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Nutritional Status of the Under Five Years Children Soba Al-Laowta  
and Soba Al-Mahata districts - Khartoum Locality Sudan, 2018.

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## **Dedication**

To Jamal and Mishkat your sacrifices and believe gave me  
hope and strength to pursue one of my dreams.

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### List of Abbreviations and acronyms

Abbreviations	Stand for
BMI	Body mass index
CBS	Central Bureau of Statistic
CDC	Centers for Disease Control and Prevention
CM	Centimeter
DDS	Dietary Diversity Score
FAO	Food and Agriculture Organization
FEWS	Famine Early Warning Systems Network
FOH	Federal Ministry of Health
GAM	Global acute malnutrition
HAZ	Height-for-Age Z-scores
HDDS	Household Dietary Diversity Score
IFAD	International fund for agricultural development
IFPRI	International Food Policy Research Institute
MAM	Moderate Acute Malnutrition
MDG	Millennium development goal
NMH	National Ministry of Health
MUAC	Mid-upper arm circumference
NPC	National Population Council
SAM	Severe acute malnutrition
SSA	Sub-Saharan Africa
S3M	Simple Spatial Surveying Method
SPSS	Statistical Package for the Social Sciences
UN	United nation
UNICEF	United Nations Children's Emergency Fund
VIP	Ventilated improved pit latrine
WAZ	weight-for-age Z-scores
WHZ	Weight-for-Height Z-scores
WFP	World Food Programme
WHO	World Health Organization



## Abstract

**Background:** Malnutrition contributes to 2.2 million children deaths and. Malnutrition is a chronic public health problem among under-five children in the developing world. in Sudan malnutrition as well one of the main contributors to children mortality and linked to the productivity and success of the adult population.

**Objectives:** The purpose of this study to assess the nutritional status of the under five years old children in Soba Al-laowta and Soba Al-mahata districts Khartoum locality, Sudan.

**Materials and methods:** Comparative cross-sectional study was carried out where mixed methods and tools were used based on World Health Organization child growth standards 2006. A sample of 245 children under five years were selected from households of both districts, Soba Al-laowta 89 and Soba Al-mahata 156.

**Results:** In Soba Al-laowta underweight 28.1% and stunting 41.6% were more prevalent than Soba Al-mahata; underweight 16.7% and Stunting 30.7% main risk factors were incomplete breastfeeding, and immunization coverage and there was significant different between the two districts ( $p= 0.001$ ). On the other hand, in Soba Al-mahata wasting 14.1% and overweight 18.7% were more prevalent than Soba Al-laowta, wasting 11.2% and overweight 5.3%, the

main risk factor was mother education level, family size and sanitation, and there were significant different between the two districts in mother education level ( $p=0.000$ ), family size ( $p=0.013$ ) and sanitation ( $p=0.000$ ).

**Conclusion:** The current study discloses that the underweight and stunting were high in Soba Al-laowta than Soba Al-mahata except for wasting high in Soba Al-mahata. Besides, that overweight considers malnutrition problem in both districts. Therefore, strengthen nutritional programme with the support of health education in both districts is crucial, and conducting a longitudinal study to investigate seasonal variations concerning children's nutritional status in relation to morbidity and sanitation in Soba Al-mahata is essential as well.

**Keywords:** Malnutrition, Children under five, Soba Al-laowta and Soba Al-mahata districts, Khartoum, Sudan, 2018.

## المستخلص

**الخلفية:** يساهم سوء التغذية في وفاة 2.2 مليون طفل و. سوء التغذية هو مشكلة صحية عامة مزمنة بين الأطفال دون سن الخامسة في العالم النامي. في السودان سوء التغذية وكذلك أحد المساهمين الرئيسيين في وفيات الأطفال وترتبط بإنتاجية ونجاح السكان البالغين.

**الأهداف:** الهدف من هذه الدراسة هو تقييم الحالة التغذوية للأطفال دون سن الخامسة في منطقتي سوبا اللعوتة وسوبا المحطه بمحلية الخرطوم، السودان.

**المواد والطرق:** أجريت دراسة مقطعية مستعرضة حيث استخدمت طرق وأدوات مختلطة استناداً إلى معايير نمو الطفل لمنظمة الصحة العالمية 2006. وقد تم اختيار عينة من 245 طفلاً دون سن الخامسة من أسر كلتا المنطقتين ، سوبا اللعوتة 89 وسوبا المحطة 156.

الادوات و الطريقة: تم إجراء دراسة تحليلية مقارنة مقطعية حيث تم استخدام طرق وأدوات مختلفة على أساس معايير منظمة الصحة العالمية 2007. تم اختيار 245 أسرة مع أطفال دون سن الخامسة من كل من المنطقتين ، سوبا اللعوتة 89 وسوبا المحطة 156.

النتائج: في سوبا اللعوتة ناقصي الوزن 28.1% والتقرم 41.6% أكثر انتشاراً من سوبا المحطة بنقص الوزن 16.7% و التقرم 30.7% وعوامل الخطورة الرئيسية كانت عدم اكتمال الرضاعة الطبيعية ، والتغطية بالتحصين ، وكان هناك اختلاف كبير بين المنطقتين ( $p = 0.001$ ) . من ناحية أخرى في سوبا المحطة نجد ان معدل الهزال 14.1% والوزن الزائد 18.7% كانت أكثر انتشاراً من سوبا اللعوتة ، حيث كان الهزال 11.2% وزيادة الوزن 5.3% في سوبا اللعوتة ، بالنسبة لعوامل الخطورة كانت مستوى تعليم الأم ، وحجم الأسرة و الاصحاح البيئي ، وهناك اختلاف كبير بين المنطقتين في مستوى تعليم الأم ( $P = 000$ ) ، وحجم الأسرة ( $P = 0.013$ ) الاصحاح البيئي. ( $P = 000$ )

**الخلاصة:** كشفت الدراسة الحالية أن نقص الوزن والتقزم كانا مرتفعين في سوبة اللعوتة من سوبا المحطة باستثناء الهزال الذي كان عاليا في سوبا المحطة. إلى جانب ذلك ، تعتبر زيادة الوزن مشكلة من مشاكل سوء التغذية في كلتا المنطقتين. ولذلك ، فإن تعزيز البرنامج التغذوي مدعوما بالتنقيف الصحي في كلتا المنطقتين أمر بالغ الأهمية ، كما أن إجراء دراسة طولية للتحقق من التغيرات الموسمية المتعلقة بالحالة التغذوية للأطفال فيما يتعلق بالمرضاة و الاصحاح البيئي في المنطقتين هو أمر مهم جدار الكلمات المفتاحية: سوء التغذية ، الاطفال دون الخامسة ، سوبا اللعوتة وسوبا المحطة، الخرطوم، السودان، 2018.

## **Chapter One**

### **Introduction**

# Chapter One

## 1.Introduction

### 1.Introduction

#### 1.1. Background:

Undernutrition remains a major public health concern for many developing nations, despite several nutrition intervention programs <sup>(1,2)</sup>. Malnutrition refers to deficiencies in a person's intake of energy and/or nutrients <sup>(3)</sup>. However, the term malnutrition addresses three broad groups of conditions undernutrition, stunting and underweight; micronutrient-related malnutrition, which includes micronutrient deficiencies (a lack of vitamins and minerals) or micronutrient excess; and overweight, obesity and diet-related noncommunicable diseases <sup>(3,4)</sup>. However, stunting is an indicator of past growth failure; poor nutritional history. It is associated with several long-term factors including chronic insufficient protein and energy intake, frequent infection, sustained inappropriate feeding practices and poverty <sup>(4,5,6)</sup>. Wasting indicates current or acute malnutrition resulting from failure to gain weight or actual weight loss <sup>(5,6)</sup>. In child nutrition, a study of 34 high-burden countries, where 90 percent of the world's children who suffer stunting live, identified 10 proven interventions with the potential to avert 900,000 under-five deaths <sup>(6,7)</sup>. The African region and South-East Asia have reported the highest prevalence of undernutrition,

with the former accounting for about 39.4% of the stunted, 24.9% of the underweight and 10.3% of the wasted children under-5 years of age <sup>(6)</sup>. According to the 2015 (MDG) report, sub-Saharan Africa (SSA) accounts for one-third undernourished children globally, highlighting that malnutrition remains a major health concern for children under 5 years in the sub-region <sup>(8)</sup>. In Sudan, 31.0% of children under 5 years are moderately or severely underweight, 32.5% suffer from moderate or severe chronic malnutrition and 14.8% suffer from global acute malnutrition <sup>(9,10)</sup>. In Khartoum state 2014 study showed the proportion of malnutrition among all registered diseases less than five years of age was 20.2%. and underweight 3.5% <sup>(11)</sup>. Other study showed that MUAC indicator was 20.9% and the children were malnourished, and 79.1% of the children were well nourished, moreover, about 15.4% of children were underweight <sup>(4)</sup>. The prevalence of wasting was 21.1% and the prevalence of stunting was 24.9% <sup>(4)</sup>. A new paragraph of increased prevalence of malnutrition was related to poor sanitary conditions and inadequate food intake <sup>(11)</sup>. Mother's education was found to be the strongest factor associated with malnutrition among the children less than 5 years of age <sup>(13)</sup>. In Sudan, the nutritional status for children under 5 years old depends on the living standard and the income of the households. <sup>(14,15)</sup>.

