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Emirates International University

Faculty of Medicine and Health Science

Department of Community Medicine

Nutrition Status for Children under the Age of Five Years in Sana'a City

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Researchers

Hamed Saleh Ali Al-Ahmadi

Ali Ahmed Ali Mohammed Jaalal

Esmail Hamood Mohammed Al- Shahethi

Fares Shawqi Ali Edrees

Baha'a Aldin Fahd Al-salmi

Hail Saad Ahmed Al-Wosaby

Ammar Ali Ali Hilal

Moath Fawzi Nasser selaan

Hesham Hassan Qahtan Al-Thyfani

Ali Hasan Alsaghir

AdeL Ali mohammed AL Mushki

Supervisor

Dr. Nora Ahmed Al-Awadhy

Community Medicine Department

Faculty of Medicine and Health Sciences

Sana'a University

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DEDICATION

To our dear fathers and mothers, whose hearts are as vibrant as ever, our gratitude falls short in front of your kindness, affection, support, and love. However, it is our duty to always thank you and pray for you. Our words cannot express the depth of our appreciation for all that you have done for us. You have given us so much, and we are forever grateful.

To all those who have extended a helping hand, love, generosity, we offer our heartfelt thanks. You have made a difference in our lives, and we will never forget your kindness.

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Table of Abbreviations

Abbreviations	Meaning
ARI	Acute Respiratory Infection
ASPEN	American Society of Parenteral and Enteral Nutrition
GAM	Global Acute Malnutrition
HIV	Human Immunodeficiency Virus
MAM	Moderately Acute Malnutrition
MUAC	Mid Upper arm circumference
SAM	Severe Acute Malnutrition
SDG	Sustainable Development Goal
TB	Tuberculosis
UN	United Nations
UNIFEC	United Nations International Children's Emergency Fund
WHO	World Health Organization

Abstract:

- **Background and Objective:**

The nutritional status of children determines their health, physical development, educational performance, and progress in life. Annually there are over 10 million deaths of children under five, over 33% of them because of malnutrition associated with inadequate nutrition. Since Yemen is in constant conflicts, the assessment of child healthcare is mandatory. This study aimed to assess the nutritional status and associated factors of children under 5 years of age in Sana'a, Yemen.

- **Material and Methods**:

A prospective descriptive cross sectional study was carried out at Al-Gumhuri Hospital, Al-Kuwait Hospital, Al-Zahrawey Medical Center, and Hanny Towmer Hospital during the period from May 1st 2024 to May 20th 2024 on all children admitted to pediatric wards. Data was collected via a multi-sectorial questionnaire and face to face interview, along with anthropometric measurements. Data was digitized with Microsoft Excel version 2013 and exported to SPSS version 26.0 for statistical analysis. Height and weight measurements was converted to Z- scores. Data were evaluated for demographic and other clinical characteristics as definite variables. Chi-square and Fisher exact test were applied between demographic, clinical presentation (Independent variables), co-morbid diseases, and anthropometrics as (dependent variables).

- **Results**:

Four hundred child between the ages 1 to 59 months, 212 of them were less than 24 months old with mean age is 22.1 months. The majority were males (53%) and the majority live in urban setting (63%). Weight at birth was obtained with a mean of 2.947±0.40. MUAC readings mostly indicated moderate malnutrition with 35.1% being severe malnourished. All three forms of malnutrition were presented among the very high classification according to WHO with wasting, stunting, and underweight scoring 17.4% (95% CI: 8.6%, 25%) 38.75% (95% CI: 35.1%, 44.9%), and 42.1% (95% CI: 16.2%, 24.3%) respectively. There were various significant associations of wasting to multiple independent factors; such as income status, age of the mother, and presence of co-morbid diseases, namely, Diarrheal Diseases. Vaccination happened to have significant association, influenced by economical and demographical aspects in malnourished children ($P<0.05$). Despite several studies evaluating the association of vaccines with nutrition, the outcome is still inconclusive. Stunting was associated with factors such as residence, status of feeding in the first 2 years, and lack of knowledge about weaning. However, underweight was significantly related with age of the child; especially between 0 to 2 years, and their overall appetite.

- **Conclusion**:

The deteriorating nutritional status has become a major problem of children, especially children under 5 years of age, which is in continuous increasing because of the current conflicts that have led to several economic factors affecting the living standards of families. The proportion of malnutrition among children under the age of five is still catastrophically high. Multiple intervention strategies based on risk factors can reduce early malnutrition of the children under the age of five in Yemen.

Keywords: Nutritional Status, Children, Yemen.

Chapter 1

INTRODUCTION

INTRODUCTION

The nutritional status of children determines their health, physical development, educational performance, and progress in life. Malnutrition among children under five years is a significant public health problem [1-4]. According to the World Health Organization (WHO), malnutrition means deficiencies, excesses, or imbalances in a person's energy or nutritional consumption [5]. Annually there are over 10 million deaths of children under five, over 33% of them because of malnutrition associated with inadequate nutrition [6]. Children's malnutrition is affected by multidimensional factors such as biological, behavioral, social, demographical, economic, and environmental factors [7, 8]. The socioeconomic situation plays a major role in nutrition type, also in the quality, and quantity of food. [9, 10]. In some rural areas; and even some Third World's urban areas, there are persistent problems with poverty, environmental issues, and other major problems that had negative effects on household food security leading to undernourishment[11, 12]. The prevalence of infectious diseases and total micronutrient deficiencies is widespread mainly because of social, economic, and geographic factors [13].

The term malnutrition refers to two distinct groups of conditions. The first is under-nutrition, which includes being underweight (low weight for age), stunting (being short for age), wasting (being underweight for height), and nutritional deficiencies or inadequacies such as lack of essential vitamins and minerals. The second aspect refers to individuals being either overweight or obese [14].

The assessment of the nutritional status involves different techniques, which are anthropometry, biochemical evaluation, clinical examination, and functional assessment, assessment of dietary intake, vital, and health statics and ecological studies. Nutrition is the intake of food, considered in relation to the body‘s dietary needs. Good nutrition– an adequate, well balanced diet combined with regular physical activity – is a cornerstone of good health. Poor nutrition can lead to reduced immunity, increased susceptibility to disease, impaired physical and mental development, and reduced productivity [15].

Worldwide, approximately 1.9 billion adults are overweight, while 462 million are underweight. Overweight or obese children under the age of five years are estimated to number 41 million, with 159 million stunted and 50 million wasted [5]. Undernourished children have a higher risk of death and are more likely to contract childhood illness [16-18].

They are prone to be cognitively impaired, perform worse in school, have lower earning potential, and are at a higher risk of developing non-communicable diseases later in life [19]. The consequences of poor nutrition begin in utero and last for generations [20].

Undernourished women are more likely to have low birth weight babies, who are more likely to have suboptimal growth and development [21]. In response to this evidence, the WHO has set goals to reduce the number of stunted children by 40% and maintain childhood wasting to less than 5% by 2025 [22, 23]. The United Nations (UN) adopted the first-ever UN Decade of Action on Nutrition to accelerate this process from 2016 to 2025 [23].

Adequate nutrition during childhood is essential to ensure children's development and health [1, 24]. Several efforts were made to reduce the burden of malnutrition, especially in developing countries [25, 26]. However, malnutrition is still a major health problem in most developing countries [1, 27] In South Asia, half of the childhood deaths are associated with malnutrition [3]. In Yemen, childhood malnutrition has continued as a severe health problem for decades, with 42.5% of children under the age of five stunted, 12.6% severely stunted, and 9.7% had wasted [28]. Current research in developing countries shows that deaths reportedly fell after standardization was introduced hospital treatment plans. Yemen still has one of the highest child birth rates in the world. Malnutrition exists around the world, and is well established as a major public health problem and a leading cause of high mortality; ranked as the most important among avoidable factors. This study aims to assess the nutritional status and its associated factors of children under 5 years of age in Sana'a Governorate, Yemen, and reflect its current situation [9].

1.1 Research problem:

Malnutrition refers to a pathological state resulting from a relative or absolute deficiency or excess of one or more essential nutrients. It is a state of nutrition where the weight for age, height for age and weight for height indices are below -2 Z-score of the NCHS reference. Malnutrition continues to be a major public health problem in developing countries. It is the most important risk factor for the burden of disease causing about 300,000 deaths per year directly and indirectly responsible for more than half of all deaths in children.

1.2 Study Objectives:

- **General Objectives:**

  Nutrition Status for Children under the Age of Five Years, Sana'a City

- **Specific objectives:**

1. To estimate the prevalence of malnutrition for children under the age of five in government Hospitals and Health Center.
2. To identify factors associated with malnutrition in children under the age of five in government Hospital.
3. To detect the association between demographic factors, and malnutrition.

1.3 Significance of the study:

Sana'a Governorate district was intentionally selected as the study area due to the high poverty levels, persistent war, and high illiteracy levels and malnutrition; while it is still the capital city. Repeated disasters like water outage can have serious impacts on health, and wellbeing of children. The age group was chosen to take into account the introduction of complementary feeding at 6 months, a fragile period when children are at high risk of malnutrition. Moreover, household food shortages that are common in the aftermath of

disasters are likely to happen because of the war and the economic blockade facing the country effects on the nutritional status of children under 5 years. Young children are a vulnerable group undergoing rapid growth and development that demand higher nutritional needs. In this regard, this study will have an important impact on the prevalence of malnutrition in an important stage of childhood. Furthermore, these study findings shall help policy makers make adjustments by updating standards and guidelines for combating malnutrition after being aware of the challenges, which encounter children with malnutrition. Identifying and understanding of the associated factors for childhood malnutrition, in Sana'a Governorate, this study will aid in planning and budgeting for the nutritional needs of children by decision makers. It will also serve as a baseline for other future studies geared towards monitoring secular trends in nutritional states in the study area. Finally, the results of this study also, will help to identify risk factors of malnutrition in children for further research.

Chapter 2

Background

2.1 Clinical Overview

Acute malnutrition is a nutritional deficiency resulting from either inadequate protein or energy intake. According to the American Society of Parenteral and Enteral Nutrition (ASPEN) [29], pediatric malnutrition is defined as "an imbalance between nutrient requirement and intake, resulting in cumulative deficits of energy, protein, or micronutrients that may negatively affect growth, development, and other relevant outcomes."[30]. Malnutrition is the most severe consequence of food insecurity amongst children under the age of 5 years. Acute malnutrition can lead to morbidity, mortality and disability, as well as impaired cognitive and physical development with an increased risk of concurrent infections [31].

2.2 Causes:

Nutrition-specific factors include:

1. Inadequate food intake.
2. Poor caregiving and parenting.
3. Improper food practices and infectious comorbidities.

Nutrition-sensitive factors include:

1. Food insecurity.
2. Inadequate economic resources at the individual, household, and community levels.
3. Limited or poor access to education, healthcare services, infrastructure and poor hygienic environment are other nutritional sensitive factors that adversely affect the children under the age of 5-year nutritional status demonstrates the theoretical framework for the causes of malnutrition under the age of 5 years [32, 33].

