the result of low height for Age.

Weight for Age is a composite index of height for age and weight for height. It takes into account both chronic and acute malnutrition. A child can be underweight for his/her age because he or she is stunted, wasted, or both. Weight for age is an overall indicator of a population’s nutritional health. Children with weight for age below minus two standard deviations (−2 SD) are classified as underweight. Children with weight for age below minus three standard deviations (−3 SD) are considered severely underweight.

In general, underweight or wasting may be driven by short term factors like illnesses or food intake fluctuations throughout the year, stunting is considered a more precise indicator of long term malnutrition. For this reason, stunting is also indicated by the WHO as a reliable measure of deprivation (WHO,1986) and most of the relevant literature on child malnutrition focused on stunting more than on wasting or underweight (WHO, 2006).

### 2.5.4. Mid Upper Arm Circumference (MUAC)

MUAC is sensitive to acute weight loss; it reflects the peripheral wasting of muscle and subcutaneous adipose tissue. MUAC findings provide a rapid indication of the risk of mortality.

Persons with MUAC below 110 mm are at risk of death (only valid for older than 1 year). MUAC remains relatively stable between the ages 1 and 60 months.
CHAPTER THREE  
MATERIAL AND METHODS

3.1. Study design

This was a cross-sectional descriptive study

3.2. Study area

The study was conducted in Khartoum locality. It's one of seven localities of Khartoum state with an estimated population of 725007 where 104183 one are children under five years old.

The locality consists of three administrative areas namely Khartoum municipal, Alshuoda and Khartoum East. The locality has 76 health facilities.

3.3. Study population

The sampling unit for this study was the mothers with children under five years

3.4. Sampling techniques

Three health facilities (these had majority of children under five years) was selected. After selecting the three facilities, all the children under five years old who visit the facilities have equal chance to participate in the study.

Random systematic sampling technique was used to select the participants included in the study and a written informed consent was obtained prior to participation. The first participant was selected randomly follow by systematic random selection of other participants using interval.
3.4.1. Inclusion criteria

- Children under five years old and is permanent residents of the study area

3.4.2. Exclusion criteria

- Children under five years old but not permanent resident of the study areas
- Participants who refused to participate in the study

3.4.3. Sample size

Sample size was determined by calculation using Fisher’s et al. (1991) formula and it’s based on the prevalence of underweight in Khartoum State, which was at 23% according to Sudan multiple indicator cluster survey carried out in the year 2014.

\[ n = \frac{Z^2 p (1-p)}{d^2} \]

(Fisher et al, 1991)

Where;

\[ n = \text{minimum sample size (for population} > 10,000) \]
\[ Z = \text{level of significance, 1.96 at 95\% Confidence level} \]
\[ P = \text{Estimated underweight prevalence, 23\%} \]
\[ d = \text{Degree of precision required (usually as a proportion, 0.05 for 5\%)} \]

By substituting this formula:

\[ n = \frac{(1.96^2 \times 0.23 \times (1-0.23))}{0.05^2} \approx 272 \]

This study required the sample size of 272.
3.5. Methods of Data Collection:

3.5.1. Questionnaire

A structured questionnaire were used to obtain information from the study participants. It was developed in English and translated into Arabic; the main language spoken in the area.

3.5.2. Instruments of Anthropometric Measurements

The following instrument was used: Salter scale, with accuracy of 0.1 Kg for weight, height/length board with accuracy of 0.1 cm to measure height and length.

a) Weight

The weight of all children aged 0 to 59 months, included in the study sample, was measured and recorded by data collectors trained to take accurate anthropometric measurements. Weighing scales, capable of measuring weight in kilograms were used.

b) Height/Length

All children included in the sample, under the age of 24 months, had their length measured using a length measuring board. For children over the age of 24 months, height was measured using a standing height measuring board. All the length/height measuring apparatus used by this study was capable of measuring to the nearest 1 cm.

c) Age

Infant’s age in months was determined by asking the mother the date of baby birthday.

3.6. Data Analysis

After collecting the data, the data were summarized and organized by using the appropriate descriptive statistics. Data was analyzed using statistical package for social sciences software (SPSS). Descriptive analysis was performed and presented in terms of
frequencies. The association was tasted using chi square. Anthropometric data were analyzed by WHO Anthro software.