## **1.2. Problem Statement**

Malnutrition prevalence consider high in Khartoum State according 2018 study; there some localities in the State had a stunting rate classified as high above 30%. Moreover, 51% of the total severe acute malnutrition (SAM) burden in Sudan of children are found in five states in Sudan Khartoum is one them <sup>(10,16)</sup>. The two-study setting in this thesis are part of Khartoum State suspect to be affected by malnutrition, and the level of economics is assumed to be different, in addition that, both areas consider between rural and semi urban with inadequate infrastructure. As well as, past studies and surveys recommended the importance of further continuous investigation of the problem, the study will be carried out to know the current nutrition status among under 5 years old children.

### **1.3. The rationale of the study:**

The final results of this study will provide crucial information for nutritionist, public health specialist, and epidemiologists. The finding of study will be important for the knowledge, and will contribute to improve health promotion program and nutrition department currently implemented in Khartoum State. A description of malnutrition prevalence in both districts in accordance with characteristic of each one, will provide useful information for local authorities



in the justification of the appropriate measures and methods to combat malnutrition problem and design suitable approach to each district.

#### **1.4. Research objectives:**

##### **1.4.1. General objective:**

To study the nutritional status of the under five years old children in Soba Al-laowta and Soba Al-mahata districts, Khartoum locality, Sudan 2018

##### **1.4.2. Specific objectives:**

1. To establish the prevalence of underweight, stunting, wasting and overweight among children below five years old in the two study districts.
2. To determine immunization coverage and morbidity status of children under five years in the two study districts.
3. To determine the breastfeeding and complementary feeding practices of mothers in the two study districts.
4. To determine demographic, socio-economic characteristics, sanitation status in the two study districts.

**Chapter Two**  
**Literature Review**

## **Chapter Two**

### **2. Literature Review**

#### **2.1. Definition of nutrition and malnutrition**

##### **2.1.1. Nutrition:**

Nutrition is the intake of food, considered in relation to the body's dietary needs. Good nutrition is an adequate, well-balanced diet combined with regular physical activity consider a cornerstone of good health. Poor nutrition can lead to reduced immunity, increased susceptibility to disease, impaired physical and mental development, and reduced productivity <sup>(17,18)</sup>.

##### **2.1.2. Malnutrition:**

It's the state of being poorly nourished, is not merely a result of too little food, but due to a combination of factors: which is insufficient protein, energy and micronutrients, frequent infections or diseases, poor care and feeding practices, inadequate health services, unsafe water and sanitation <sup>(19,20)</sup>.

#### **2.2. Malnutrition types:**

The term malnutrition addresses three broad groups of conditions:

##### **Undernutrition:**

There are 4 broad sub-forms of undernutrition: wasting, stunting, underweight, and deficiencies in vitamins and minerals. Undernutrition makes children much more vulnerable to disease and death <sup>(21)</sup>.

### **Micronutrient-related malnutrition:**

Inadequacies in intake of vitamins and minerals often referred to as micronutrients, can also be grouped together. Micronutrients enable the body to produce enzymes, hormones, and other substances that are essential for proper growth and development. Iodine, vitamin A, and iron are the most important in global public health terms; their deficiency represents a major threat to the health and development of populations worldwide, particularly children and pregnant women in low-income countries <sup>(19,21)</sup>.

### **Overweight and obesity:**

Overweight and obesity is when a person is too heavy for his or her height. Abnormal or excessive fat accumulation can impair health. Body mass index (BMI) is an index of weight-for-height commonly used to classify overweight and obesity <sup>(21)</sup>. It is defined as a person's weight in kilograms divided by the square of his/her height in meters (kg/m<sup>2</sup>). Overweight and obesity result from an imbalance between energy consumed (too much) and energy expended (too little) <sup>(20,21)</sup>.

### **2.3. Malnutrition: causes and consequences:**

The underlying causes are those that give way to immediate causes. 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 <sup>(22)</sup>. Malnutrition causes a degraded immune response and weak musculature. The degraded immune response makes the body more susceptible to infections. The energy and nutrient resources of the body are being consumed and the body tissue breaks down. The body protein has many vital functions and cannot be dispensed without causing damage to vital functions. Heart muscle weakens leads to decreased blood pressure and slower pulse, which in turn leads to impaired circulation. Weakened respiratory musculature leads to shallow breathing and less energy to cough up phlegm. The synthesis of enzymes and proteins, that occur in each cell during normal conditions deteriorate and leads, for example, to poorer wound healing. It is the amount of body fat in a person, which determines the survival time. Permanent damages will occur if more than 30 percent of the body's protein is consumed <sup>(23)</sup>. Malnutrition is estimated to contribute to more than one-third of all child deaths, although it is rarely listed as the direct cause. <sup>(24)</sup>

#### **2.4 Classification of nutrition and malnutrition status:**

There are two categories of malnutrition: Acute Malnutrition and Chronic Malnutrition. Children can have a combination of both acute and chronic <sup>(5,23,24)</sup>.

Acute malnutrition is categorized into Moderate Acute Malnutrition (MAM) and Severe Acute Malnutrition (SAM), determined by the patient's degree of wasting. All cases of bi-lateral oedema are categorized as SAM. Chronic malnutrition is determined by a patient's degree of stunting, i.e. when a child has not reached his or her expected height for a given age. SAM is further classified into two categories: Marasmus and Kwashiorkor. Patients may present with a combination, known as Marasmic Kwashiorkor. Patients diagnosed with Kwashiorkor are extremely malnourished and at great risk of death <sup>(5,24,29)</sup>.

## **2.5. Methods of nutritional status assessment:**

Assessing nutritional status is the primary start in the coping of malnutrition. the aims of nutritional evaluation are to detect individuals who have, or are at risk of developing malnutrition, to determine malnutrition level and to monitor the appropriate methods of nutrition treatment. The methods of evaluation are relying on procedure of anthropometric, dietary, laboratory and clinical observations used either together or separately. The right interpretations of the outcomes always require consideration of other factors such as socioeconomic status, cultural practices, and health and vital statistics <sup>(30,31,32)</sup>.

## **2.6. Anthropometric methods**

Anthropometry includes measurement of variation of physical dimension and gross composition of the body at different ages and degree of nutrition. Anthropometry is certainly useful when there is an imbalance between intake of protein and energy <sup>(31)</sup>. Anthropometric indices are derived from combination of raw measurement. These include height, weight, and age of the individuals whose nutritional status is being determined. The measurements are then used to calculate the anthropometric indicators of nutritional status such as height-for-age, weight-for-age and weight for height. The indicators are then used to classify nutritional status of individuals as presented in table 1. 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. This method however has some limitation as well. Although sometimes the method can detect moderate and severe form of malnutrition, it cannot be used to identify specific nutrient deficiency states <sup>(5,30,31)</sup>. The basic imprecision errors in anthropometric are random imperfection in scaling instruments or in the measuring and recording techniques <sup>(5,30,34)</sup>.

Table 2.1: Cut off Points of Malnutrition, WHO standard.

Indicators	Moderate (GAM)	Severe (SAM)
Wasting	WHZ; <-2 to ≥-3 Z scores	WHZ; below -3Z
Underweight	WAZ; <-2 to ≥-3 Z scores	WAZ; below -3Z
Stunting	HAZ; <-2 to ≥-3 Z scores	HAZ; below -3Z

(34)

Table 2.2: Indicators of Malnourished

Indicator of malnourished	MUAC (cm)
Severely malnourished	<11.5
Moderately malnourished	11.5-12.5
At risk of malnutrition	12.5-13.5
Satisfactory nutrition	>13.5

(35)

## 2.7. Malnutrition globally:

In 2016; 155 million children are stunted 52 million children have wasted 41 million children are overweight. Around 45% of deaths among children under 5 years of age are linked to undernutrition <sup>(21)</sup>. 88% of countries face a serious burden of either two or three forms of malnutrition <sup>(22)</sup>. These mostly occur in low- and middle-income countries. At the same time, in these same countries, rates of childhood overweight and obesity are rising <sup>(21)</sup>.

## 2.8. Malnutrition in Africa

In 2016 an estimated 1.4 million children could die this year from famine-like conditions in South Sudan, Somalia, Nigeria, and Yemen, according to the U.N. children's agency <sup>(24,25)</sup>. 4 million people in Kenya need food aid, and about



700,000 Kenyan children younger than 5 are facing starvation <sup>(24,25)</sup>. Disease outbreaks have plagued Ethiopian communities amid worsening food insecurity <sup>(25,26)</sup>. Crop and livestock losses and water shortages in Somalia have caused more than 766,000 people including 480,000 children to leave their homes <sup>(25,26)</sup>. Severe drought and widespread food insecurity are ravaging entire communities in Niger, Chad, Nigeria, Cameroon, parts of the Southern Africa region, and in Yemen, on the Arabian peninsula, according to the Famine Early Warning Systems Network (FEWS) <sup>(24,25,26)</sup>. About 10.9 million people need humanitarian assistance in the Lake Chad Basin, which includes northeastern Nigeria, northern Cameroon, eastern Niger, and southwestern Chad. More than 500,000 children are suffering severe levels of malnutrition <sup>(25,26)</sup>. The refugee and food crises have swelled for two years due to ongoing extremist attacks and mass displacements in the region <sup>(24,25,26)</sup>.