2.3 The major factors affecting the nutritional status of children under the age of 5 years are classified into the following three categories:

1. Individual level factors:

The risk factors for malnutrition on the basis of individuals include age, gender, birth weight, breastfeeding and childhood comorbidities. Teenage pregnancy, lower maternal education, low birth weight, lack of breastfeeding and personal food preference are also individual determinants of malnutrition of children under the age of 5 years [34, 35]. Although low birth weight is an individual factor, it is influenced by maternal health and nutritional status, as well as food security at the household or community level.

2. Household-level factors:

At the household level, age, gender, geographical area, level of maternal education, family income, household size, food security and healthcare access are important factors that had a significant association with child malnutrition [35, 36]. Malnutrition is an economic problem at the household level, which is accompanied by poverty, disturbed family structure, and ignorance of health and wellness of children. Lack of awareness of the nutritional quality of food, cultural and community beliefs about food and inappropriate feeding habits all lead to malnutrition amongst children under the age of 5 years [34]. The nurturing care that children receive early in their life provides the basis for prospective nutritional status, with children of teenage mothers and younger household heads being more likely to be undernourished [33].

3. Community-level factors:

The indicators of childhood malnutrition at the household level are influenced by place of residence, household infrastructure, income and ethnicity [37, 38]. The area of residence is a proxy indicator to determine the nutritional status of children for environmental risks, availability of health and wellness services, and shared community and cultural beliefs [39]. The external force that influences food availability, accessibility and utilization is highly influenced by politics, ideology, pandemics, economics and climate [40]. Community wealth, community education level, prevalence of communicable diseases (e.g. human immunodeficiency virus [HIV], Tuberculosis [TB], etc.), and the distance of community to healthcare facilities also have a great influence on the child nutritional status [34]. The theatrical framework for child malnutrition under the age of 5 years was adopted by UNICEF in 1990. It highlighted both basic and underlying causes of malnutrition, which includes the roles of inadequate dietary intake and healthcare received during childhood. The availability, accessibility and utilization of

food are highlighted as direct causes of malnutrition; however, the intermediate and underlying causes of malnutrition are multi-sectoral and extended to human, economic, household and community resources, influenced by geographical factors and economic structure [41, 42]. The adoption of the SDGs has brought global recognition of child nutrition, which was determined not only by children surviving but also by growth and thriving [43].

2.4 Patterns of malnutrition:

There is coexistence of substantial levels of under-nutrition, particularly stunting and wasting, within the same geographical region, indicating the double burden of malnutrition [44]. The nutritional status is also influenced by other factors at the individual, household and community levels. The WHO uses anthropometric indices to identify and categorize the nutritional status, which include height for age, weight for height and weight-for-age for measuring stunting, wasting and underweight. These indices are measured and compared as standard deviation units (Z-scores) from the median of the reference population demonstrates the pattern of malnutrition in children under the age of 5 years [32].

2.5 Stunting in children under the age of 5 years:

Stunting (height-for-age) in a child is defined as too short for his or her age with a height for age Z-score less than −2 s.d. from the median of the reference population. It is an indicator of linear growth retardation and cumulative growth deficits in children because of chronic malnutrition [45]. Stunting is usually associated with low socio-economic conditions, poor maternal health and nutritional status, inappropriate feeding and frequent hospital admissions in early life [46]. Linear growth is a strong predictor of morbidity, mortality and learning capability during later life. Stunting is largely irreversible; especially the first 1000 days from conception have adverse effects in child's life [47]. It has a major influence on the physical and cognitive development of a child [48]. According to UNICEF, WHO and World Bank Group 2020 report, an estimated 144 million children under the age of five suffer from stunting, globally. The stunting rates are decreasing in all regions worldwide, except for the African region that faces a rising number of stunted children [47]. The number of stunted

children under the age of 5 years in Africa has risen from 49.7 to 57.5 million between 2000 and 2019 [49]. During the same period, Southern Africa alone had reported the rise of 100,000 stunted under-5 years children [32].

2.6 Wasting in children under 5 years of age:

Wasting in a child is defined as low weight-for-height, where the weight-for-height Z-score is less than −2 s.d. from the median of the reference population. Wasting demonstrates an acute under-nutrition status that measures body mass with height and describes the current nutritional status of a child [32]. It usually indicates recent and severe weight loss because of unavailability of enough food and infectious diseases, such as diarrhea. A young child with moderate-to-severely wasted episodes has an increased risk of death [39].

The main underlying causes of wasting include poor access to appropriate healthcare, lack of food security, inappropriate feeding practices, a monotonous diet with low nutrient density, and lack of water, sanitation and hygiene services. Severe wasting episodes weaken a child's immunity, thereby making him or her susceptible to long-term developmental delays with an increased risk of death [50]. According to the 2020 WHO report, of the 47.0 million children under the age of 5 years who were wasted, 14.3 million were severely wasted, with over a one-third of them living in Africa [32].

1. **Underweight:**

   Underweight amongst children under the age of 5 years is defined as low weight-for-age, with a Z-score of −2 s.d. from the median of the reference population. This condition is a composite extraction of both stunting and wasting, that is, an underweight child may be stunted, wasted or both [51].

2. **Overweight**:

   Overweight refers to a child whose weight-for-height Z-score is above two standard deviations (+2 s.d.) from the median of the reference population. Overweight is an emerging face of childhood malnutrition. There are reportedly now 38.3 million overweight children globally, an increase of 8 million since 2000. The rise of the

overweight epidemic has been because of greater access to processed foods, along with lower levels of physical activity [52].

3. Severe Acute Malnutrition:

Severe acute malnutrition (SAM) is a severe form of malnutrition defined as weight-for *height/weight-for-length*, with a Z-score of −3 s.d. from the median of the reference population and the mid-upper-arm circumference of < 115 mm with bilateral nutritional edema [53]. Based on the current WHO guidelines, childhood malnutrition is broadly categorized into acute and chronic malnutrition. Acute malnutrition is further classified based on severity into Moderate Acute Malnutrition (MAM) (weight-for-height/weight-for-length with Z-score between –3 s.d. and –2 s.d.) and SAM as defined above [32].

2.7 Previous Related Study:

2.7.1 A study was conducted in Palpa by Pushkar Singh Raikhola PhD, Tribhuwan University, Kirtipur, Kathmandu, Nepal; with a sample size of 115 children (under 5 years) of Magar ethnic group of Nisdi Rural Municipality. The results showed that Out of 115 children, 60% were continuing breastfeeding whereas 1.7% dropped in less than 2 year and 38.3% continued for more than 2 years. Based on Gomez-classification for weight for age (Underweight), among 115 children only 26.1% children aged under 59 months were normal. While, more than half (53.9%) were mildly malnourished, 16.5% were moderately malnourished and 3.5% were severely malnourished. Based on Waterlow's classification for Weight for height (wasting), less than half 128 International Research Journal of MMC 128 (46.1%) children aged under 59 months were normal. While, 40.9% were mildly malnourished, 10.4% were moderately malnourished and 2.6% were severely malnourished [56].

2.7.2 Department of Community Medicine, Indira Gandhi Medical College and Research Institute, Pondicherry conducted a study in 2019 led by Kavita Vasudevan, Carounanidy Udayashankar that had a sample size of 5 villages in the field practice area of which Manapet village was chosen randomly. All children less than 5 years of age living in that village were included in the study. The results revealed that The prevalence of underweight, stunting and wasting in the study population 18.3%, 31.6% and 20.1% respectively. Proportion of moderate and severe underweight and wasting was highest in the age group of 11-23 months while proportion of moderate and severe stunting was highest in the age group of 48-59 months [57].

2.7.3 A cross-sectional study was done by Gawad M. A. Alwabr, Nwbal M. A. Alwabr Department of Biomedical Engineering, Sana'a Community College, Beit Annam Health Center, Ministry of Public Health, Sana'a Governorate, Sana'a, Yemen. The study was conducted at five rural health centers of Sana'a Governorate, from March to May 2018. A convenience sampling method was used in the selection of 150 mothers and their children under five. This study results showed that of all the children, 38.7% had Mild Malnutrition, 34% had Moderate Malnutrition, 6.7% had Severe Malnutrition, and 20.7% were normal. Majority of the participants' mothers (81.3%) were not knowledgeable about malnutrition causes. Place of delivery, mothers' education, fathers' education, age of mothers in the first pregnancy, numbers

of all children per household, a child's weight at birth, and age of the child at weaning. Despite the efforts of redressing child malnutrition issues in Yemen, the proportion of malnutrition among children under the age of five still high. Multiple intervention strategies based on risk factors can reduce early malnutrition of the children under the age of five [58].

2.7.4 A Hospital-based Case Control Study in Bangladesh was conducted in 2017 by Mustapha Kabir Musa , Faisal Muhammad , Kabir Musa Lawal , A B M Alauddin Chowdhury , Ahmed Hossain. The study had a sample of of 196 children under 5 years (98 cases and 98 controls) whose age ranged from 6 to 60 months were included in the study, data were collected retrospectively using a questionnaire, and mid-upper arm circumference (MUAC) was taken using standard procedures. The results ended up revealing that Severe Acute Malnutrition was found to be associated with father's education level, lack of taking balanced diet, and irregular hand washing. Interventions to reduce malnutrition and address the factors contributing to malnutrition should be a policy priority [59].

2.7.5 A study was carried out by Ghosh et al, to determine the prevalence of under nutrition among the Nepalese children of Kathmandu Valley which showed that prevalence of stunting and underweight (below-2 Z-score) was similar in both boys(45.57% stunting and 52.465 underweight) and girl (43.42% stunting and 46.09% underweight).Likewise, it revealed that a high prevalence of under nutrition exists in Nepalese children, although the magnitude of under nutrition is similar in both boys and girls [60].

2.7.6 Nabila Ali Ahmad Alsonini, and Muhammed Saleh Abdullah Masood, Associate Professor, Geographic Department, Faculty of Education and Language, Amran University, Yemen, had carried out a research about The Nutritional Indices Patterns of Children under 5 years Old in Sana'a City in 2015. The results of chi-square and analysis of variance revealed that highly significant stunting among children in Sanhan District when compared to others ($P < 0.01$), while risk of wasting among Snahan's children was likely to be lower significant as compared to other districts. In addition, risk of wasting and underweight among children of Al-sabeen District was likely to be lower significant as compared to other districts. Risk of stunted significantly was higher more in old children (12 - 59) compared to youngest (0 - 11)

(P < 0.01), underweight was more highly significant prevalent among (36 - 59) months old children, while risk of severe and moderate wasting were higher among (0 - 11) months youngest children as compared to (24 - 35) months old children (P < 0.01) [61].