3.7. Ethical Considerations

- Approval to carry the study was obtained from the University of Gezira, Ministry of Health research department and from health facilities.
- Research purpose and objectives was be explained to participants in clear simple words.
- Participant has right to voluntary informed consent.
- Participants has right to withdraw at any time without any deprivation.
- Confidentiality were guaranteed by use of code numbers instead of individual names for identification. Access to data were restricted to the principal investigator and his assistant.
- The results of this study will be published.
CHAPTER FOUR
RESULTS AND DISCUSSION

This study aimed to assess the nutritional status and associated factors of children under five years. The sample of 272 mothers with children under five years old were included in the analysis and discussed as follow:

4.1. Socio - Demographic Characteristics

Data displayed in figure (4.1.1) shows that nearly half (51.5%) of the respondents were aged between 31-40 years. Age of the mother may influence the nutritional status of a child in various ways. Very young mothers are known to have psychological feelings that they are not knowledgeable enough to take good care of their children. This finding agree with the other study reported by Nube et al., (1997) who found a significant relation between mother age and nutrition status of the child.
Data in figure (4.1.2) indicated that majority of the participants (96%) were married. This indicated that high number of children born to married mothers which could have positive on under-five child nutritional status since the kind of care that the child receives from their parent may have advantage compared to children of separated and divorced mothers.
Figure (4.1.3): Distribution of participant's educational level in Khartoum Locality 2017.

Regarding the educational level of the participants, the figure (4.1.3) shows that majority of the respondents (40%) attended the university and above. Education level of the mother has an effect on the nutritional status of the children. The high level of education could have a positive impact on child care as many of the mothers with low knowledge may lack the basic skills and knowledge to look after their children by offering nutritious feeding.
information in figure (4.1.4) show that, majority of the mothers (77.6%) were housewives. this indicated that, mothers were not engaged in any income generating activity. Children whose mothers were housewives are more likely chances of caring than Children whose mothers were employed.

Data in figure (4.1.5) indicated that nearly more than half families (53.7%) earned monthly income between 1000 – 3000 SDG. This finding might be due to the fact that
low economic status families are not able to afford the nutritious foods for their child and high socio-economic households can get enough food for children to feed their child. This result agree with study conducted by Odunayo and Oyewole, (2006) who found that poor family income is a risk factor for under-nutrition.

Figure (4.1.6): Distribution of household size in Khartoum Locality 2017

Data in figure (4.1.6) shows that, majority of households (65%) had less than five members in their families. This is an indication that children is families that have 5 persons are more likely to be given care and attention.
4.2. Child characteristics:

Figure (4.2.1): Distribution of age of Children in Khartoum Locality 2017.

Figure (4.2.1) shows that majority of children under study (48.2%) were aged between 0-11 months, this is an indication that children are still depended on the mothers breast milk. The ages of children in the early years of life are the most critical period. This finding agree with finding reported by Kandala et al., (2009) who found that older children are mixed breastfed, even not breastfed at times, while younger children may be protected by the mother's immune system at birth.
On the child gender figure (4.2.2) shows that, majority of children under study (57.7%) were female. Gender of child may have an effect of nutrition status. In some cultures males are breast fed for longer period of time than females because males are expected to be, grow in fast pace, to be strong enough to help fathers at farm lands, to help them in domestic labors, to have prestige and respect in the society.

Data in figure (4.2.3) shows that, majority of children (34.9%) are first born infant, this indicated that they are more likely had a good chance of care as mothers concentrated on them.
Information in figure (4.2.4) shows majority of mothers (88.6%) were delivered at Health facilities. This reflex the knowledge of participants on the important role health facilities in care provision. And may be due to advices that mothers gained during antenatal care visits.

4.3. Nutritional status of children

Children’s nutritional status is a reflection of their overall health. The analysis of nutrition status in this study was performed according to the new WHO, 2006 standard. Nutritional status of children under five years of age is an outcome of immediate, underlying and basic causes of malnutrition (WHO/UNICEF, 1998).
The result of the study in figure (4.3.1) indicates that only (9.2%) of children were moderately wasted and (3.3%) of children were severe wasted. This is an indication that mothers aware of best food for child. low weight for height (wasting) is a measure of body composition especially the fat and muscle mass. Wasting is a reflection of recent nutritional deficiency it therefore indicates acute under-nutrition. Wasting is significantly associated with seasonal shifts in food availability as well as disease prevalence. The prevalence of wasting reported in this study is lower than the national level at 16% (UNICEF and CBS, 2016).
Regarding weight for age the figure (4.3.2) reveal that (6.6%) of the children were severely underweight and (11%) of children were moderate underweight. Low weight for age (underweight) is a measure of both acute and chronic under nutrition. The underweight level reported in this study area is lower than Sudan national level of 32.8% (UNICEF and CBS, 2016). This is good indicator that mother have a high knowledge about appropriate way of feed the child and young infant.
The findings in figure (4.3.3) showed that, the overall prevalence of stunting was observed to be 13.6% moderate stunted and (12.9%) severe stunted using the proposed WHO reference (WHO 2006). The rate of stunting in the locality is much lower than estimation reported by Sudan multi-Cluster Indicators survey conducted in 2014.