## **2.9. Malnutrition in Sudan**

Sudan has a high level of acute and chronic malnutrition indicators, GAM is 16.4%, which is above the international 'emergency' thresholds of 15%. Severe Acute Malnutrition (SAM) rates are also worryingly high at 5.3% which translates into half a million children suffering from SAM. Put another way, at any point in time, 1 in 20 Sudanese children are severely malnourished, with a greatly increased risk of death <sup>(27)</sup>. About 35% of children under-fives were

moderately or severely stunted (too short for their age). The proportion of children who are stunted is highest in Kassala state (55%) and lowest in Khartoum state (20%). It is higher in rural areas (38.7 %) than in urban areas (25.3 %). Some difference exists among boys (37.4%) and girls (32.6%). Almost one of three under five children (32.2%) in Sudan was found to be moderately or severely underweight. The proportion varies between 15.6% in Khartoum state and 49% in Kassala state. The proportion of moderately or severely underweight children was higher in rural areas (35.4 %) compared to urban areas (23.6%). For the last forty years, one-third of the population has suffered from irreversible chronic malnutrition a life-long growth condition that has consistently plagued Sudanese children since 1987 <sup>(10)</sup>. Furthermore, more than two million children are already stunted and unlikely to ever reach their full growth potential. 17% of Sudanese children are acutely malnourished and over half a million will suffer from life-threatening severe acute malnutrition for one year <sup>(10)</sup>

### **2.10. Malnutrition in Khartoum state**

In Khartoum state study in 2014 showed that MUAC indicator was 20.9% of children were badly nourished. In addition to that the study found about 15.4% of children were underweight, 8.8% were moderate underweight and 6.6% were severe underweight <sup>(4)</sup>. The prevalence of wasting was 21.1% (12.3% moderate

and 8.8% severe) and the prevalence of stunting was 24.9% (15.1% moderate and 9.7% severe) <sup>(4)</sup>. Other study in 2010 showed that in children who participated in the study the prevalence of acute malnutrition (wasting) was 19%, the prevalence of underweight was 35%, and chronic malnutrition (stunting) represents 51%. <sup>(28)</sup>

**Chapter three**  
**Materials and Methods**

## **Chapter three**

### **3. Materials and Methods**

#### **3.1. Study design:**

Comparative cross-sectional study.

#### **3.2. Study duration:**

The study was start at the 3<sup>rd</sup> of January 2018, and ended at the 8<sup>th</sup> of March 2018.

#### **3.3. Study area:**

The study was conducted in Soba Al-laowta and Soba Al-mahata districts. These districts are considered semi urban rural area, and part of Khartoum Locality which located in the Southeastern part of the Khartoum Center. Soba Al-mahata between Golf Course and the railway. the population in Soba Al-mahata is displaced from the different states of Sudan furthermore, most occupation marginalized and heavy duties job in Khartoum. While Soba Al-laowta between the railway and Khartoum Medani high way closed to veterinary research laboratory. In Soba Al-laowta most inhabitants occupation in agriculture scheme and trading profession in Khartoum, estimated population of Soba Al-laowta 896 inhabitants and, Soba Al-mahata 3892 inhabitants.

### 3.4. Study population:

Children aged (below 5years) in the Soba Al-laowta and Soba A-lmahata districts, Khartoum Locality, Khartoum State.

**3.4.1. Inclusion criteria:** Children between 6 months and 59 months, whose parents agreed to be interviewed were included in the study.

**3.4.2. Exclusion criteria:** All children who their parents declined to participate were excluded.

### 3.5. Sample size and sampling procedure:

The sample size was calculated according to the following formula:

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

Where:

n: sample size

Z =value (e.g. 1.96 for 95% confidence level).

P=prevalence of child aged 6-59 months with malnutrition in previous study in Khartoum 20% <sup>(11)</sup>.

d= confidence interval, expressed as decimal= (0. 05).

$$1.96*1.96*0.20*0.80/ 0.05*0.05 =\mathbf{245}$$

Sample size = **245** children from both districts.

Table 3.1. A sample size of children between 6 months and 59 months from each area as below 2018:

<b>Items</b>	<b>No. children</b>	<b>Percentage of children in each area</b>	<b>A sample of children in each area</b>
Children between 6- & 59-months Soba Al-mahata	350	63.6%	156
Children between 6 months and 59 months Soba Al-laowta	200	36.4%	89
<b>Total</b>	<b>550</b>	<b>100%</b>	<b>245</b>

The number of children of that age obtains from immunization and vaccination unit.

The two areas Soba Al-laowta and Soba Al-mahata were purposively selected (due to the economic situation, sanitation level, and infrastructure availability in the two areas). After selecting the two areas, all the households with children under five years old were listed and then simple random sampling method was used to select children below five years in each area based on proportionate to sample size till the desired number was attained. If the selected household had two or more children within the age category of 6 months to 59 months.

### **3.6. Study variables:**

**3.6.1. Socio-demographic information:** This were included gender, age, education and occupation, number of under 5 children.

**3.6.2. Medical history:** Question about any child illness for fifteen days ago recoded by the questionnaire.

**3.6.3. Dietary assessment:** Question about a type of food, the number of meals were collected through the questionnaire.

**3.6.4. Anthropometric Measurement:** Anthropometric indicators (mid-upper arm circumference MUAC, weight and length/height) were measured out according to the nutrition guidelines <sup>(4,5)</sup>.

**3.6.4.1. Body weight:** Body weight was measured using a hanging baby scale and a mechanical dial weighing scale <sup>(4)</sup>.

**3.6.4.2. Length/ height:**

Heights/lengths were carefully measured using measuring tape to the nearest 0.1 cm <sup>(4)</sup>.

**3.6.4.3. Age:**

Age was recorded from health card or immunization card, or birth certificate.

**3.7. Data collection techniques and tools:**

The main data collection tool was an administered written closed questionnaire.

It was used to collect socio-demographic information, feeding practices, morbidity and anthropometric data and water and sanitation with the aid of



Anthropometric Measurement tools. Qualified nutrition specialist was included in the team.

### **3.8. Pretesting study methods and tools and assistants' training**

Twenty-three households were not part of the study sample were tested for the study methods tools and questionnaire validation. The time required to administer the questionnaires and participants acceptance and understanding of the questions were noted. During the pretesting. changes were made to the questionnaire using the pretest results. Assistants were trained in Anthropometric measurement and how to fill the questionnaire.

### **3.9. Statistical analyses:**

Statistics software (SPSS) were used to describe data on nutritional status, feeding practices, maternal socio-demographic characteristics and morbidity prevalence. Chi-square tests were performed to establish the relationship between the socio-demographic, morbidity, and the nutritional of the children.

The significance level was set at  $\leq 0.05$ .

### **3.10. Ethical consideration:**

The study was approved by the University Research Board and Khartoum state Ministry of Health, research department. A consent for the interview was obtained from each child's parents after explaining the purpose of the study. No

names were recorded, and the participants were assured of their confidentiality. with the respective two areas heads the objectives of the study were explained. An administered structured questionnaire was filled with the aid of qualified and professional researcher.

# **Chapter Four**

## **Results**

## Chapter Four

### 4.Results

**Table 4.1. Education level, occupation, income, family size and child rank, in Soba Al-laowta and Soba Al-mahata district, 2018.**

Variables	Soba Al-laowta n=89		Soba Al-mahata n=156	
	Frequency	Percentage (%)	Frequency	Percentage (%)
<b>Mother education level</b>				
Illiterate	2	2.2	9	5.7
Primary	23	25.8	90	57.7
Secondary	56	63	41	26.3
University	8	9	16	10.3
Postgraduate	0	0	0	0
Total	89	100	156	100
<b>Mother occupations</b>				
Employee	4	4.5	16	10.3
House wife	85	95.5	139	89.1
Free work	0	0	1	0.6
Total	89	100	156	100
<b>Father education level</b>				
Illiterate	0	0	11	7.1
Primary	8	9	64	41
Secondary	56	62.9	59	37.8
University	24	27	21	13.5
Postgraduate	1	1.1	1	0.6
Total	89	100	156	100
<b>Family size</b>				
1-3 persons	9	11.1	14	9
3-5 persons	21	23.6	42	26.9
5-7 persons	36	40.4	31	19.9
More than 7	23	25.8	69	44.2
Total	89	100	156	100
<b>Monthly income</b>				
Low (1000-3000 SDG)	0	0	7	4.5
Moderate (3000-5000 SDG)	88	98.9	148	94.9
High (5000-8000 SDG)	1	1.1	1	0.6
Total	89	100	156	100

Table 4.1. shows that mother education level; illiterate 2.2% in Soba Al-laowta and, 5.7% in Soba Al-mahata. However, primary school level represents 25.8% in Soba Al-laowta and, 57.7% in Soba Al-mahata; in addition to that, Secondary school level constitutes 63% in Soba Al-laowta and greater than Soba Al-mahata which it constitutes 26.3%. Lastly university level 9% and 10.3% Soba Al-laowta and Al-mahata respectively. And there is significant difference in mother education level between the two districts ( $\chi^2=35.145$ ,  $df=3$ ,  $p= 0.000$ ). On the other hand, mother occupations an Employee mother constitutes 4.5% in Soba Al-laowta; 10.3% Soba Al-mahata, the house-wife is 95.5% and, 89.1% respectively. The moderate monthly income from both district (moderate) 98.9% in Soba Al-laowta and 94.9% in Soba Al-mahata, and there is no significant difference in Monthly income between the two districts ( $\chi^2=4.194$ ,  $df=2$ ,  $p= 0.123$ ). In regard of family size in the category of more than seven person per family; Soba Al-laowta constitutes 25.8% and higher in Soba Al-mahata 44.2%; Soba Al-laowta is higher in categories of 5-7 person per family 40.4%, than Soba Al-mahata 19.9%. There is a significant difference in family size between the two districts ( $\chi^2=10.813$ ,  $df=3$ ,  $p= 0.013$ ).