2.7.7 A cross-sectional study titled Nutritional Status of Children under Five Years and Associated Factors in Mbeere South District, Kenya was conducted in 2014 by Kenya Agricultural Research Institute (KARI), with a sample size of total of 144 households that was randomly sampled, and the nutritional status of one child from each household assessed using anthropometric measurements. Up to 39% of the children were stunted; 7.1% were wasted; and 18.1% underweight. The prevalence of stunting and wasting was significantly higher in boys than in girls (χ =6.765, P =.034) and (χ= 13.053, P = .036), respectively [62].

2.7.8 A study conducted by Department of Public Health, Faculty of Science and Technology, Pokhara University, Kaski, Nepal in 2013; titled Nutritional Status of Under Five Year Children and Factors Associated in Kapilvastu District, Nepal. With a sample size of 76 Village Development Committees, out of these 76, 30 were selected by using simple random sampling method. For collecting required information, 15 pairs of under five year children and their mother/care taker were measured and interviewed from each conveniently. Later on, the results showed that more than 60% children had any kind of malnutrition. Out of them, nearly one-fourth children were in critical condition (below -3SD) and they need immediate intervention [63].

Chapter 3

Materials and Methods

3.1 Study design:

Descriptive cross-sectional study used to study on factor affecting nutritional status of children of age 1 -59 months who were admitted to hospitals and health centers during the period of study.

3.2 Study Site and Time:

Children age 1 -59 months admitted during period of study (May 1st 2024 to May 20th 2024) to four targeted hospitals and one health center:

- **Al-Gumhuri Tertiary Hospital:**

A central hospital at the heart of Sana'a city that receives about 318900 cases, with pediatrics wards and nurseries registering 24313 cases on daily basis [64].

- **Al-Kuwait Hospital:**

A referral hospital on the northeast of Sana'a that receives most of the pediatric from Al-Tahrrir District which counts for about 5230 [65].

- **Al-Zahrawy Medical Center:**

A district private health center that receives about 100,000 pediatric cases from Al-Saffiah District in Sana'a which counts for about 109109 [65].

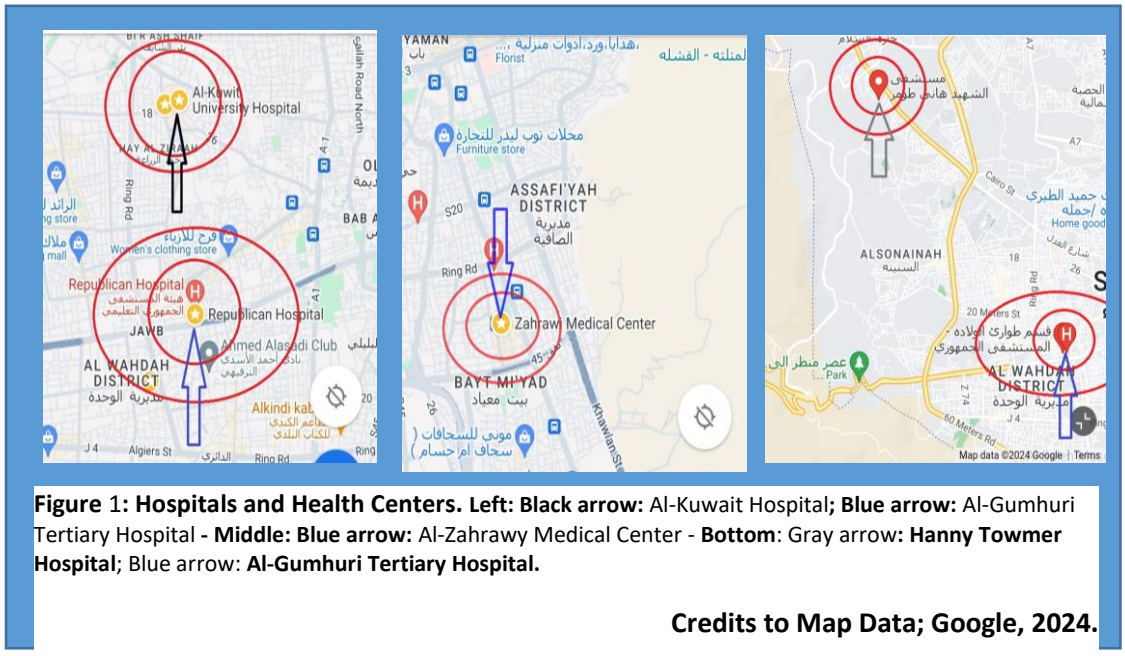

Figure 1: **Hospitals and Health Centers. Left: Black arrow:** Al-Kuwait Hospital**; Blue arrow:** Al-Gumhuri Tertiary Hospital **- Middle: Blue arrow:** Al-Zahrawy Medical Center - **Bottom**: Gray arrow**: Hanny Towmer Hospital**; Blue arrow: **Al-Gumhuri Tertiary Hospital.**

Credits to Map Data; Google, 2024.

- **Hanny Towmer Hospital:**

A district hospital in Mo'een District that receives 1500 cases on a weekly estimation of 200,000 patient overall [66].

- **Al-Sabeen Hospital:**

A specialized referral hospital in Sana'a city that receives advanced pediatric cases with specialized department for malnutrition care. The hospital resides in Al-Sabeen District, which has about 45016 potential case daily [65].

The aforementioned hospitals and health center welcomed the research proposal, and agreed to participate; except for Al-Sabeen Hospital which refuse to accept us.

3.3 Study population:

3.3.1 Inclusion Criteria:

All children ages 59 months or less, admitted to clinical ward of Al-Gumhuri tertiary hospital, Al-Kuwait Hospital, Al-Zahrawy Health Center, and Hany Towmer Center.

3.4 Sample Size and Sampling Technique:

Sample size was determined by using Kish and Leslie (1965) a single population proportion formula [67].

$$n = (Z^2 (P)(1-P))/e^2$$

n is the sample size required, calculated to be (n=384),

e is the margin of error (confidence interval) of 5% (e = 0,05),

Z is the degree of accuracy required (95% level of significance = 1,96).

P is the estimated proportion of the study variable (standard deviation)

p = 0,5 (50%) was used because the population size is unknown.

And to increase the precision the sample size used was 400.

3.5 Data Collection Method and Tools:

The data was collected using structural administered questionnaire [Appendix]. Questionnaire was specially designed to extrapolate the necessary information to determine possible risk factors of disturbed nutritional status. After modification, we finally came up with a final form of the questionnaire. It consisted of five main parts:

First part: Demographic Data (Age, Gender, Residence, Number of Family Members).

Second part: Parents' information and Vaccination.

Third part: Special Nutritional Conditions.

Fourth part: Co-morbid Disease(s).

Fifth part: Anthropometry: Measurement such as height weight and other measurements in human are important tools in the evaluation of measurement of individual or groups. The basic anthropometrics measurements are made in malnutrition surveys like height, weight and circumference (Mid Upper Arm Circumference):

- **Weight-for-Age (W/A):** Low weight-for-age identifies the condition of being underweight at a specific age. W/A is used to identify the nutritional condition **underweight**, which is a composite measure of stunting and wasting. Normally the weight of baby in birth is 2.5 kg and should be double than in birth within 5 month, 3 times within a year, 4^{th} times in two years and 5 times in 3 years.

- **Height-for-Age (H/A):** H/A is an indicator of past or chronic malnutrition. Deficits in L/A or H/A are signs of **stunting**. Normally in birth, the height of baby is 50 cm, and should be 60cm within 3 month, 70cm in 9month and 75cm in a year.

- **Weight-for-Height (W/H):** Helps to identify children suffering from current or acute malnutrition. It is used to examine short-term effects, i.e. recent rapid weight loss associated with a period of starvation and/or severe disease. **Wasting** results from weight falling significantly below the weight expected of a child of the same length or

height. Wasting indicates current/acute malnutrition resulting from feeding practices, diseases and infection, or, more frequently, a combination of these factors. Wasting in individual children and population groups can change rapidly and shows marked seasonal patterns associated with changes in food availability or disease prevalence.

- **Mid Upper Arm circumference (MUAC) Tape:** It is a measuring tool for assessment of children's nutritional status. The left upper arm is measured while hanging freely, at its midpoint. The arm circumference is considered as a useful and practical means of assessing the protein-energy childhood. The three bands used in this study that indicate the state of nutrition through measurement are:

  - **Red band:** Measures 11.5cm or lower show severe malnutrition.
  - **Yellow band:** Measures 11.6 to 13.4cm shows under nutrition and those at risk.
  - **Green band:** Measures 13.5cm or higher shows adequately nourished child.

3.6 Data analysis:

Three anthropometric indicators were utilized to assess children' nutritional status: weight-for-age (W/A), length-forage (L/A) and weight-for-length (W/L) based on WHO 2006 Growth Standards and deficits found classified infants as follows [68]:

Wasting (Global acute malnutrition) was W/L <-2 Z-score (W/L < -3 Z-scores = severe wasting and W/L ≥ -3 Z-Scores and < -2 Z-Scores = Moderate Wasting).

The classification used for Stunting was L/A <-2 Z-score (L/A < -3 Z-Scores = Severe Stunting and L/A ≥ -3 Z-Scores and < -2 Z-Scores = moderate Stunting).

The classification used for underweight was W/A <-2 Z-score (W/A < -3 Z-Scores = Severe Underweight and W/A ≥ -3 Z-Score and <-2 Z-Scores = Moderate Underweight).

The classification of severity of malnutrition was based on WHO guidelines for assessing malnutrition as a follows [69]:

Wasting: Low: <5%, Medium: 5-9%, High: 10-14% and Very High: ≥15%,

Stunting: Low: <10%, Medium: 10-19%, High: 20-29% and Very High: ≥30%

Underweight: Low: <20%, Medium: 20-29%, High: 30-39% and Very High: ≥ 40%.

The collected data was entered and analyzed using the statistical program SPSS version 26, applying the appropriate statistical tests as Chi-square Fisher exact test (p value < 0.05 is considered statistically significant). Descriptive and inferential statistics were done and the data were presented as frequency and percentage. Data will also be presented using tables and figures.

4 Ethical consideration:

Ethical approval for this study dated back to May 8, 2024 and was acquired from the Ethics Committee of the Faculty of Medicine and Health Sciences, Emirates International University prior to data collection. An official letter was obtained from the Faculty of Medicine and Health Sciences, to be submitted to the administration of previously mentioned hospitals. Consents was taken from all centers' management and staff, and they were be informed that participation is voluntary and that they can refuse this without stating any

reason. Among selected hospitals, Al-Sabeen Hospital refused to participate in the study completely. Consent was also taken from parents and caregivers/guardians of participating children prior to any data collection; ensuring that they were aware that participation is voluntary and they can refuse it without stating any reason. A feedback about the results of the study was given to the participants and contributors at the end of the study.