4.4. Health Status of Children

Finding in figure (4.4.1) summarizes the percentage of children who had suffered from diseases in the last three months preceding the study. It was found that majority of
children (79.8%) are well nourished without any illness reported during previous three months. This reflex high knowledge of mother toward child care and feeding practices.

![Figure (4.4.2): Distribution of anaemia prevalence in last three months in Khartoum Locality 2017.](image)

Data in figure (4.4.2) shows prevalence of anaemia at (8.5%). This prevalence in infants below five years of age may depend on inadequate breastfeeding and complementary feeding practices, including low nutrient quality of complementary food, especially in iron. Prevalence of infectious disease may also be a reason although prevalence of diarrhoea and/or acute respiratory infections was not particularly high in this age group. Micronutrient supplementation (or distribution of fortified food support) strategies need to be revised to improve effectiveness of interventions in the fight against anaemia in children under five years.
Finding in figure (4.4.3) shows that Infection with measles in the last year it indicated that majority (94.5%) do not reported any measles infection case. This may be due to high coverage of immunization in the area.

Table (4.4.1): Distribution of Child morbidity in last two weeks in Khartoum Locality 2017.

<table>
<thead>
<tr>
<th>Type of illness in the last 2 weeks</th>
<th>n</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Respiratory Infection</td>
<td>97</td>
<td>35.7%</td>
</tr>
<tr>
<td>Fever</td>
<td>121</td>
<td>44.5%</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>117</td>
<td>43%</td>
</tr>
</tbody>
</table>

Study in Table (4.4.1) show the prevalence levels of the different illnesses among the study children. It indicated that most of the children has suffered from the listed diseases in the last two weeks. Fever was the most common disease (44.5%) of children had suffered. The prevalence of diarrhea was (43%), this could be due to high prevalence of usage of unsafe water and generally poor hand washing practices.
The prevalence of acute respiratory infections were at (35.7%). The risk factors for acquiring respiratory infections could be due to poverty, restricted family income, low parental education level and lack of breastfeeding. This finding agree with the finding reported by Dewey and Begum, (2011) who found the susceptibility of malnourish child to contracting diseases.

### 4.5. Child caring practices

Study figure (4.5.1) indicated that majority (94.9%) of the children are reported to have been ever breastfeed. This proportion is less compared to national rate of 95.6% reported by Sudan multi-Cluster Indicators survey, 2014.
The finding in figure (4.5.2) shows that, the proportion of infants reportedly put on the breast within the first hour of birth was (86.4%). Early breastfeeding practices determine the successful establishment and duration of breastfeeding. Timely initiation of breastfeeding and provision of colostrum provide the necessary maternal antigens to the infant through colostrum. This finding agree with WHO, (2001) recommendations which cited initiating breastfeeding within the first hour after birth has significant effect on child bonding to mother.
Data in figure (4.5.3) show that majority of children (76.8%) received Pre-lacteal feeds. This result agree with study reported by Kengne, et al., (2007) who found that pre-lacteal feed inhibit a baby from receiving adequate protection from colostrums.

Study finding in figure (4.5.4) indicated that, majority of participants (65.1%) introduced complementary food after six month. This is an indication that mothers’ practiced exclusive breast feeding before six months of age. Timely introduction of appropriate
complementary feeding is a key factor in child growth. Introducing these foods too early reduces the amount of breast milk the child is taking. This finding agrees with the result reported by Kikafunda et al., (2003) who found that, introduces the child to pathogens and subsequent diarrhea diseases and in most cases in developing countries, these foods are not really tailored to the needs of the infant.

Figure (4.5.5): Distribution of child's care taker in Khartoum Locality 2017.

Study in figure (4.5.5) indicated that, majority of mothers are taking care of their children. This allows them to directly supervise their children on time.
Regarding changes in child feeding practices during illness the study in figure (4.5.6) show that majority (52%) of participants didn't provide additional food. This is a good indicator that mother did not changed the feeding of their children during sickness.

The health seeking behavior by mothers of sick children showed by figure (4.5.7). It's indicated that during the illness majority (90.0%) of mothers reportedly took the children
to public health facilities when their under five children was sick. This is a good indicator that mothers have good knowledge and positive attitude towards importance of seeking treatment in health facility.

![Figure (4.5.8): Distribution of serving child’s food in Khartoum Locality, 2017.](image)

Study finding in figure (4.5.4) indicated that, majority of children are severed individually. This indicated that serving the child food individually is good for health of the child.