**Table 4.2. Houses condition and types, sanitation, water supply and number of rooms, in Soba Al-laowta and Soba Al-mahata district, 2018.**

Variables	Soba Al-laowta n=89		Soba Al-mahata n=156	
	Frequency	Percentage (%)	Frequency	Percentage (%)
<b>Housing condition</b>				
Mud house	1	1.1	116	74.4
Red break house	86	96.6	38	24.4
Concrete house	2	2.3	2	1.2
Total	89	100	156	100
<b>Drinking water Source</b>				
Water pipe	89	100	156	100
Well water	0	0	0	0
Other	0	0	0	0
<b>No. of rooms</b>				
One room	10	11.2	68	43.6
Two rooms	65	73.1	61	39.1
Three rooms	10	11.2	20	12.8
More than 3 rooms	4	4.5	7	4.5
Total	89	100	156	100
<b>Toilet type</b>				
Pit latrine	28	31.5	145	92.9
VIP latrine	26	29.2	0	0
Siphon	32	35.9	0	0
None	3	3.4	11	7.1
Total	89	100	156	100

Table 4.2 shows housing condition 96.6% of houses from Soba Al-laowta built out of the red break on other hands, 74.4% in Soba Al-mahata made out of the mud. In both areas the drinking water Source is through a water pipe 100%. Moreover, one room per house constitutes 11.2% in Soba Al-laowta, and

constitute 43.6% in Soba Al-mahata. Two rooms per house constitute 73.1 in Soba Al-laowta; and 39.1% in in Soba Al-mahata. In Soba Al-laowta in regard of sanitation; pit latrine constitutes 31.5%, ventilated improved pit latrine constitute 29.2%, siphon constitute 35.9% and 3.9% of them without latrine better than Soba Al-mahata in which pit latrine constitutes 92.9%, ventilated improved pit latrine constitute 0% and siphon constitute 0% and 7.1% of them without latrine. there was significant different in sanitation between the two districts ( $\chi^2=55.311$ ,  $df=3$ ,  $p= 0.000$ )

**Table 4.3 Food types, Number of meals, breastfeeding, Initiation of complementary feeding in Soba Al-laowta and Soba Al-mahata 2018.**

Variables	Soba Al-laowta n=89		Soba Al-mahata n=156	
	Frequency	Percentage (%)	Frequency	Percentage (%)
<b>Food types</b>				
Porridge; bread	6	6.7	122	78.2
Porridge; okra	6	6.7	14	9
Falafel; bean; egg; bread	34	38.2	6	3.8
Bean; bread; porridge	7	7.9	5	3.2
Various: Porridge; okra bean; egg; bread; rice; potato	36	40.5	9	5.8
Total	89	100	156	100
<b>Number meals</b>				
1 meal	0	0	0	0
2 Meals	79	88.8	147	94.2
3 Meals	10	11.2	9	5.8
More than 3	0	0	0	0
Total	89	100	156	100
<b>Breastfeeding initiation</b>				
Immediately	89	100	156	100
After one hour	0	0	0	0
Other	0	0	0	0
<b>Complementary feeding Initiation</b>				
Before six months	35	39.3	64	41
after six months	54	60.7	92	59
Total	89	100	156	100
<b>Breastfeeding continuation</b>				
Six months	6	6.7	8	5.1
six months and less than 12 months	3	3.4	3	1.9
12 months	12	13.5	28	18
More than 12 months up to 23 months	41	46.1	55	35.3
More than 23 months	27	30.3	62	39.7
Total	89	100	156	100



Table 4.3 shows the available type of food in Soba Al-laowta (Falafel; Porridge; okra bean; egg; bread; rice; potato) constitute 38.2%. And (Porridge; bread) represent 78.2% in Soba Al-mahata. Both areas are always having two meals per day 88.8% and 94.2% respectively. There is a significant difference in the number of meals and monthly income in both districts ( $\chi^2=6.7$ ,  $df=2$ ,  $p= 0.035$ ). However, Initiation of breastfeeding after birth start Immediately in both areas 100%. Furthermore, a continuation of breastfeeding more than 12 months up to 23 months 46.1% in Soba Al-laowta and 35.3% in Soba Al-mahata. Initiation of complementary feeding before six months 39.3% and 60.7% after six months in Soba Al-laowta. 41% before six months and 59% after six months in Soba Al-mahata. There is no significant difference between initiation breastfeeding and mother education level in both districts ( $\chi^2=1.137$ ,  $df=3$ ,  $p= 0.768$ ).

**Table 4.4 History of morbidity and Immunization coverage, in Soba Al-laowta and Soba Al-mahata district, 2018.**

Variables	Soba Al-laowta n=89		Soba Al-mahata n=156	
	Frequency	Percentage (%)	Frequency	Percentage (%)
<b>History of morbidity two weeks before the survey</b>				
Diarrheal disease	5	5.6	24	15.4
Malaria	5	5.6	6	3.9
Respiratory infection	19	21.4	25	16
No history two weeks before the survey	57	64.1	92	59
Tonsillitis	1	1.1	6	3.9
Diarrhoea and Respiratory infection	2	2.2	1	0.6
Eye infection	0	0	1	0.6
Anaemia	0	0	1	0.6
Total	89	100	156	100
<b>Immunization coverage</b>				
No vaccination	1	1.1	3	1.9
Fully	59	66.3	135	86.6
Partial	29	32.6	18	11.5
Total	89	100	156	100

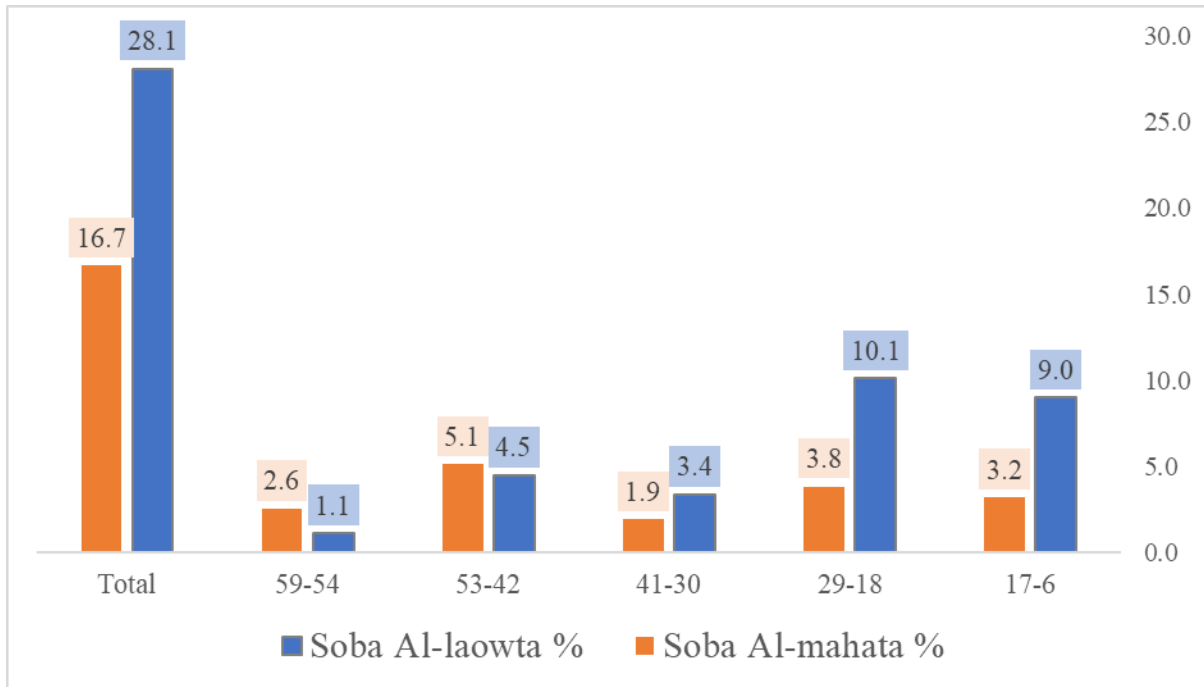
Table 4.4 shows the history of morbidity two weeks before the survey the most incidence was respiratory infection 21.4% in Soba Al-laowta. While Diarrheal disease 15.4% and respiratory infection 16% in Soba Al-mahata; there is no significant difference of history of morbidity two weeks prior to the study between both district ( $\chi^2=9.372$ ,  $df=7$ ,  $p= 0.227$ ). However, fully immunization coverage 66.3% and partially 32.6% in Soba Al-laowta. On the other hand, in

Soba Al-mahata fully immunization coverage 86.6% and partially 11.5%. there is significant difference in immunization coverage between both district ( $\chi^2=15.170$ ,  $df=2$ ,  $p= 0.001$ ).