Chapter 4

Results

Result

Of the 400 child, ages 1 to 59 months, admitted to pediatric wards in each of the selected cooperated hospitals and health centers mention in the previous chapter during the study period. Our study found the following results:

4.1 Demographic Distribution:

Four hundred patients constituted the study sample. The age distribution of children were 253 for children ages 1 to 24 months (one month up to 2 years old), and 147 for those 25 to 59 months old (2 to 5 years old), with a mean age of 22.1±15.68 months. (Table 1).

Table 1: Distribution of Participants According to Age in Months

		Frequency	Percentage
Age in Months Mean± SD (22.1±15.68)	**1 – 24**	**253**	**63.2**
	25 – 59	**147**	**36.8**
	Total	**400**	**100.0**

In this study, 212 (53%) were males and 188 (47%) were females (Table 2) (Figure 2).

Table 2: Distribution of Participants According to Sex

		Frequency	Percentage
Gender	**Male**	**212**	**53.0**
	Female	**188**	**47.0**
	Total	**400**	**100.0**

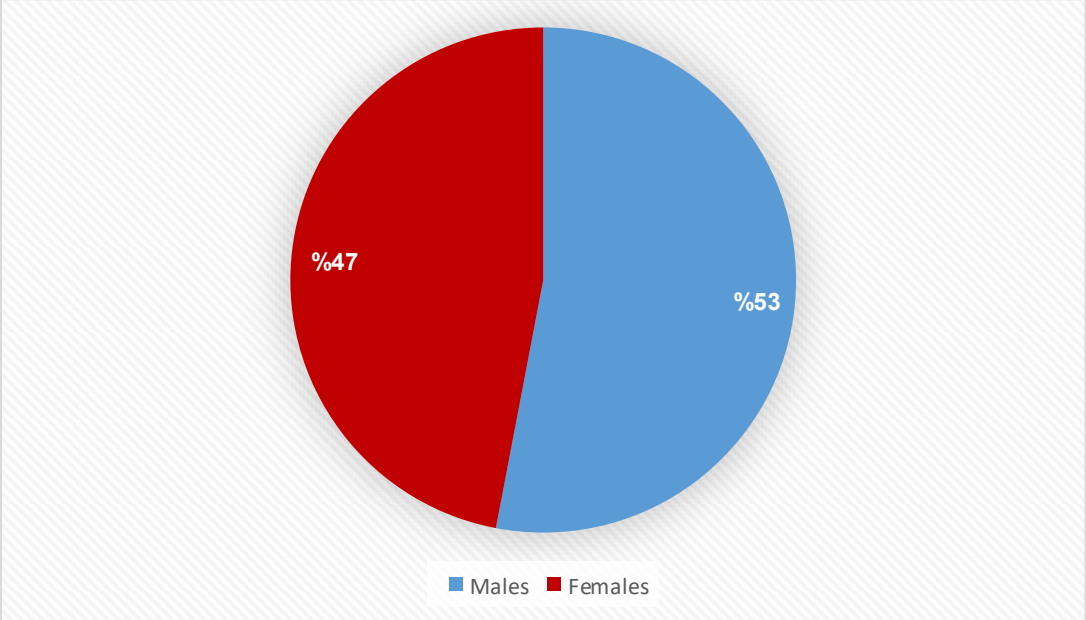

Figure 2: Distribution of Participants According to Sex

All participants have records of their weight at birth, which the mean ± SD was 2.947±0.40. The count of family members, currently living with each child in the same household on daily basis, happened to be between the minimum of 3 to maximally 15 members in total, with the mean of 5.68±2.2. The most common number of members in the child's family was 4 with a percentage of 21.5% (Table 3) (Figure 3).

Table 3: Distribution of Family Size According to Number of Family Members

		Frequency	Percentage
Family Members **Mean± SD (5.68±2.267)**	**3**	**59**	**14.8**
	4	**86**	**21.5**
	5	**76**	**19.0**
	6	**63**	**15.8**
	7	**49**	**12.3**
	8	**18**	**4.5**
	9	**21**	**5.3**
	10	**11**	**2.8**
	11	**5**	**1.3**
	12	**8**	**2.0**
	13	**2**	**.5**
	14	**1**	**.3**
	15	**1**	**.3**
	Minimum	**3**	
	Maximum	**15**	
	Total	**400**	**100.0**

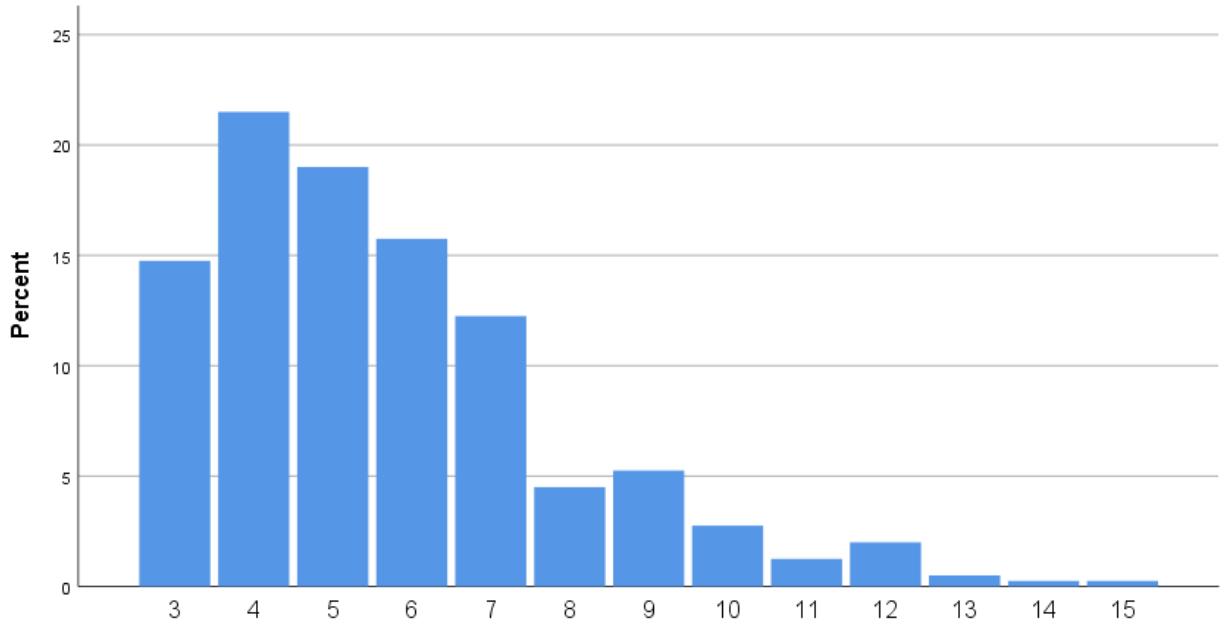

Figure 3: Distribution of Family Size According to Number of Family Members

Among study sample, 131 child (32.8%) resides originally in rural area, and 269 (67.3%) lives permanently in urban areas (Table 4) (Figure 4).

Table 4: Distribution of Participants According to Residency

		Frequency	Percentage
Residence	**Rural**	**131**	**32.8**
	Urban	**269**	**67.3**
	Total	**400**	**100.0**

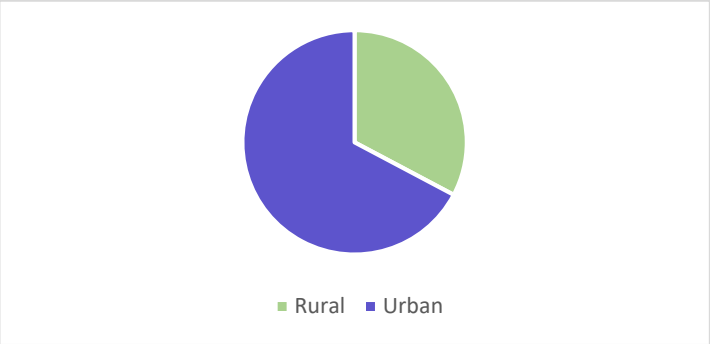

Figure 4: Distribution of Participants According to Residency

4.2 Anthropometric Measurements:

All of MUAC, height, and weight were measured in centimeters and kilogram respectively. The readings were later converted to Z-scores for both height and weight using SPSS with the addition of WHO Child Growth Standards SPSS Syntax File (Table 6). The mean for weight in study sample was -1.27±22, and mean for height was 0.2±1.0. MUAC readings were classified to *Green*, *Yellow*, and *Red* to indicate severity as previously explained in *Chapter 3* (Table 7) (Figure 5).

Table 5: Z-score Converted Anthropometric Measurements in Participants

	Minimum	Maximum	Mean	Std. Deviation
Z-score: Weight for Age	**-4.357257**	**2.48029**	**-1.2711457**	**220787.271440**
Z-score: Height for Age	**-2.28696**	**2.38254**	**.20000**	**1.0000**
Z-score Weight for Height	**-3.99**	**3.00**	**1.2890**	**1.66488**

Table 6: Mid Upper Arm Circumference in Study Participants

		Frequency	Percentage	Indicator
MUAC	**≤11.5**	**140**	**35.0**	Red
	≥13.5	**40**	**10.0**	Green
	11.6 - 13.4	**218**	**55.0**	Yellow
	Total	**400**	**100.0**	

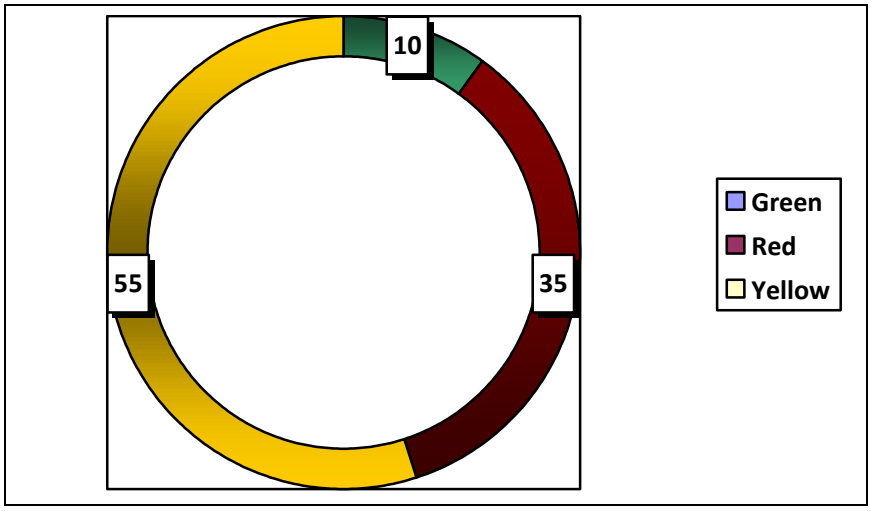

Figure 5: Mid Upper Arm Circumference in Study Participants

Co-morbid diseases were present in study sample with 92.9% of children suffering from a co-morbid condition, and 7.1% were free from any additional diseases. Diarrheal diseases were the most frequent systemic co-morbid disorders in study sample (36.6%) (Table 8) (Figure 6).