**Table (4.5.1): Proportion of vitamin A and iodine supplementation in Khartoum Locality 2017.**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vitamins supplement</strong></td>
<td>Vitamin A</td>
<td>100</td>
<td>57.8%</td>
</tr>
<tr>
<td></td>
<td>Vitamin B complex</td>
<td>26</td>
<td>15.0%</td>
</tr>
<tr>
<td></td>
<td>Vitamin C</td>
<td>4</td>
<td>2.3%</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>43</td>
<td>24.9%</td>
</tr>
<tr>
<td><strong>Iodine salt supplement</strong></td>
<td>Administered</td>
<td>53</td>
<td>25.1%</td>
</tr>
<tr>
<td></td>
<td>Not administered</td>
<td>158</td>
<td>74.9%</td>
</tr>
</tbody>
</table>
Finding in table (4.5.1) shows majority of the children (57.8%) received vitamin A supplement vitamin A supplement. Worldwide, vitamin A supplementation to children aged from 6 to 59 month has shown a large impact on child survival and is one of the most common public health programs targeting children. On iodine salt the table reveal that, only (25.1 %) of the children had received Iodine salt supplementation. The low iodine supplementation levels among the children is not in line with the policies which mothers are regularly mobilized to take their children to health units for immunization.

Table (4.5.2): Proportion of diet diversity in Khartoum Locality 2017.

<table>
<thead>
<tr>
<th>Food group (n=211)</th>
<th>Daily</th>
<th>Weekly</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Meat</td>
<td>117</td>
<td>55.5%</td>
</tr>
<tr>
<td>Fish/sea food</td>
<td>40</td>
<td>19%</td>
</tr>
<tr>
<td>Eggs</td>
<td>110</td>
<td>52.1%</td>
</tr>
<tr>
<td>Milk and milk products</td>
<td>134</td>
<td>63.5%</td>
</tr>
<tr>
<td>Legumes, nuts and seeds</td>
<td>123</td>
<td>58.3%</td>
</tr>
<tr>
<td>Cereals</td>
<td>155</td>
<td>73.5%</td>
</tr>
<tr>
<td>Dark green leafy vegetables</td>
<td>113</td>
<td>53.6%</td>
</tr>
<tr>
<td>Fruits</td>
<td>125</td>
<td>59.1%</td>
</tr>
</tbody>
</table>

Study finding in table (4.5.2) shows that majority of children (73.5%) had eaten cereals e.g. bread, millet, sorghum, maize, rice, wheat on daily bases while (26.5%) had consumed weekly. (53.6%) had consumed vegetables daily and (46.4%) Consume vegetable weekly, (55.5%) and (52.1%) eat meat and eggs products respectively on daily bases while (44.5%) and (47.9%) eat meat and eggs products respectively once a week. consumption frequencies of fruits by the children were relatively high (59.1%) reported that they give their children fruits every day and (40.8%) reported that they give their children fruits every week, (63.5%) of children consumed milk and milk products daily and (36.5%) of children consumed milk and milk products weekly.

The daily and monthly food consumption was indication that Cereals, milk and milk products were the main food consumed by the children on daily bases. Cereal based foods may be energy dense; they lack other essential nutrients, such as proteins and micronutrients, required for optimal growth in infants and children. This finding agree
with a finding of cross-sectional study in Tanzania by Nyaruhucha et al., (2006) who reported that, increased prevalence of under-nutrition among children fed energy-dense foods. Moreover, study conducted in a rural South African community by Faber et al., (2001) found that an increased intake of cereals, poor dietary diversity and low intake of micronutrients resulted in stunting among children under five years.