**Table 4.5. Prevalence of underweight based on weight-for-age z-scores and by sex (95% C.I.), Soba Al-laowta and Al-mahata district, 2018.**

District	Prevalence of underweight		
		Boys	Girls
Soba Al-laowta	n=89		
	(25) 28.1 %	(14) 15.7 %	(11) 12.4 %
Soba Al-mahata	n=156		
	(26) 16.7 %	(14) 8.9 %	(12) 7.7 %

Table 4.5 shows underweight prevalence in Soba Al-laowta 28.1% (n =89). Furthermore, the boys constitute 15.7% and the girls 12.4% (n =89). In Soba Al-mahata underweight constitutes 16.7% (n =156), furthermore, the boys constitute 8.9% and the girls 7.7%. There is no difference between boys and girls from the two districts ( $p=0.175$ ).



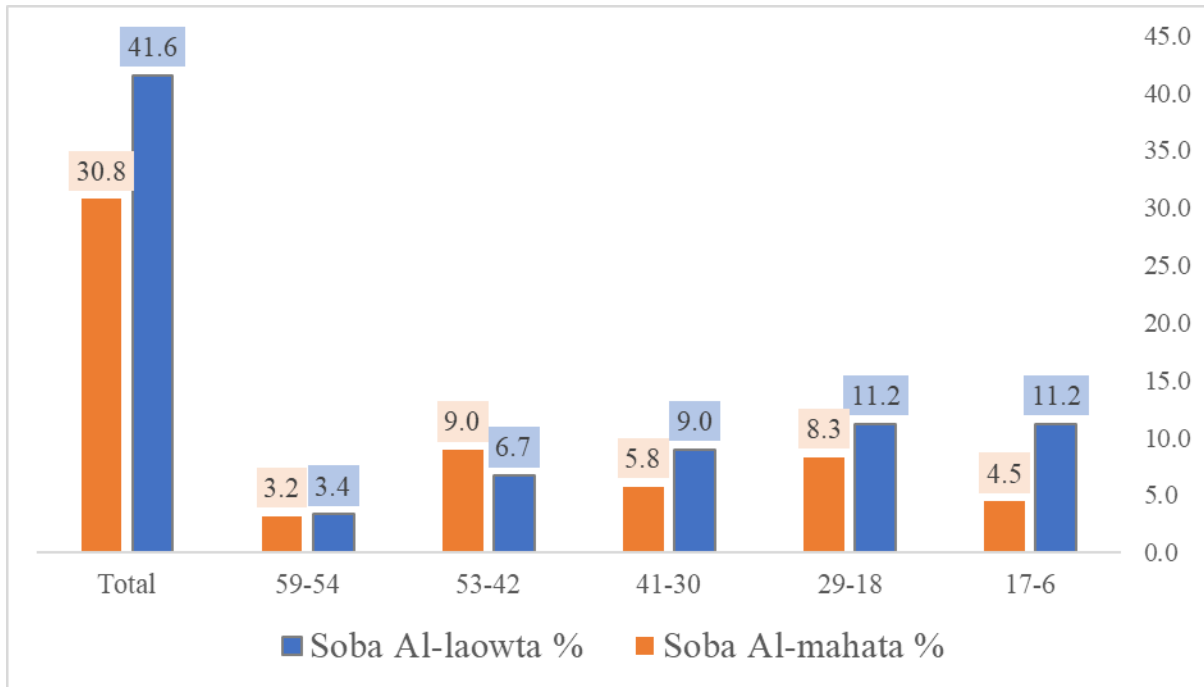
**Figure 4.1. Prevalence of underweight by age, based on weight-for-age z-scores, Soba Al-laowta and Al-mahata districts, 2018.**

Figure 4.1 shows underweight prevalence by age from Soba Al-laowta and Al-mahata district. The highest prevalence of underweight by age in categories of 06-17 and 18-29 months they constitute 9% and 10.1% respectively, in Soba Al-laowta; on the other hand, the highest prevalence of underweight by age in Soba Al-mahata in categories of 18-29 and 42-53 months they constitute 3.8% and 5.1% respectively.

**Table 4.6. Prevalence of stunting based on height-for-age z-scores and by sex (95% C.I.), Soba Al-laowta and Al-mahata districts, 2018.**

District	Prevalence of stunting		
		Boys	Girls
Soba Al-laowta	n = 89		
	(37) 41.6 %	(15) 16.9 %	(22) 24.7%
Soba Al-mahata	n = 156		
	(48) 30.7 %	(25) 16 %	(23) 14.7%

Table 4.6 shows stunting prevalence in Soba Al-laowta 41.6% (n =89). Furthermore, the boys constitute 16.9% and the girls 24.7%. In Soba Al-mahata stunting constitutes 30.7%; furthermore, the boys constitute 16% and the girls 14.7%. There is no difference between boys and girls from the two districts (p=0.261).



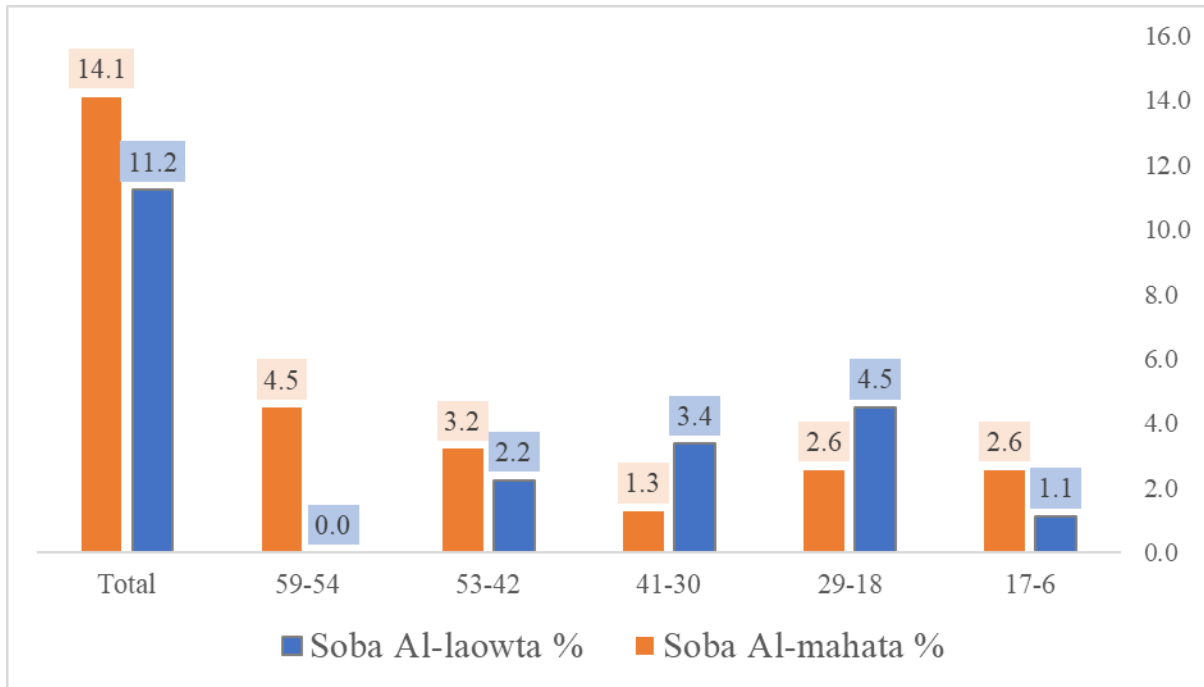
**Figure 4.2. Prevalence of stunting by age based on height-for-age z-scores from Soba Al-laowta and Al-mahata districts, 2018.**

Figure 4.2 shows stunting prevalence by age from Soba Al-laowta and Al-mahata district. The highest prevalence of stunting by age in categories of 06-17, 18-29 and 30-41 months they constitute 11.2%, 11.2%, and 9% respectively, in Soba Al-laowta. On the other hand, Soba Al-mahata the highest prevalence of stunting by age in categories 18-29, 30-41 and 42-53 months they constitute 8.3%, 5.8%, and 9% respectively. Soba Al-laowta was higher than Soba Al-mahata, in contrast to the age 42-53 Soba Al-mahata is higher than Soba Al-laowta.