Table 7: Co-morbid Conditions among Participants

		Frequency	Percentage
Co-morbidities	**Anemia**	**36**	**13.6**
	Diarrheal Diseases	**96**	**36.6**
	Edema	**11**	**3.1**
	Fever	**70**	**30.3**
	Hypothermia	**1**	**.3**
	Critical Illness Resulting in Weight Loss	**67**	**30.2**
	Respirators Disorder	**78**	**32.2**
	Skin Rash	**17**	**4.4**
	None	**24**	**7.1**
	Total	**400**	**100.0**

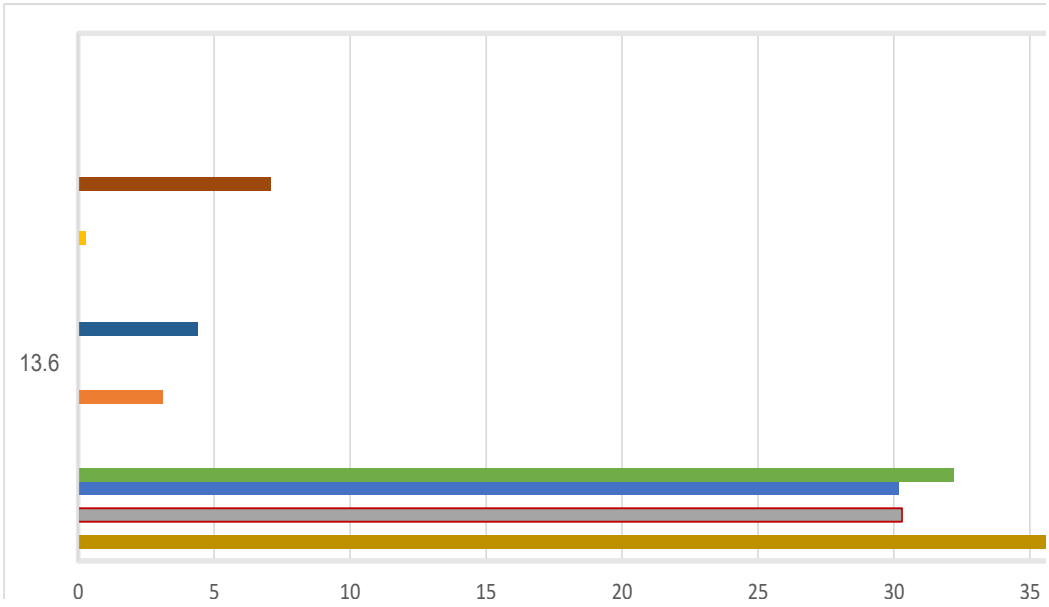

Figure 6: Co-morbid conditions among Participants

4.3 Nutritional Status:

In the present survey, the three forms of malnutrition (wasting, stunting, and underweight) are defined independently based on 2006 WHO growth standards:

4.3.1 Prevalence of wasting (Global Acute Malnutrition):

The prevalence of moderate wasting was 69.5% (CI: 5.1%-10.2%), while severe wasting constituted 17.3% (CI: 2.3%, 6.7%) (Table 8) (Figure 7).

Table 8: Distribution of Wasting among Study Participants

		Frequency	Percentage	95% Confidence Interval of the Difference	
				Minimum	Maximum
W/H	Severe Wasting	69	17.3	2.3	6.7
	Moderate Wasting	278	69.5	5.1	10.2
	Within Normal	53	13.3	13.3	14.1

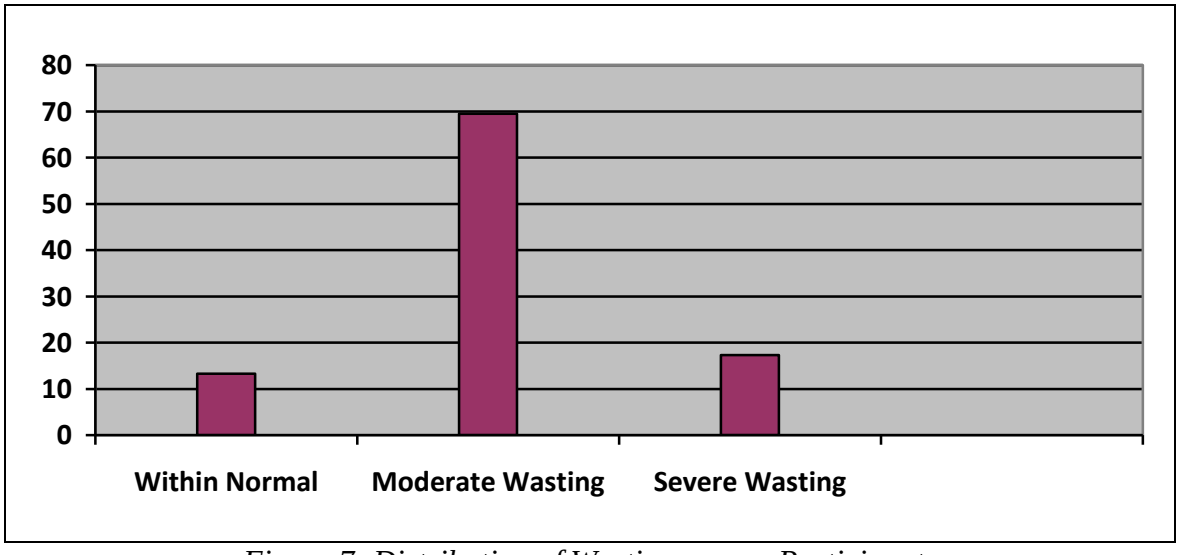

Figure 7: Distribution of Wasting among Participants

4.3.2 Prevalence of stunting (Chronic Malnutrition):

The prevalence of stunting was 70.2% (95% CI: 17%, 25%) for children who were shown to have moderate stunting, and 7.3% (95% CI: 15.3%, 23.2%) for those severely stunted (Table 9) (Figure 8).

Table 9: Distribution of Stunting among Participants

		Frequency	Percentage	95% Confidence Interval of the Difference	
				Minimum	Maximum
H/A	Within Normal	90	22.5	22.4	22.5
	Severe Stunting	29	7.3	15.3	23.2
	Moderate Stunting	281	70.2	17.0	25.0

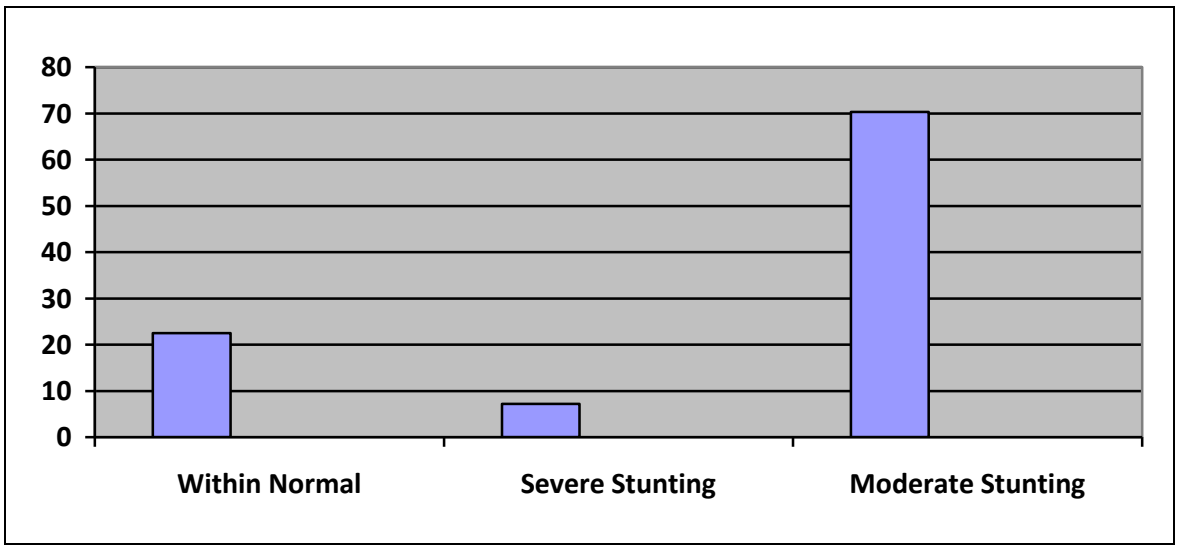

Figure 8: Distribution of Stunting among Participants

4.3.3 Prevalence of Underweight:

The prevalence of underweight was 75.8% (95% CI: 12%, 19.1%) for children who were moderately underweight, and 9.3% (95% CI: 2.7%, 7.3%) for severely underweight (Table 10) (Figure 9).

Table 10: Distribution of Underweight among Participants

		Frequency	Percentage	95% Confidence Interval of the Difference	
				Minimum	Maximum
W/A	Severe Underweight	37	9.3	2.7	7.3
	Moderate Underweight	303	75.8	12	19.1
	Within Normal	60	15.0	15.0	15.2.0

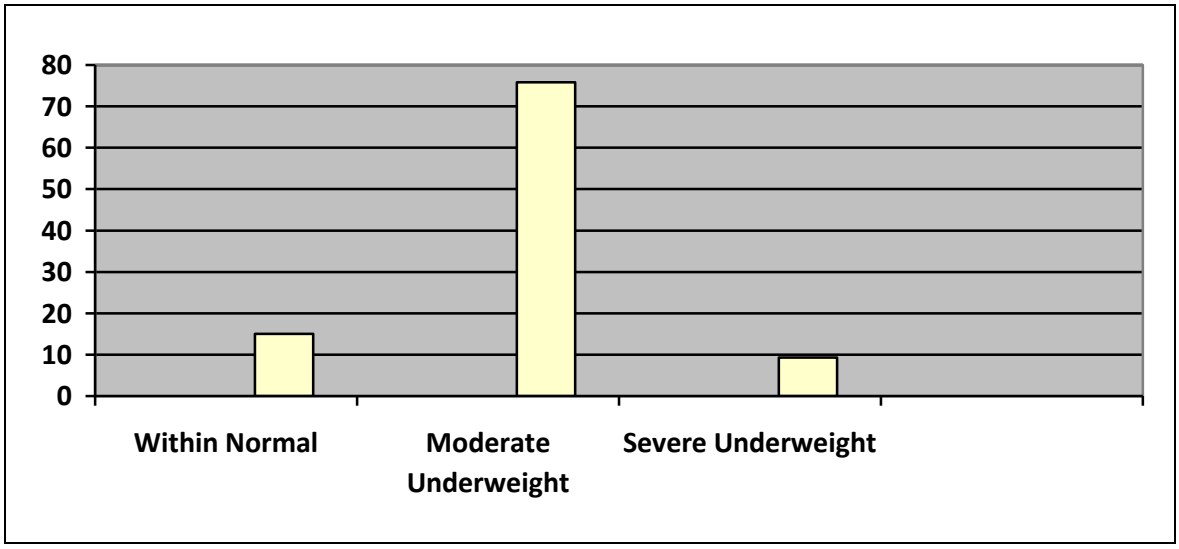

Figure 9: Distribution of Underweight among Participants

4.3.4 Prevalence of the severity of malnutrition among children:

Based on the classification developed by WHO, the prevalence of global acute malnutrition (wasting) in the present study is 17.4% (95% CI: 8.6%, 25%) which is classified as "*very high*". The prevalence of chronic malnutrition (stunting) is 38.75% (95% CI: 35.1%, 44.9%), and classified also as "*very high*". Moreover, the prevalence of underweight is 42.1% (95% CI: 16.2%, 24.3%) that is classified as "*very high*", as well (Table 11)