4.6. Relationship between socio demographic variables and Nutritional status of children

Table (4.6.1): Association between Socio-economic characteristics and wasting

<table>
<thead>
<tr>
<th>Variable</th>
<th>Normal n(%)</th>
<th>Moderate Wasting (&lt;-2 z-score) n(%)</th>
<th>Severe wasting (&lt; -3 z-score) n(%)</th>
<th>Total n(%)</th>
<th>$X^2$</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age of Mother</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 20 years</td>
<td>7 (2.6%)</td>
<td>0 (0%)</td>
<td>2 (0.7%)</td>
<td>9 (3.3%)</td>
<td>22.469</td>
<td>0.001*</td>
</tr>
<tr>
<td>21-30 years</td>
<td>53 (19.5)</td>
<td>11 (4.0%)</td>
<td>2 (0.7%)</td>
<td>66 (24.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31-40 years</td>
<td>129 (47.5%)</td>
<td>6 (2.2%)</td>
<td>5 (1.8%)</td>
<td>140 (51.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above 41 years</td>
<td>49 (18.1%)</td>
<td>8 (2.9%)</td>
<td>0 (0%)</td>
<td>57 (21%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Marital Status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>227 (83.5%)</td>
<td>25 (9.2%)</td>
<td>9 (3.3%)</td>
<td>261 (96%)</td>
<td>1.638</td>
<td>0.802</td>
</tr>
<tr>
<td>Separated</td>
<td>5 (1.8%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>5 (1.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Divorced</td>
<td>6 (2.2%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>6 (2.2%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mother Education</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illiterate</td>
<td>15 (5.5%)</td>
<td>3 (1.1%)</td>
<td>0 (0%)</td>
<td>18 (6.6%)</td>
<td>12.953</td>
<td>0.226</td>
</tr>
<tr>
<td>Khalwa</td>
<td>7 (2.6%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>7 (2.6%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary/basic</td>
<td>39 (14.9%)</td>
<td>3 (1.1%)</td>
<td>0 (0%)</td>
<td>42 (16%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary</td>
<td>5 (1.8%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>5 (1.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>University and above</td>
<td>77 (28.3%)</td>
<td>13 (4.8%)</td>
<td>2 (0.7%)</td>
<td>92 (33.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mother Occupation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employed</td>
<td>45 (16.6%)</td>
<td>2 (0.7%)</td>
<td>0 (0%)</td>
<td>47 (17.3%)</td>
<td>6.592</td>
<td>0.581</td>
</tr>
<tr>
<td>Business</td>
<td>10 (3.8%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>10 (3.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Housewife</td>
<td>179 (65.8%)</td>
<td>23 (8.5%)</td>
<td>9 (3.3%)</td>
<td>211 (77.6%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>2 (0.7%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>2 (0.7%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>2 (0.7%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>2 (0.7%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Data in table (4.6.1) show the distribution of nutrition status of children according to the marital status of their mother it indicated that majority of wasted children were born to mothers who were married, but chi square test show no significant relationship. Socio – economic factors age and family income found have significant relationship with nutritional status of children under the study ($p < 0.05$).

### Table (4.6.2): Association between Socio-economic characteristics and Weight for-age

<table>
<thead>
<tr>
<th>Variable</th>
<th>Normal n(%)</th>
<th>Moderate underweight ($&lt;-2$ z-score) n(%)</th>
<th>Severe underweight ($&lt;-3$ z-score) n(%)</th>
<th>Total n(%)</th>
<th>$X^2$</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age of Mother</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 20 years</td>
<td>5 (1.8%)</td>
<td>4 (1.5%)</td>
<td>0 (0%)</td>
<td>9 (3.3%)</td>
<td>14.570</td>
<td>0.024*</td>
</tr>
<tr>
<td>21-30 years</td>
<td>53 (19.4%)</td>
<td>10 (3.8%)</td>
<td>3 (1.1%)</td>
<td>66 (24.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31-40 years</td>
<td>120 (43.9%)</td>
<td>10 (3.8%)</td>
<td>10 (3.8%)</td>
<td>140 (51.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above 41 years</td>
<td>46 (17%)</td>
<td>6 (2.2%)</td>
<td>5 (1.8%)</td>
<td>57 (21%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Marital Status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>216 (79.4%)</td>
<td>27 (10%)</td>
<td>18 (6.6%)</td>
<td>261 (96%)</td>
<td>10.640</td>
<td>0.031*</td>
</tr>
<tr>
<td>Separated</td>
<td>5 (1.8%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>5 (1.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Divorced</td>
<td>3 (1.1%)</td>
<td>3 (1.1%)</td>
<td>0 (0%)</td>
<td>6 (2.2%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mother Education</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illiterate</td>
<td>13 (4.8%)</td>
<td>5 (1.8%)</td>
<td>0 (0%)</td>
<td>18 (6.6%)</td>
<td>20.218</td>
<td>0.027*</td>
</tr>
</tbody>
</table>
Results on the relationship between maternal Socio-economic characteristics and Nutritional status (Weight- for-age) of under five children presented in table (4.6.2). indicated that educated mothers are less likely to give more nutritious food than their uneducated counterparts. There was significant relationship between mother education and child underweight (p-value = 0.027). The prevalence of underweight was increased when the monthly income is less than 3,000 SDG in this study. Households whose income was 2000 – 3000 SDG per month had more likely to have children with malnutrition

Table (4.6.3): Association between Socio-economic characteristics and height for-age