**Table 4.7. Prevalence of wasting based on weight-for-height z-scores and by sex, Soba Al-laowta, and Al-mahata district, 2018 (n=245).**

District	Prevalence of wasting		
		Boys	Girls
Soba Al-laowta	n = 89		
	(10) 11.2 %	(2) 2.2 %	(8) 9%
Soba Al-mahata	n = 156		
	(22) 14.1 %	(13) 8.3 %	(9) 5.8 %

Table 4.7. shows wasting prevalence in Soba Al-laowta 11.2% (n =89). Furthermore, the boys constitute 2.2% and the girls 9%. In Soba Al-mahata wasting constitutes 14.1% (n =156). Moreover, the boys represent 8.3% and the girls 5.8% (n =156). There is no difference between boys and girls from the two districts (p=0.199).



**Figure 4.3. Prevalence of wasting by age, based on weight-for-height z-scores Soba Al-laowta and Al-mahata districts, 2018.**

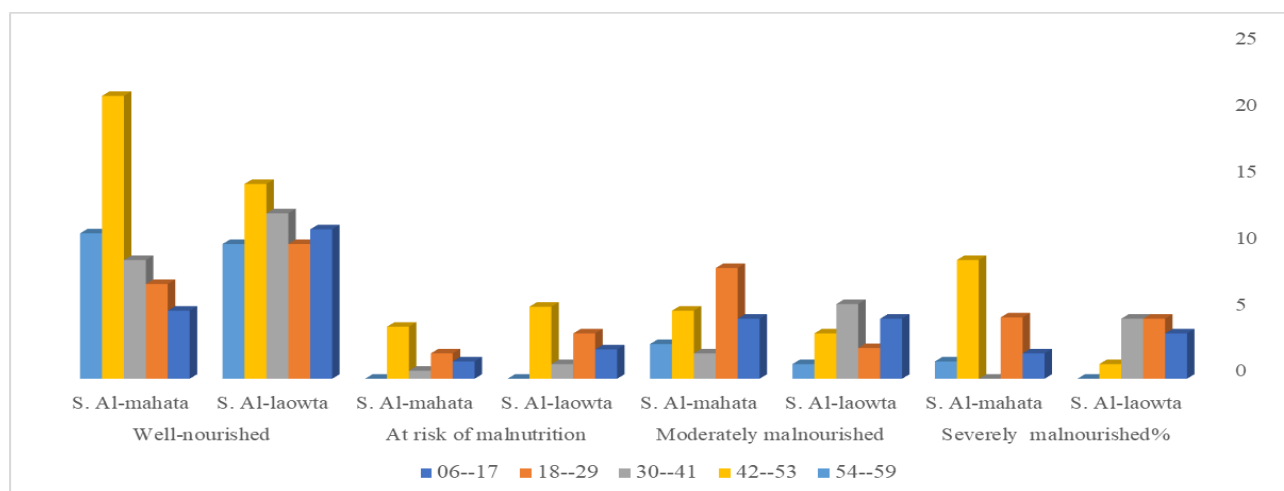
Figure 4.3 shows wasting prevalence by age from Soba Al-laowta and Al-mahata district. The highest prevalence of wasting by age in categories of 18-29 and 30-41 months they constitute 4.5% and 3.4% respectively, in Soba Al-laowta; on the other hand, Soba Al-mahata the highest prevalence of wasting by age in categories 42-53 and 54-59 months they constitute 3.2% and 4.5% respectively.



**Table 4.8. Distribution of children according to MUAC, Soba Al-laowta, and Al-mahata district, 2018).**

Malnourished status	MUAC (cm)	S. Al-laowta		S. Al-mahata	
		No	%	No	%
Severely malnourished	<11.5	12	13.5	26	16.7
Moderately malnourished	11.5-12.5	15	16.9	35	22.4
At risk of malnutrition	12.5-13.5	10	11.2	12	7.7
well-nourished	>13.5	52	58.4	83	53.2
Total		89	100	156	100

Table 4.8 shows the distribution of children according to MUAC. Generally, the children who were Severely malnourished 13.5% Soba Al-laowta and 16.7% Soba Al-mahata, in those who were moderately malnourished 16.9% Soba Al-laowta and 22.4% Soba Al-mahata and, those who were at risk of malnutrition constitute 11.2% in Soba Al-laowta and 7.7% in Soba Al-mahata.



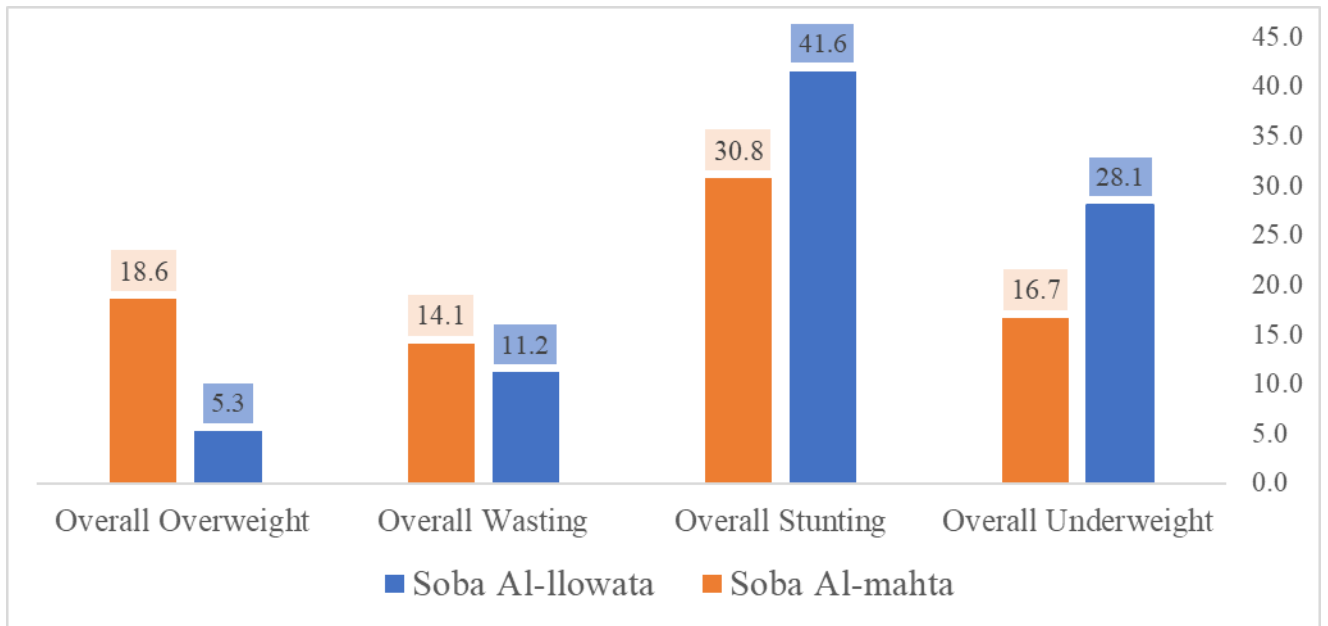
**Figure 4.4. Distribution of malnutrition by age according to MUAC, Soba Al-laowta, and Al-mahata district, 2018).**

Figure 4.4. shows the distribution of malnutrition by age according to MUAC. Children who were Severely malnourished at age group (06-17,18-29 and 30-41) months from Soba Al-laowta and at age group (18-29 and 42-53) months from Soba Al-mahata. Beside that, those who were moderately malnourished at age group (06-17,18-29 and 30-41) months from Soba Al-laowta and at age group (06-17,18-29 and 42-53) months from Soba Al-mahata. However, those who were at risk of malnutrition at age group (06-17,18-29 and 42-53) months from Soba Al-laowta and, age group of (18-29 and 42-53) months from Soba Al-mahata.

**Table 4.9. Prevalence of overweight based on weight for height cut off's and by sex (95% C.I.), Soba Al-laowta and Al-mahata district,2018.**

District	Prevalence of overweight (WHZ > 2)		
	n = 89	Boys	Girls
Soba Al-laowta	(6) 5.3 %	(4) 4.5 %	(2) 2.2%
	n= 156	Boys	Girls
Soba Al-mahata	(29) 18.6 %	(15) 9.6 %	(14) 9 %

Table 4.9 shows overweight prevalence 5.3% n=89, furthermore, the boys constitute 4.5% and the girls 2.2% in Soba Al-laowta. In Soba Al-mahata overweight greater than Soba Al-laowta which represents 18.6% n=156. Moreover, the boys form 9.6% and the girls 9%. There is no difference between boys and girls from the two districts (p=0.261).



**Figure 4.5. Summary of all nutrition prevalence Soba Al-laowta and Al-mahata districts, 2018.**

Figure 4.5 show summery of all nutrition status prevalence in Soba Al-laowta and Al-mahata. In Soba Al-laowta underweight 28.1%, stunting 41.6% is higher than Soba Al-mahata where underweight was 16.7%, and stunting 30.8%. in contrast wasting and overweight were higher in Soba Al-mahata and, constitutes 14.1% and 18.6% respectively. There are no significance differences from the two districts ( $p=0.157$ ).