Table 11: Prevalence of the severity of malnutrition among Participants

Indicators	Severity of Malnutrition (%)				
	Prevalence	Low	Mid	High	Very High
Wasting	17.4%	<5	5 – 9	10 – 14	≥15
Stunting	38.75%	<10	10 – 19	20 – 29	≥30
Underweight	42.1%	<20	20 - 29	30 - 39	≥40

4.3.5 Association between Nutritional Status and Demographic Characteristics:

4.3.5.1 Age:

There was significant association between age and being underweight ($\mathcal{X}2$ = 109.2, P < 0.05). 74.3% of children 0 to 24 months were moderately underweight, while 25.7% suffered from being severely underweight. Moreover, 70.3% of children, 25 to 59 months, were moderately underweight, while 29.7% suffered for being severely underweight (Table 12). There was no significant association regarding stunting or wasting with age ($\mathcal{X}2$ = 0.48 and $\mathcal{X}2$ = 1.0 respectively with P= 0.87 and P= 0.9 respectively).

Table 12: Association between Age and Prevalence of Underweight among Participants

			Age Intervals			P value
			1 - 24	25 - 59	Total	
Weight Status	**Severe Underweight**	**Count**	26	11	37	**0.000**
		% within Weight Status	70.3%	29.7%	100.0%	
		% of Total	6.5%	2.8%	9.3%	
	Moderate Underweight	**Count**	225	78	303	
		% within Weight Status	74.3%	25.7%	100.0%	
		% of Total	56.3%	19.5%	75.8%	
	Within Normal	**Count**	2	58	60	
		% within Weight Status	3.3%	96.7%	100.0%	
		% of Total	0.5%	14.5%	15.0%	
		Chi-square	109.246			

4.3.5.2 Gender:

There was no significant association between gender and stunting, wasting, or being underweight ($\mathcal{X}^2$ = 1.57, 5.35, and 0.872 respectively, and P = 0.6, 0.1, and 0.56 respectively). Among males, 39.3% were severely underweight and 5% were moderately underweight; while, it was 33.3% being moderately stunting with 4% were severely stunting in females.

Males scored 39% for moderate wasting, while females scored 30%, and males scored 7% for severe wasting, while females scored 10.3%.

4.3.5.3 Residence::

There was a significant relationship between residence and the prevalence of stunting ($\mathcal{X}2$ = 1.36, P = 0.001 < 0.05). Moderate and severe stunting scored 22% and 3% respectively in rural areas, while it scored 48.3% and 4.3% respectively in urban areas (Table 13). There was no significant relationship between residence and the prevalence of wasting or being underweight. Moderate and severe wasting scored 23.3% and 3.3% respectively in rural areas, while it scored 46.3% and 14% respectively in urban areas. Regarding being underweight, prevalence in rural areas was 25.3% for moderately underweight, and 3% for severely underweight, and urban area scored 50.5% and 12% respectively.

Table 13: Association between Residence and Prevalence of Malnutrition among Participants

			Residence		Total	P value
			Rural	Urban		
Height Status	Within Normal	Count	31	59	90	0.001
		% within Height Status	34.4%	65.6%	100.0%	
		% of Total	7.8%	14.8%	22.5%	
	Severe Stunting	Count	12	17	29	
		% within Height Status	41.4%	58.6%	100.0%	
		% of Total	3.0%	4.3%	7.2%	
	Moderate Stunting	Count	88	193	281	
		% within Height Status	31.3%	68.7%	100.0%	
		% of Total	22.0%	48.3%	70.3%	
		Chi-square	1.360			

4.3.5.4 Co-morbid Conditions:

There was a significant relationship between Co-morbid Diseases and the prevalence of wasting ($\mathcal{X}2$ = 404.3, P< 0.05). Diarrheal Diseases, being the most prevalent co-morbid disease that scored 22% and 18% on severe and moderate wasting respectively (Table 14).

Table 14: Association of Comorbid condition with prevalence of malnutrition among Participants

Comorbid condition		Weight Status			Weight for Height			Height Status			P-value
		Severe Underweight	Moderate underweight	Within Normal	Severe Wasting	Moderate Wasting	Within Normal	Within Normal	Severe Stunting	Moderate Stunting	
	Anemia	10	6	5	10	2	01	12	3	0	.000
	Diarrheal Diseases	16	5	13	22	15	5	5	10	15	
	Edema	0	6	0	1	0	0	0	4	0	
	Fever	12	20	5	2	20	3	3	1	4	
	Hypothermia	0	0	0	1	0	0	0	0	0	
	Critical Illness Resulting in Weight Loss	33	14	0	10	6	0	0	0	4	
	Respiratory Disorder	11	15	2	20	18	0	1	3	10	
	Skin Rash	3	2	5	4	0	0	0	3	0	
	None	2	6	8	0	4	0	4	0	0	
	Chi-square	404.3									

4.4.5.1 Association between Nutritional Status and Vaccination Status of Children:

Regarding vaccination, 82% of children reported to have completed all their vaccinations, 69.3% of them being on time. The table below shows the vaccination status of study population (Table 15).

Table 15: Vaccination status and characteristics among Participants in the Study

Variables	Value	Number	Percent
Vaccine completion	Yes	328	82 %
	No	288	18 %
Vaccine Timing	On Time	277	69.3%
	Late	57	14.2%
Vaccine Type	TB	334	83.5 %
	Polio	322	83.2 %
	PENTA	321	80.3 %
	PCV	320	80 %
	Rota	320	80 %
	Measles	256	64%
	Vitamin A	256	64%

The table below shows the causes of why there were children who did not get their vaccines fully, and the conditions that have contributed (Table 16).

Table 16: Causes for Vaccine Incompliance among Participants

		Frequency	Percent
Vaccine incompletion	Not Yet Vaccinated	72	18.0
	Yes: Anemia	1	.3%
	Yes: Chronic Diarrhea	2	.5%
	Yes: Diarrhea + Fever	3	.8%
	Yes: Fever	2	.5%
	Yes: Unspecified Illness	1	.3%
	Yes: No Cause	1	.3%
	Yes: No Center Of Vaccine	5	1.3%
	Yes: Vaccine Unavailable	2	.5%
	Yes: Skin Rash	1	.3%
	Yes: Weak Infant	1	.3%
	Yes: Away From Vaccine Center	7	2.8%
	Yes: Continuous Fever	3	.8%
	Yes: Family Refused	2	.5%
	Yes: Father Refused	24	6.4%
	Yes: Lack Of Awareness	11	3.1%
	Yes: Negligence	4	1.0%
	Yes: Repeated Illness	1	.3%
	Total	400	100.0%

4.4.5.2 Association between vaccination and prevalence of malnutrition:

There was no significant association between vaccination status and nutritional status in this study (Table 17).

Table 17: Association between vaccination completion and prevalence of malnutrition

		Malnourished	Within Normal	P-value
Vaccine completion	**Yes**	**20**	**182**	**0.28**
	No	**177**	**21**	
Chi-square		**11.69**		

4.4.5.3 Association between Vaccination status and Demographic characteristics among malnourished children:

There was a significant association between vaccination status and Demographic characteristics among malnourished children in this study ($\mathcal{X}2$ = 11.6, P= 0.03). Most malnourished children who did not take any vaccine were of fathers who were workers and farmers, of illiterate married housewives mothers, lives in rural areas, and whom monthly income between 50 and 100 thousand Yemeni ryals. Whereas, children who took their vaccines were of fathers who were workers, live in urban areas, of hghschool level mother who were also housewives, and of household income between 100 – 150 ryals per month (Table 18).

Table 18: Association between family incomes with vaccination status among malnourished children.

	Income	Number of Malnourished Children		P-value
		Incompletion	Completion	
Family Income	>200	0	0	0.03
	<50	14	43	
	100 - 150	15	60	
	150 - 200	4	21	
	50 - 100	30	97	
Chi-square	11.6			

The following table shows the distribution of malnourished children among fathers of various occupations, and their vaccination status (Table 19).

Table 19: Association between Father Occupations with Vaccination Status among malnourished children in the Study

	Occupation	Number of Malnourished Children		P-value
		Incompletion	Completion	
Father Occupation	Carpentry	0	0	0.03
	Expatriate	0	1	
	Farmer	22	25	
	government Work	9	38	
	None	2	2	
	Private work	5	42	
	Worker	27	130	
Chi-square	11.6			

The following table shows the distribution of malnourished children among mother of various occupations, and their vaccination status (Table 20)

.

Table 20: Association between Mother Occupations with Vaccination Status among malnourished children in the Study

	Occupation	Number of Malnourished Children		P-value
		Incompletion	Completion	
Mother occupation	Accountant	0	1	0.03
	Bank worker	0	0	
	Cleaner	1	0	
	Farmer + House wife	2	9	
	House wife	59	205	
	Laboratory Tech.	0	2	
	Nurse	1	5	
	Pharmacy	0	2	
	Secretariat	1	2	
	Student	0	6	
	Teacher	0	5	
	Worker	1	1	
Chi-square	11.6			

The following table shows the distribution of malnourished children among mother of various marital statuses, and their vaccination status (Table 21)

Table 21: Association between Marital Status with Vaccination Status among malnourished children in the Study

Marital Status	Status	Number of Malnourished Children		P-value
		Incompletion	Completion	
	Divorced	2	2	0.03
	Married	61	234	
	Widow	2	2	
Chi-square	11.6			

The following table shows the distribution of malnourished children and their residence, along their vaccination status (Table 22).

Table 22: Association between Residence with Vaccination Status among malnourished children in the Study

Residence	Status	Number of Malnourished Children		P-value
		Incompletion	Completion	
	Rural	38	175	0.03
	Urban	27	2	
Chi-square	11.6			

The following table shows the distribution of malnourished children and their housing condition, along their vaccination status (Table 23).

Table 23: Association between Housing Conditions with Vaccination Status among malnourished children in the Study

Housing	Status	Number of Malnourished Children		P-value
		Incompletion	Completion	
	Own	39	137	0.03
	Rent	26	101	
Chi-square	11.6			

The following table shows the distribution of malnourished children among mothers in various education levels, along their vaccination status (Table 24).