<table>
<thead>
<tr>
<th>Variable</th>
<th>Normal n(%)</th>
<th>Moderate Stunting</th>
<th>Severe stunting</th>
<th>Total n(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Khalwa</td>
<td>6 (2.2%)</td>
<td>1 (0.4%)</td>
<td>0 (0%)</td>
<td>7 (2.6%)</td>
</tr>
<tr>
<td>Primary/basic</td>
<td>39 (14.9%)</td>
<td>0 (0%)</td>
<td>3 (1.1%)</td>
<td>42 (16%)</td>
</tr>
<tr>
<td>Secondary</td>
<td>5 (1.8%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>5 (1.8%)</td>
</tr>
<tr>
<td>University and above</td>
<td>81 (29.8%)</td>
<td>6 (2.2%)</td>
<td>5 (1.8%)</td>
<td>92 (33.8%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mother Occupation</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Employed</td>
<td>42 (15.5%)</td>
<td>5 (1.8%)</td>
<td>0 (0%)</td>
<td>47 (17.3%)</td>
</tr>
<tr>
<td>Business</td>
<td>10 (3.8%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>10 (3.8%)</td>
</tr>
<tr>
<td>Housewife</td>
<td>170 (62.5%)</td>
<td>23 (8.5%)</td>
<td>18 (6.6%)</td>
<td>211 (77.6%)</td>
</tr>
<tr>
<td>None</td>
<td>2 (0.7%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>2 (0.7%)</td>
</tr>
<tr>
<td>Others</td>
<td>0 (0%)</td>
<td>2 (0.7%)</td>
<td>0 (0%)</td>
<td>2 (0.7%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Household monthly income</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 1000 SDG</td>
<td>47 (17.3%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>47 (17.3%)</td>
</tr>
<tr>
<td>1000 – 2000 SDG</td>
<td>113 (41.5%)</td>
<td>24 (9%)</td>
<td>9 (3.3%)</td>
<td>146 (53.8%)</td>
</tr>
<tr>
<td>3000 – 5000 SDG</td>
<td>33 (12.1%)</td>
<td>4 (1.5%)</td>
<td>2 (0.7%)</td>
<td>39 (14.3%)</td>
</tr>
<tr>
<td>5000 SDG and above</td>
<td>31 (11.4%)</td>
<td>2 (0.7%)</td>
<td>7 (2.6%)</td>
<td>40 (14.7%)</td>
</tr>
</tbody>
</table>

Results: **X²** 23.192, **P-value** 0.001*
<table>
<thead>
<tr>
<th>Age of Mother</th>
<th>(&lt;-2 z-score) n(%)</th>
<th>( &lt; -3 z-score) n(%)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 20 years</td>
<td>7 (2.6%)</td>
<td>2 (0.7%)</td>
<td>0 (0%)</td>
<td>9 (3.3%)</td>
</tr>
<tr>
<td>21-30 years</td>
<td>53 (19.5%)</td>
<td>6 (2.2%)</td>
<td>7 (2.6%)</td>
<td>66 (24.3%)</td>
</tr>
<tr>
<td>31-40 years</td>
<td>99 (36.4%)</td>
<td>20 (7.4%)</td>
<td>21 (7.7%)</td>
<td>140 (51.5%)</td>
</tr>
<tr>
<td>Above 41 years</td>
<td>41 (15.1%)</td>
<td>9 (3.3%)</td>
<td>7 (2.6%)</td>
<td>57 (21%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Marital Status</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Married</td>
<td>192 (70.8%)</td>
<td>34 (12.5%)</td>
<td>35 (12.7%)</td>
<td>261 (96%)</td>
</tr>
<tr>
<td>Separated</td>
<td>5 (1.8%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>5 (1.8%)</td>
</tr>
<tr>
<td>Divorced</td>
<td>3 (1.1%)</td>
<td>3 (1.1%)</td>
<td>0 (0%)</td>
<td>6 (2.2%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mother Education</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Illiterate</td>
<td>12 (4.4%)</td>
<td>4 (1.5%)</td>
<td>2 (0.7%)</td>
<td>18 (6.6%)</td>
</tr>
<tr>
<td>Khalwa</td>
<td>6 (2.2%)</td>
<td>1 (1.3%)</td>
<td>0 (0%)</td>
<td>7 (2.6%)</td>
</tr>
<tr>
<td>Primary/basic</td>
<td>30 (%)</td>
<td>9 (3.3%)</td>
<td>3 (1.1%)</td>
<td>42 (16%)</td>
</tr>
<tr>
<td>Secondary</td>
<td>2 (0.7%)</td>
<td>3 (1.1%)</td>
<td>0 (0%)</td>
<td>5 (1.8%)</td>
</tr>
<tr>
<td>University and above</td>
<td>75 (27.6%)</td>
<td>6 (2.2%)</td>
<td>11 (4%)</td>
<td>92 (33.8%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mother Occupation</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Employed</td>
<td>34 (12.6%)</td>
<td>5 (1.8%)</td>
<td>8 (2.9%)</td>
<td>47 (17.3%)</td>
</tr>
<tr>
<td>Business</td>
<td>10 (3.8%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>10 (3.8%)</td>
</tr>
<tr>
<td>Housewife</td>
<td>154 (56.6%)</td>
<td>32 (11.8%)</td>
<td>25 (9.2%)</td>
<td>211 (77.6%)</td>
</tr>
<tr>
<td>None</td>
<td>2 (0.7%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>2 (0.7%)</td>
</tr>
<tr>
<td>Others</td>
<td>2 (0.7%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>2 (0.7%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Household monthly income</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 1000 SDG</td>
<td>43 (15.9%)</td>
<td>2 (0.7%)</td>
<td>2 (0.7%)</td>
<td>47 (17.3%)</td>
</tr>
<tr>
<td>1000 – 2000 SDG</td>
<td>99 (36.4%)</td>
<td>27 (9.9%)</td>
<td>20 (7.5%)</td>
<td>146 (53.8%)</td>
</tr>
<tr>
<td>3000 – 5000 SDG</td>
<td>33 (12.1%)</td>
<td>0 (0%)</td>
<td>6 (2.2%)</td>
<td>39 (14.3)</td>
</tr>
<tr>
<td>5000 SDG and above</td>
<td>25 (9.2%)</td>
<td>8 (2.9%)</td>
<td>7 (2.6%)</td>
<td>40 (14.7%)</td>
</tr>
</tbody>
</table>
Study finding in table (4.6.3) shows that, mothers aged above 30 years had significantly more children with stunting compared to those aged below 30 years. Age of the mother may influence the nutritional status of a child in various ways. The finding of this study revealed that mothers age independently correlated with stunting. However chi square test show no significant relationship between mother age and stunting.
6.1. CONCLUSIONS