## **Chapter Five**

### **Discussion**

## Chapter Five

### 5. Discussion

#### Social factors

The number of the children under the study were 36.3% from Soba Al-laowta and 63.7% from Soba Al-mahata. Mother education level; primary school level considers the highest level of education to the most mother in Soba Al-mahata in comparison to Soba Al-laowta to the most mother education level; high secondary school this agree with Sulaiman *et al* study 2018 <sup>(36)</sup> in Soba Al-laowta and disagree in Soba Al-mahata. There was a difference in mother education level between the two districts. Because may be due to tradition and custom, most of the mother from Soba Al-mahata married before or after completed primary school. However, most mother from Soba Al-laowta they married within and after finished secondary school. In both district most mother occupation was a house-wife. Most of family provider from both districts had the same monthly income (moderate monthly) and there is no difference in monthly income between the two districts. And that because most of the family provider education level between primary school and secondary school as well as most of them rely on day by day work (free work). In family size Soba Al-

mahata is higher than Soba Al-mahata because may be attributed to early marriage of mothers from Soba Al-mahata.

**Houses condition, types, sanitation, water supply and the number of rooms.**

House condition, sanitation, and water source have an impact on diseases transmission especially diarrheal (type of latrine, house fly breeding site) and respiratory infection (number of rooms in relation to family size) and therefore it may affect the nutritional status of the children. This study pointed that in Soba Al-mahata most of houses made of mud. More than one over third of houses in Soba Al-mahata with one room per house and a high number of inhabitants per place due to the family size which, will increase the transmission of disease and compromise their nutrition status <sup>(37,38)</sup>. In contrast to that, in Soba Al-laowta most of the houses made of a red brick with two rooms per house per houses or more with fewer number inhabitants per room. In regard of sanitation; most of toilet were siphon and ventilated improved pit latrine in Soba Al-laowta and fewer of them without latrine better than Soba Al-mahata most inhabitants have pit latrine as toilet and less than ten percent of them without latrine. there was different in sanitation status (latrine) between the two area, and that will increase the transmission of diarrheal disease, in turn, it may compromise the nutrition status as mentioned in several studies' poor

sanitation and inadequate housing situation and their impact on nutrition status (37,39).

### **Food types, Number of meals and breastfeeding**

The available type of food in Soba Al-laowta (Falafel; Porridge; okra bean; egg; bread; rice; potato). And (Porridge; bread, okra) in Soba Al-mahata. In general, the households in Soba Al-laowta and Soba Al-mahata were facing some degree of food insecurity; two meals per day, another study from Tanzania mentioned the same situation <sup>(43)</sup>. Initiation of breastfeeding after birth start Immediately in both districts and that may be to of the tradition and custom of the mothers. Furthermore, a continuation of breastfeeding twelve months to twenty-three months in Soba Al-laowta greater than Soba Al-mahata may be this attributed to the education level of the mother from Soba Al-laowta.

### **History of morbidity and Immunization coverage**

History of morbidity two weeks prior the survey the most incidence was respiratory infection in Soba Al-laowta. While Diarrheal disease and respiratory infection in Soba Al-mahata may be due to sanitation, and the house condition numbers of rooms per house in relation to the family size.

Immunization coverage in Soba Al-laowta is less than Soba Al-mahata and that may be due to the work of the international and nongovernmental organization



in the area of vaccination in Soba Al-mahata. Vaccination status may contribute to affect nutrition status as well <sup>(40)</sup>.

### **Nutritional Status of the children:**

The nutrition status in this study carried out according to the WHO standard. First underweight in Soba Al-laowta consider higher in comparison to Soba Al-mahata. The highest prevalence of underweight by age in categories of (6-17 and 18-29) months in Soba Al-laowta; on the other hand, Soba Al-mahata the highest prevalence of underweight by age in groups of (18-29 and 42-53) months and may be attributed to breastfeeding habit, children in the first months of their life start, grow normally, After that, incomplete breastfeeding, inadequate type and quantity of complementary foods and high rate of morbidity were mainly to cause that. The underweight in this study is greater than 2010 and 2014 studies from Khartoum state <sup>(4,28)</sup>

Stunting prevalence in Soba Al-laowta higher than Soba Al-mahata. The highest prevalence of stunting by age in categories of (06-17, 18-29 and 30-41) months in Soba Al-laowta. On the other hand, Soba Al-mahata the highest prevalence of stunting by age in categories (18-29, 30-41 and 42-53) months. The stunting in this study from both districts is higher than both 2014 studies from Khartoum state <sup>(4,28)</sup>, and that is may attributed to shortage of micronutrient or/and frequent morbidity.

Wasting prevalence in Soba Al-laowta less than Soba Al-mahata and, the highest prevalence of wasting by age in group of (18-29 and 30-41) months. And the highest prevalence of wasting by age in categories (42-53 and 54-59) months. These could be attributed to the poor and inadequacy of complementary feeding practices moreover the quality and number of meals per day. The wasting prevalence in this study from both districts is less than 2010 and 2014 study from Khartoum state <sup>(4,28)</sup>.

Overweight prevalence in Soba Al-laowta. was less than Soba Al-mahata. And that could be attributed to the excess of carbohydrates type of food and unorganized time of the daily meals <sup>(41,42,43)</sup>.

Generally, to MUAC indicator, children who were Severely malnourished in Soba Al-laowta and Soba Al-mahata were less than ten percent of children under five, moreover, those who were moderately malnourished in Soba Al-laowta and Soba Al-mahata and, those who were at risk of malnutrition constitute consider critical in Soba Al-laowta and in Soba Al-mahata. While children at age group (06-17,18-29 and 30-41) months from Soba Al-laowta and at age group (18-29 and 42-53) months from Soba Al-mahata who were Severely malnourished. Besides that, children at age group (06-17,18-29 and 30-41) months from Soba Al-laowta and at age group (06-17,18-29 and 42-53) months from Soba Al-mahata were moderately malnourished. However, those

who were at risk of malnutrition at age group (06-17,18-29 and 42-53) months from Soba Al-laowta and, age group of (18-29 and 42-53) months from Soba Al-mahata, and these may be attributed to type of food, number of meals per day and, morbidity frequency at these age group. However, severely and moderately malnourished prevalence in this study is higher than 2014 studies from Khartoum state <sup>(4)</sup>.

**Chapter Six**  
**Conclusion and Recommendations**

## **Chapter Six**

### **6. Conclusion and Recommendations**

#### **6.1. Conclusion**

The current study discloses that the underweight and stunting prevalence among the children under five years were between medium to very high level in Soba Al-laowta and Soba Al-mahata. On the other hand, wasting was classified as poor for a Soba Al-laowta, and classified as serious for Soba Al-mahata, according to the WHO criteria (cut-off value for public health significance).

In Soba Al-mahata sanitation status consider critical; number of rooms compare to house inhabitant's, toilet condition and availability with the manifestation of house fly and diarrheal disease cases two week prior to the survey.

The recent study reveals that overweight considered as malnutrition problem in both districts.

#### **6.2. Recommendations**

1. Comprehensive development for both areas; infrastructure planning and sanitation.
2. Health promotion programme to be implemented in both areas with emphasis on nutrition and immunization.

3. Further studies to be encourage among different district in Khartoum State.
4. Further studies are essential to clarify the risk factors.
5. Further studies on protein-energy malnutrition is recommended

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## Annexes

### Annex I Questionnaire in English

Questionnaire No. ( )

<u>No.</u>	<u>Questions</u>	<u>Answer</u>
<u>1</u>	Mother: Education level	
	1) Illiterate	
	2) Primary	
	3) Secondary	
	4) University	
	5) postgraduate	
<u>2</u>	Mother: occupations:	
	1) Employee	
	2) House wife	
	3) Free work	
<u>3</u>	Father: Education level	
	1) Illiterate	
	2) Primary	
	3) Secondary	
	4) University	
	5) postgraduate	
<u>4</u>	Family size:	
	1) 1-3	
	2) 3-5	

	3) 5-7	
	4) More than 7	
<u>5</u>	Monthly income	
	1) Low income (1000-3000 SDG)	
	2) moderate income (3000-5000 SDG)	
	3) High income (5000-8000 SDG)	
<u>6</u>	Type of house	
	1) Mud house	
	2) Red brick house	
	3) Concrete house	
<u>7</u>	Source drinking water	
	1) Water pipe net	
	2) Well water	
	3) Other specify	
	.....	
<u>8</u>	Number of rooms per house	
	1) One	
	2) Two	
	3) Three	
	4) More than three	
<u>9</u>	Toilet	
	1) Pit latrine	
	2) Ventilated improved pit latrine	
	3) Siphon	



	4) None	
<u>10</u>	Children number	
<u>11</u>	Anthropometrics	
	1) Height	
	2) Weight	
	3) Age	
	4) MUAC	
<u>12</u>	Breastfeeding initiation	
	1) Immediately	
	2) After one hour	
	3) Other specify .....	
<u>13</u>	Complementary feeding Initiation	
	1) Before six months	
	2) After six months	
<u>14</u>	Breastfeeding continuation	
	1) 6 months	
	2) 12 months	
	3) 12-23 months	
	4) More than 23 months	
<u>15</u>	Number of meals per day	
	1) 1 meal	
	2) 2 meals	
	3) 3 meals	
	4) More than 3	