Table 24: Association between Mother Education with Vaccination Status among malnourished children in the Study

Mother Education	Occupation	Number of Malnourished Children		P-value
		Incompletion	Completion	
	Illiterate	22	41	0.03
	Elementary School	16	40	
	Middle School	15	59	
	High School	9	71	
	University	3	27	
Chi-square	11.6			

4.5 Mother Characteristics and Associations:

4.5.1 Age:

The mean for mothers' age appeared to be 28.66±6.368 with the majority of mothers happened to be between ages 26 to 34 years old (Table 25 and 26).

Table 25: Mean age of Participants' Mothers

	N	Minimum	Maximum	Mean	Std. Deviation
Mother Age	**400**	**16**	**82**	**28.66**	**6.368**
Valid N (list-wise)	**400**				

Table 26: Distribution of Participant' Mothers According to Age

		Frequency	Percentage
Age in Years Mean± SD (28.66±6.368)	<18	8	2.1
	19 - 25	90	22.5
	26 - 34	229	57.1
	35 - 49	73	18.3
	>50	1	.3
	Minimum	16	
	Maximum	82	
	Total	400	100.0

4.5.1.1 Association of mothers' age and the prevalence of malnutrition:

There was a significant association between mothers' age the prevalence of wasting ($\mathcal{X}2$ = 16.4, P < 0.05). The majority of wasted children belonged to mothers aging 26 to 34 with 15.8% of these children suffered from severe wasting and 53.8% were moderately wasted. There was no significant association between mothers' age and stunting or underweight (Table 27).

Table 27: Association of mothers' age and the prevalence of Wasting among Participants

			Mother Age Intervals		Total	P-value
			19 - 25	26 - 34		
Weight for Height	Severe Wasting	Count	6	63	69	.000
		% within Weight for Height	8.7%	91.3%	100.0 %	
		% of Total	1.5%	15.8%	17.3%	
	Moderate Wasting	Count	63	215	278	
		% within Weight for Height	22.7%	77.3%	100.0 %	
		% of Total	15.8%	53.8%	69.5%	
	Within Normal	Count	21	32	53	
		% within Weight for Height	39.6%	60.4%	100.0 %	
		% of Total	5.3%	8.0%	13.3%	
		Chi-square	16.4			

4.5.2 Education:

The education levels of mothers in study sample were recorded and categorized; with the majority (25%) of them stopped perusing education past high school. Whereas, 21.8% were illiterate (Table 28).

Table 28: Distribution of education levels among Participants' Mothers

		Frequency	Percentage
Education Level	Illiterate	87	21.8
	Elementary School	76	19.0
	Middle School	93	23.3
	High School	102	25.5
	University	42	10.5
	Total	400	100.0

4.5.2 Association between mothers' education level and prevalence of wasting

There was a significant association between mother's education level and prevalence of wasting ($\mathcal{X}2 = 21.1$, $P < 0.05$) with mothers at high school level scoring 18.3% for moderate wasting and 5.5% for severe wasting. There is no significant associations between mother's education level and stunting or being underweight in the study sample (Table 29).

Table 29: Association between mothers' education level and prevalence of Wasting

		Severe Underweight	Moderate underweight	Severe Stunting	Moderate Stunting	Severe Wasting	Moderate Wasting
Mother education	Illiterate	10	63	7	56	13	57
	Elementary School	10	56	5	56	12	57
	Middle School	7	74	4	72	16	56
	High School	6	80	9	68	22	73
	University	4	30	4	29	6	35
Total		37	303	29	281	69	278
Chi-square						21.1	
P-value						.000	

4.5.3 Marital Status:

The majority of participants 97% were currently married in this study, while 2% were divorced, and only 1% were widows (Table 30).

Table 30: Distribution of among Participants' Mothers According to Marital Status

		Frequency	**Percentage**
Marital Status	**Divorced**	8	2.0
	Married	388	97.0
	Widow	4	1.0
	Total	400	100.0

There was no significant association between mother's marital status and prevalence of malnutrition (Table 31).

Table 31: Association between Marital Status and prevalence of malnutrition among Participants

		Severe Underweight	Moderate underweight	Severe Stunting	Moderate Stunting	Severe Wasting	Moderate Wasting
Mother marital status	Divorced	1	4	1	7	0	8
	Married	36	295	28	270	68	267
	Widow	0	4	0	4	1	3
Total		37	303	29	281	69	278

4.5.4 Occupation:

Regarding occupation**,** 87% of mothers were house-wives, 3.8% were both farmers and house-wives, 1.8% were either students or teachers (Table 32).

Table 32: Distribution of Participants' Mothers According to occupation

		Frequency	Percentage
Occupation	Accountant	1	.3
	Bank worker	1	.3
	Cleaner	1	.3
	Farmer + House wife	15	3.8
	House wife	348	87.0
	Laboratory	4	1.0
	Nurse	6	1.5
	Pharmacist	4	1.0
	Secretariat	3	.8
	Student	7	1.8
	Teacher	7	1.8
	Worker	3	.8
	Total	400	100.0

There is a significant association between mother's occupation and prevalence of malnutrition (Table 33).

Table 33: Association between Family's Income and prevalence of malnutrition among Participants

			Income in Thousand Ryals					Total
			< 50	50 - 100	100 - 150	150 - 200	> 200	Total
Weight for Height	Severe Wasting	Count	13	70	28	11	0	69
		% within Weight for Height	18.8%	27.4%	30.2%	17%	0.0%	100.0 %
		% of Total	3.3%	3.0%	9.0%	3%	0.0%	17.3%
	Moderate Wasting	Count	57	115	68	37	0	278
		% within Weight for Height	20.5%	62.5%	30.1%	13.2 %	0.4%	100.0 %
		% of Total	14.2%	37.2%	46.0%	9.1%	0.3%	69.5%
	Within Normal	Count	17	7	21	4	0	53
		% within Weight for Height	32.1%	13.2%	39.6%	6.1%	0.0%	100.0 %
		% of Total	4.3%	1.8%	5.3%	0.9%	0.0%	13.3%
Total		P-value	.000					
		Chi-square	24.6					

4.6 Living Condition and Accommodation:

4.6.1 Income:

Regarding income of children' family, it was reported that the majority (45.8%) secured an income of 50 to 100 thousand Yemeni Ryals in a month, with another considerable number of families (23.9%) stated to secure 100 to 150 thousand Ryals per month, and 72 families were able to secure below 50 thousand (Table 34).

Table 34: Distribution of income among Participants

		Frequency	Percentage
Income	**<50**	72	18.0
	>200	13	3.3
	100 - 150	93	23.9
	150 - 200	35	8.8
	50 - 100	185	45.8
	Total	400	100.0

4.6.1.1 Association between family's income and prevalence of wasting:

There was a significant association between family's income and wasting ($\chi 2$ = 24.6, P = 0.038) with majority (62.5%) reporting the ability of securing 50 to 100 thousand Ryals monthly, suffering from moderate wasting. There is no association between stunting or underweight state with family income.

4.6.2 Housing:

Regarding living condition and accommodation, more than half of the families (58.8%) live in their own house, while the remaining (41.3%) live in rented houses (Table 35).

There was no significant association found between accommodation and prevalence of malnutrition.

4.6.3 Water Supply:

In the study sample, water supply was reported to mostly be from Government Sources (37.8%), with a chunk (30.1%) of study sample get their water from on demand Clean Wells. Around 91 families (22.8%) uses Public Water Supply as their primary source of water, while only 36 families (9%) uses Unclean Wells.

There is no significant association between water supply and prevalence of malnutrition.

4.6.4 Fathers' Occupation:

Regarding fathers' current occupation, most fathers in study sample were reported as Workers (52%), while 67 of fathers (16.8) were Government Workers, 61 were Farmers, 58 were on Private Work, and only 4 had no particular occupation.

There is no significant association between father's occupation and prevalence of malnutrition (Table 35).

Table 35: Living Condition and Accommodation among Participants

		Weight Status			Weight for Height			Height Status			P-value
		Severe Underweig	Moderate underweight	Within Normal	Severe Wasting	Moderate Wasting	Within Normal	Within Normal	Severe Stunting	Moderate Stunting	
		Count	Count	Count	Count	Count	Cou nt	Count	Count	Count	
Water Supply	Clean Well	10	91	17	13	93	12	18	16	84	0.3
	Unclean Well	6	24	6	11	19	6	8	0	28	
	Government Source	16	114	21	21	99	31	43	6	102	
	Public Water Supply	5	71	15	23	66	2	20	7	64	
	Rain	0	2	0	1	1	0	0	0	2	
	clean Well	0	1	1	0	0	2	1	0	1	
Chi-square		0.43									
Housing	Own	19	176	40	31	157	47	52	16	167	0.2
	Rent	18	127	20	38	121	6	38	13	114	
Chi-square		0.30									
Father occupation	Carpentry	1	0	0	1	0	0	0	0	1	0.13
	Expatriate	0	1	0	0	1	0	1	0	0	
	Farmer	5	47	9	6	45	10	10	4	47	
	government Work	8	47	12	8	48	11	15	7	45	
	None	0	4	0	1	3	0	0	0	4	
	Private Work	4	47	7	13	41	4	9	3	46	
	Worker	19	157	32	40	140	28	55	15	138	
Chi-square		0.28									

4.7 Nutrition:

4.7.1 Feeding in the first 2 years:

Feeding in the first 2 years was recorded to all participating children in this study with Breast Feeding coupled with Artificial Milk scoring the highest (50%), followed by Breast Feeding (40%), and lastly, Artificial Milk alone (9.5%) (Table 36).

Table 36: Feeding in the first 2 years among Participants

		Frequency	Percentage
Feeding in 1st 2 years	**Artificial Milk**	38	9.5
	Breast Feeding	159	40
	Breast Feeding And Artificial Milk	200	50
	Total	400	100.0

4.7.1.1 Association between nutritional status and feeding in the first two years:

There was a significant association between stunting and feeding in the first two years ($\mathcal{X}2$ = 24.9, P = 0.018). There is no likewise association between feeding in the first two years of life and wasting or being underweight (Table 37).

Table 37: Association between prevalence of malnutrition and Feeding in the First Two Years among Participants

		Weight Status			Weight for Height			Height Status			P-value
		Severe Underweight	Moderate underweight	Within Normal	Severe Wasting	Moderate Wasting	Within Normal	Within Normal	Severe Stunting	Moderate Stunting	
Feeding in 1st 2 years	**Artificial Milk**	6	27	5	10	28	0[1]	12	4	22	.018
	Breast Feeding	16	107	23	19	101	26	35	6	105	
	Breast Feeding And Artificial Milk	15	145	28	39	128	21	37	19	132	
	Chi-square							24.9			

4.7.2 Using Any Additional Methods for Feeding:

Regarding whether children' family were using any additional methods for feeding, most answered with none (56.5%), while 174 (43.5%) families reported the use of other feeding methods (Table 38).