- Malnutrition among children under five years in Khartoum locality is indicative of poor knowledge of child feeding practices. Large households size and morbidity experience are important associated factors.
- Diseases in the form of infections are a great burden in malnutrition of the children, (35.7%) of the children had acute respiratory infection, (44.5%) had fever while (43%) have diarrhea. By increasing the dietary intake and treating the infections the prevalence of stunting and wasting can be reduced.
- Introduction of complementary food was too early in life which may to be a major contributory factor for the high incidences of under nutrition observed in this study. Education is one of the most important resources that enable women to provide appropriate care for their children. Education of women is believed to exert an impact on health and nutritional status of children since it provides the mother with the necessary skills for child care, increase awareness of nutritional needs and preference of modern health facilities as well as change of traditional beliefs about diseases causation.
- The results also confirmed that mothers’ educational level and age are some of the key determinants of nutritional status of under five years’ children. Maternal age at birth of children as found determining the nutritional status of children.
6.2. RECOMMENDATIONS

The following recommendations were made based on the findings of this study:

- Mothers should be advised to initiate breastfeeding within 30 minutes of delivery (as recommended by WHO) through campaigns by the Ministry of Health. The Ministry of Health and concerned NGOs should advocate and initiate enlightenment campaign strategies to the community about the importance of colostrum, avoiding pre-lacteal feeding, appropriate time for weaning.
- Exclusive breastfeeding programs need to be enhanced so as to reduce the rate of complementary feeding before children reach an age of 6 months.
- Health seeking behavior need to be enhanced through advocacy and education programs as a large proportion of the population was observed not to seek professional medical assistance when their children showed signs of illnesses.
- Improve the quality and quantity of diets by improving household food security through income-generating activities, poultry farming or fish-farming.
- Promote homestead gardening, practices which facilitate an increased intake of additional nutrients, such as Vitamin A, through leafy green vegetables.
- Implement a programme for nutrition extension workers (nurses and other health practitioners who focus on this area of activity), or volunteers to create awareness and educate communities on the importance of nutrition and the dangers of malnutrition in the informal settlements.
- Establish or strengthen community-based growth monitoring activities in order to identify children who fail to thrive.
- Identify and involve stakeholders who could contribute to solutions to the nutrition crisis. These could include the community, the government of Sudan, non-governmental organizations, faith-based organizations, and the international community.
REFERENCES:


Childhood Undernutrition in three Sub-Saharan African Countries. Population, Space and Place, 15, 461-473.


Kengne, N., A., Ngondi, J.l. Oben, J.E. (2007). Factors Associated with Breast Feeding as well as the Nutritional Status of Infants (O-12) Months; An Epidemiological Study In Yaounde, Cameroon, Pakistan Journal of Nutritional l6(3); 259-263.


Appendix 1:
Consent form for the study

Good morning/ afternoon. My name is Khalid Rassam M. Bajari and I am a graduate student of public health at University of Gezira. I would like to thank you for your time that you will take in this study. I am carrying out a study on child nutrition and I would like to get your views on this.

The purpose of this study is to find out your views on various issues on child nutrition with an aim of understanding women’s view on this topic. I would like to assure you that all your views will be kept confidential, known only to me. your responses will be combined with responses from other people and reported cumulatively, no names will be used on the study. Please feel free as there are no wrong or right answers, it’s your honest opinion that I will want.
Appendix 2:

Study Questionnaire

University of Gezira
Faculty of Health and Environmental Sciences
Assessment of Nutritional Status and Associated Factors among Children under
Five in Khartoum Locality, Khartoum State, Sudan

Respondents No ………………..