<u>16</u>	Type of food specify	
<u>17</u>	Morbidity two weeks prior to the survey	
	Diarrheal disease	
	Malaria	
	Respiratory infection	
	Other specify .....	
	None	
<u>18</u>	Immunization and vaccination	
	Fully	
	Partially	

إستبيان رقم ( )

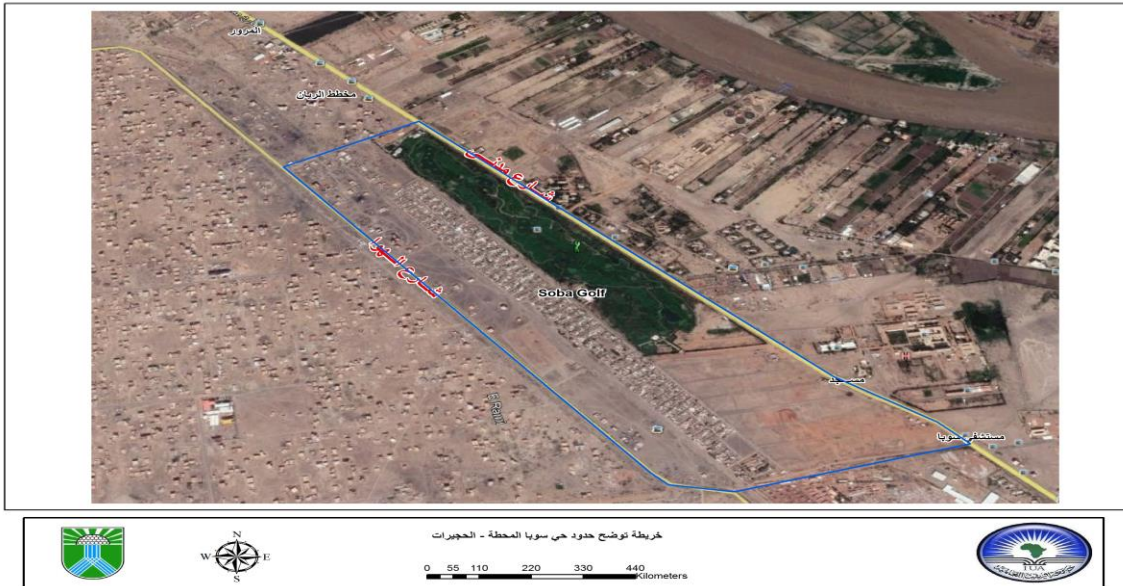
الإجابة	الأسئلة	الرقم
	الأم : مستوى التعليم	1
	1. أمية	
	2. ابتدائي	
	3. ثانوي	
	4. جامعي	
	5. فوق الجامعي	
	الام: المهنة	2
	1. موظفة	
	2. ربة منزل	
	3. عمل حر	
	الاب: مستوى التعليم	3
	1. خلوة	
	2. ابتدائي	
	3. ثانوي	
	4. جامعي	
	5. فوق الجامعي	
	حجم الاسرة	4
	1. 1-3	
	2. 3-5	
	3. 5-7	
	4. اكثر من 7	
	الدخل الشهري	5
	منخفض (1000-3000 جنيه سودانى)	

	متوسط (3000-5000 جنيه سودانى)	
	عالى (5000-8000 جنيه سودانى)	
	نوع المنزل	<b>6</b>
	1. منزل من الطين	
	2. منزل من الطوب الاحمر	
	3. منزل بالاسمنت المسلح	
	مصدر المياه	<b>7</b>
	1. شبكة عامة	
	2. آبار	
	3. أخرى	
	حدد	<b>8</b>
	عدد الغرف	
	1. غرفة واحدة	
	2. غرفتين	
	3. ثلاث غرف	
	4. أكثر من 3	
	نوع المراض	<b>9</b>
	1. المراض الحفرة	
	2. المراض المهوى المحسن	
	3. سايفون	
	4. لا يوجد	
	عدد الأطفال	<b>10</b>
	قياس الطفل	<b>11</b>
	1. الطول	
	2. الوزن	
	3. العمر	

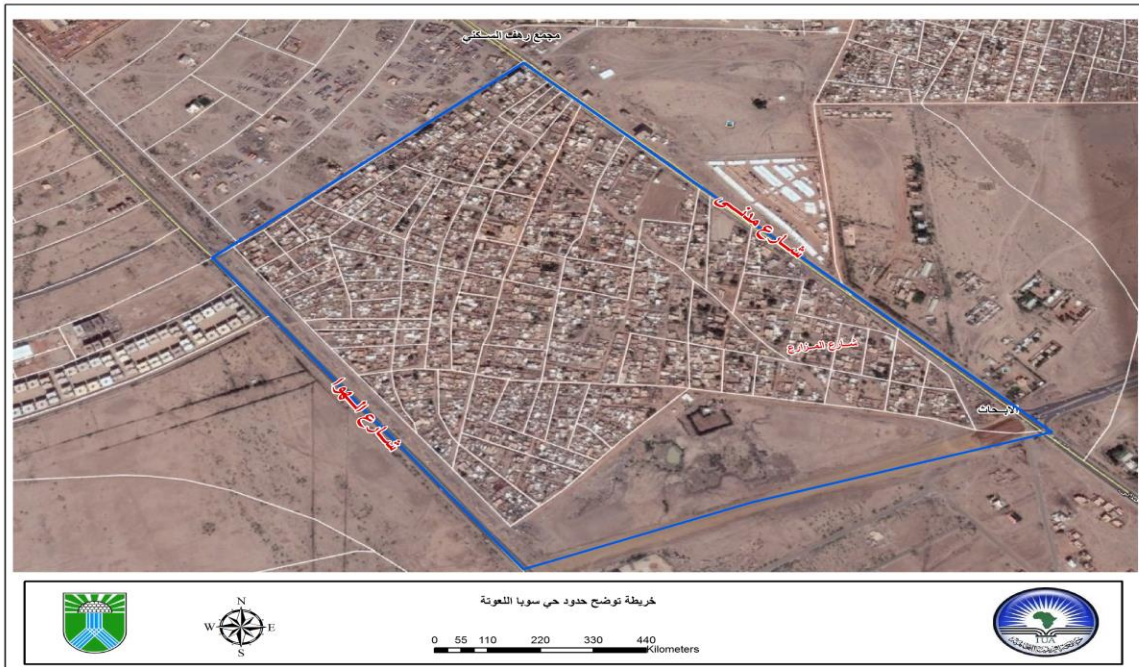
	4. محيط الذراع	
	بداية الرضاعة الطبيعية بعد الولادة	<b>12</b>
	1. في الحال	
	2. بعد ساعة	
	3. أخرى حدد .....	
	بداية الأغذية التكميلية	<b>13</b>
	1. قبل 6 شهر	
	2. بعد 6 شهر	
	17/ الاستمرار في الرضاعة الطبيعية	<b>14</b>
	6 أشهر	
	6-12 شهر	
	12 شهر	
	12-23 شهر	
	اكثر من 23 شهر	
	عدد الوجبات خلال اليوم	<b>15</b>
	1. وجبة واحدة	
	2. وجبتين	
	3. ثلاث وجبات	
	4. أكثر	
	نوع الوجبه حدد	<b>16</b>
	تاريخ المرض قبل أسبوعين من الدراسة	<b>17</b>

	اسهال	
	ملاريا	
	التهابات الجهاز التنفسي	
	أخرى	
	لا توجد	
	التطعيم	
	كامل	<b>18</b>
	جزىء	

Annex 2 Map No. (1) Study area map Soba Al-mahata area

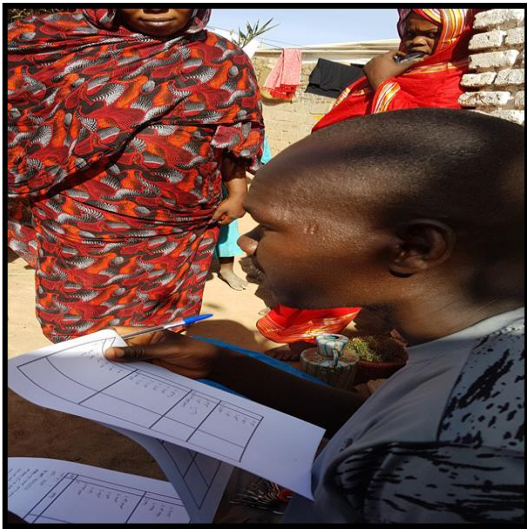


Annex 2 Map No. (2) Study area map Soba Al-laowta





Annex 3 Plate No. (1) Field nutrition survey documentation Soba Al-laowta and Al-mahata area.





Annex 3 Plate No. (2) Field nutrition survey documentation Soba Al-laowta and Al-mahata area.



## Declaration

This thesis (The current nutritional status of the under five years children in Soba Al-laowta and Soba Al-mahata districts, Khartoum locality, Sudan) is my original work. All chapters in this thesis, that use quotes or describe a discussion or material developed by another scientist or researcher including all literature used, was clearly referenced.

Khartoum, Sudan

Signature.....

Date .....

Place.....

Afrah Abdalrahim Mustafa Ahmed

This thesis was submitted for examination with my approval as University Supervisor.

Khartoum, Sudan

Signature

Date

Place

Dr. Murwan Eissa Osman