PART 1: SOCIO - DEMOGRAPHIC CHARACTERISTICS

1. Age of mother
   a) Less than 20  b) 21-30  c) 31-40  d) Above 41

2. Marital status
   a) Married  b) Separated
   c) Divorced  d) Widowed

3. Education level of mother
   a) Illiterate  b) Kalwa  c) Primary/Basic school
   d) Intermediate school  e) Secondary school  f) University

4. Education level of father
   a) Illiterate  b) Kalwa  c) Primary/Basic school
   d) Intermediate school  e) Secondary school  f) University

5. Mother occupation
   a) Housewife  b) Employed  c) Business
   d) None  d) Others specify..............

6. Father occupation
   a) Employed  b) Business  c) None  d) Others
   specify..............

7. Income per month
   a) < 1000 SDG  b) 1000 - 3000 SDG  c) 3000 – 5000 SDG
   d) 5000 SDG and above

8. Family size
   a) ≤5 persons  b) 5 – 10 persons  c) ≥10 persons and above

PART 2: CHILD CHARACTERISTICS

1. Age ............. (Months)

2. Weight of the child? (Kgs)

3. Height/length of the child? (CM)

4. Sex:
   a) Male  b) Female

5. Order of child
   a) 1st child  b) 2nd child  c) 3rd child  d) 4th child
   above

6. Gestational age at birth
a) Less than 9 Months  b) At 9 months  
c) Greater than 9 Months  d) Do not know

7. Place of delivery  
   a) Hospital/Health facility  b) Home  
   c) Traditional Birth Attendant  d) others specify………………..…..

8. State of Child on birth  
   a) Single  b) Twins

9. Did the child get ill in the last 3 months that you thought he/she could die?  
   a) Yes  b) No  c) do not know

10. Incidence of anemia in the last 3 months?  
   a) Yes  b) No  c) do not know

11. Has the child had the following diseases in the last two weeks?  
   a) Diarrhea  
      Yes (  )  No (  )  
   b) Fever  
      Yes (  )  No (  )  
   c) Respiratory disease  
      Yes (  )  No (  )

12. Has the child get sick with measles in the last Year?  
   a) Yes  b) No

PART 3: INFANT AND YOUNG CHILD FEEDING PRACTICE

1. Did you ever breast fed the child?  
   a) Yes  b) No

2. When after birth did the child first put to the breast  
   a) Immediately after birth (within 1 hr)  b) After the first hour of birth  
   b) After the first day  d) Don’t remember/ don’t know

3. Did you give the child pre-lactation food/fluid?  
   a) Yes  b) No

4. If yes, what did you gave him/her?  
   a) Boiled Water  b) Glucose  c) Milk  
   d) Formula  e) Other(Specify)_______

5. When did you give the child other food with breastfeeding?  
   a). (0-2)months  b). (2-4)months  c). (4-6)months  d).more than 6 months

6. Did you squeeze out and throw the first milk?  
   a) Yes  b) No

7. If yes why didn’t you give it for your child?  
   a) It is dirty  b) It creates abdominal pain to the baby  c) Others (specify)_______

7. Is the child still being breastfed? For children less than two years
8. If No, at what age did the child stopped breastfeeding? ________________

9. If YES, how often do you breast feed the child?
   a) On demand
   b) Own (mothers) choice
   c) Others (specify)__________________________

10. What is the suitable time for giving additional food to child?
   a) 4 months    b) 5-6 months    c) more than 6 months

10. Who is usually taking care of the baby feeding?
   a) Mother       b) Sister        c) Grandmother    d) others (Specify) ______

11. during the illness, has the child feeding practice changed?
   a) Yes
   b) No

12. If yes, How could the practice changed?
   a) Preventing from breast   b) Preventing from giving food
   c) Providing additional food   d) other (specify)_____

13. How did you usually treat your child when get sick?
   a) Usually home treatment       b) Taking to traditional healers
   c) Taking to Health facility      d) Other (Specify)_____

14. Did you prepare special meals for this child?
   a) Yes
   b) No

15. How is the child’s food served and eaten?
   a) Together with other children in one plate   b) individually   c) others (specify)

16. How many times is this child fed in a day?
   a) Once       b) twice        c) 3-4times      d) > 4 times

17. Type of Vitamins supplement administered to the child?
   a) Vitamin A
   b) Vitamin B complex
   c) Vitamin C
   d) Others specify

18. Iodine salt supplement administered to the child?
   a) Yes
   b) No
**PART 4: DIET**

When did the child consume this item of the following food group

<table>
<thead>
<tr>
<th>Food group</th>
<th>Daily</th>
<th>Weakly</th>
<th>monthly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fish/sea food</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eggs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milk and milk products</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Legumes, nuts and seeds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cereals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dark green leafy vegetables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruits</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>