Table 38: Responses for Additional Methods for Feeding among Participants

		Frequency	Percent
Additional Feeding Methods	**None**	226	56.5
	Yes	174	43.5
	Total	400	100.0

4.7.2.1 Association between using additional methods of feeding and prevalence of stunting:

There was a significant association between using additional methods of feeding and prevalence of stunting ($\mathcal{X}2$ = 4.5, P = 0.02) (Table 39).

Table 39: Association between using additional Methods of Feeding and prevalence of stunting among Participants

		Height Status			Weight Status			Weight for Height			P-value
		Within Normal	Severe Stunting	Moderate Stunting	Severe Underwei	Moderate underwei ght	Within Normal	Severe Wasting	Moderate Wasting	Within Normal	
		Count	Count	Count	Count	Count	Count	Count	Count	Count	
Additional Feeding Methods	None	45	21	160	17	166	43	42	181	3	.023
	Yes	45	8	121	20	137	17	27	97	50	
Chi-square		4.5									

4.7.3 Frequency of Feedings:

Half of families (50%), reported that they feed their child between 4 to 6 times per day, with 30% reported to deliver more than 6 feeds in a day, and only 23.5% give 1 to 3 feeds per day (Table 40).

Table 40: Frequency of Feedings among Participants

		Frequency	Percent
Frequency Of Feedings	**>6 times**	120	30.0
	1 - 3 times	55	23.5
	4 - 6 times	201	50.5
	None	28	7.0
	Total	400	100.0

There was no significant correlation between frequency of feeding and Prevalence of malnutrition. (P= 0.2).

4.7.4 Child's Current Appetite:

Regarding child's current appetite, most children in the sample came across as Moderate (62.3%), with 108 child (27%) reported Good appetite, and only 42 child (10.5%) suffered from Poor appetite (Table 41).

Table 41: Child's Current Appetite

		Frequency	Percent
Child's Appetite	Good	108	27.0
	Moderate	249	62.3
	Poor	42	10.5
	Total	400	100.0

4.7.4.1 Association between Child's Current Appetite and Prevalence of wasting

There was significant association between Child's Current Appetite and Prevalence of wasting ($\mathcal{X}2$ = 1.4, P = 0.01) (Table 42).

Table 42: Association between Child's Current Appetite and Prevalence of Wasting

		Weight for Height			Weight Status			Height Status			P-value
		Severe Wasting	Moderate Wasting	Within Normal	Severe Underweight	Moderate underweight	Within Normal	Within Normal	Severe Stunting	Moderate Stunting	
		Count	Count	Count	Count	Count	Count	Count	Count	Count	
Child current appetite	Good	21	74	13	11	75	22	29	3	76	0.01
	Moderate	42	172	35	22	195	32	51	21	177	
	Poor	6	31	5	4	32	6	10	5	27	
Chi-square		1.4									

4.7.5 Weaning:

Regarding Weaning, it was reported that nearly the majority of children in this study (46%) were introduced to it at or before the age of six. 179 (44%) children were introduced to weaning at or after they reached six years old. And 9.3% of children were not at weaning yet (Table 43).

Table 43: Distribution of weaning among Participants

Age in Months	Months	Frequency	Percentage
	≤ 6	184	46.0
	≥ 6	179	44.8
	Not Yet At Weaning	37	9.3
	Total	400	100.0

There was no significant association between Age of Weaning and being underweight (P= 0.12).

4.7.6 Knowledge about Weaning in Mothers

Regarding knowledge about weaning in mothers of study sample, 217 (54.3%) reported not having sufficient knowledge about Child's Weaning, while 183 (45.8%) reported to have full knowledge (Table 44).

Table 44: Responses of Knowledge about Weaning among Participants' Mothers

		Frequency	Percentage
Knowledge about Weaning	**No**	217	54.3
	Yes	183	45.8
	Total	400	100.0

4.7.6.1 Association between family's knowledge about weaning and prevalence of underweight:

There was a significant correlation between family's knowledge about weaning and prevalence of being underweight ($\mathcal{X}2 = 2.3$, $P = 0.000 < 0.05$) (Table 45)

Table 45: Association between family's knowledge about Weaning and prevalence of malnutrition among Participants

		Weight Status			Height Status			Weight for Height			P-value
		Severe Underweight	Moderate Underweight	Within Normal	Within Normal	Severe Stunting	Moderate Stunting	Severe Wasting	Moderate Wasting	Within Normal	
		Count	Count	Count	Count	Count	Count	Count	Count	Count	
Knowledge about Weaning	Yes	14	139	30	32	16	135	37	122	24	.000
	No	23	161	30	58	13	143	30	156	28	
Chi-square		2.34									

4.7.7 Receiving Complementary Nutrition

Two hundred and thirty-eight child (59.5%) reported to be receiving complementary nutrition after weaning; whereas 162 child (40%) noted to not receiving any complementary nutrients after weaning (Table 46).

Table 46: Receiving Complementary Nutrition among Participants

		Frequency	Percentage
Receiving Complementary Nutrition	No	162	40.5
	Yes	238	59.5
	Total	400	100.0

4.7.7.1 Association between Receiving Complementary Nutrition and prevalence of wasting:

There was a significant association between Receiving Complementary Nutrition and prevalence of wasting ($\mathcal{X}2$ = 7.1, P = 0.02) (Table 47).

Table 47: Association between Receiving Complementary Nutrition and prevalence of Wasting among Participants

Complementary Nutrition	Height Status			Weight for Height			Weight Status			P-value
	Within Norma	Severe Stunting	Moderate Stunting	Within Norma	Severe Wasting	Moderate Wasting	Within Norma	Severe Underweight	Moderate underweight	
No	0	2	20	41	11	70	12	129	21	.027
Yes	1	3	43	31	13	112	25	174	39	
Chi-square	7.1									

Chapter 5

Discussion

DISCUSSION

This study aimed to determine the nutritional status among children 5 years old or less in Sana'a, Yemen, and shade the light on the associated factors that might cause malnutrition. Four hundred child involved in this study with 63.2% of them were between the ages of one month to 2 years, and 36.8% between ages of 2 to 5 years, and the mean age turned out to be around 22.1±15.68 months. The number of boys were slightly larger than the number of girls in this study sample. Scoring 53% compared to its 47% counterpart. The majority of participants were originally residing in urban areas counting for about 67.3% of overall sample. Most of the children' families were consisting of four members. A study conducted in Afghanistan reported that 44.2% of women reported that their children were living with 7–9 family members, while 37.5% were living with 4–6 members and only 14% were living with 10-12 family members [70]. Another study conducted in Ghana reported that 35% of the children were from households with 5–8 members while 35% were from households with 1–4 members.[71]

Weight at birth has also been investigated among participating children. Either verbally, by directly asking the caregiver, or obtaining past records if feasible. The mean for weight at birth was 2.947±0.40. This result is higher than the one obtained by Gawad M. A. Alwabr in Sana'a in 2021, where in a sample size of 150 mother and their children under 5 years old, 40% of the participants' children had low weight at birth (less than 2.5 kg), while 60% had a normal birth weight [73]. This might be because of the health and nutritional status of their mothers during pregnancy. This result was mimicked a previous study conducted in Afghanistan reported that 46.2% of children had a birth weight 2.5 kg [70].

The anthropometric measurements had been recorded to all participants; including height, weight, and mid upper arm circumference. MUAC measurements were categorizes into three bands indicating severity to assess in the analyses. Green band indicating 13.5cm or higher which denoted adequately nourished child. Red band, which indicated a reading of 11.5cm or lower that pointed out severe malnutrition. Finally, Yellow band, that indicated a range between 11.6 to 13.4cm, which in turn, implied under nutrition and those at risk. The majority of children in this sample measured to be in the Yellow band range with scoring 55%; while 35% yielding Red band, and only 10% being in the Green band. One study in Malaysia reported that the prevalence of acute and

chronic under-nutrition among hospitalized children were 11% and 14% respectively [72]. This large difference highlights the poor conditions regarding nutrition and general health of children in Sana'a, Yemen; as most of them are either being malnourished on remaining at risk for malnourishment. The records of both height and weight were later converted to Z-scores for the assessment of the mainly common ones: Stunting or Chronic Malnutrition, Wasting or Globally Acute Malnutrition, and Underweight. The mean was -1.27±220 for underweight, 0.2±1 for stunting, and 1.2±1.6 for wasting.

The prevalence of all three forms of malnutrition among study sample was very apparent, if not disastrous. In the presented study, wasting, stunting, and underweight are defined independently based on 2006 WHO growth standards [68]. The prevalence of global acute malnutrition (wasting) in the present study (17.4%) was classified as "*very high*" according to WHO. The prevalence of chronic malnutrition (stunting) (38.75%) is also classified as "*very high*". Moreover, the prevalence of underweight (42.1%) is considered "*very high*", as well. These results approximately coincides with the results of a study done in South Delhi, India by Mohit Goyal in 2023; although, still much larger; where the prevalence of underweight, stunting, and wasting were 24.5%, 27.2%, and 17.8%, respectively [74]. Another study conducted in University of Rajasthan, India by Pragati Chaudhary and Mukta Agrawal in 2019 on a total sample of 2007, and found that 35.7% who were found underweight, 43% were stunted and 10.5% were wasted. Moderate acute wasting was found among 8.0% children while severe acute wasting was found among 2.5% children [75].

On testing the plausible associations between children' nutritional status and their demographic characteristics, the results found various correlation that play a key factor in developing nutritional diseases. Age was shown to have a significant correlation with being underweight with a ($P< 0.05$). As children 59 months or less, exhibited a larger percentage of underweight cases compared to children 24 to 59 years of age with 25.7% suffering from being severely underweight. This finding is in line with studies in India by Kumar, D in 2006, that also report a high prevalence of malnutrition among children under two years old [76]. This clearly points out a how this period of life is crucial for physical growth and an increase in metabolic demands is to be expected. Therefore, any shortage of adequate nutrition at that time is frequently apparent.

DISCUSSION

There was a significant relationship between residence and the prevalence of stunting ($P< 0.05$). Since most children in this study live in urban settings, the prevalence of moderate and severe stunting was 48.3% and 4.3% respectively in urban areas. The poverty, raising rates of assets and house rents might contributed to the complication and backtracking of the quality of life which forces families to live in more unhygienic conditions. This in turn raises the state of chronic malnutrition as access to nutrients becomes limited.

In this study, co-morbid conditions were grouped into relative categories according to their clinical picture and organ system affected. A significant correlation was found between co-morbid diseases and the prevalence of wasting ($P< 0.05$). Diarrheal Diseases, being the most prevalent co-morbid disease that scored 22% and 18% on severe and moderate wasting respectively with Anemia Respiratory Disorders following up. These results support the study done in Aden in 2019 by Fekri Dureab; where the prevalence of diarrhea was 26.5% among children within the week preceding the survey, which was less than the national prevalence in the DHS 2013 report (31%). A history of cough and acute respiratory infection among children under five was 31% in, while in DHS 2013 it had been 12% [77].

Information about the mothers of participating children were obtained in this study, including age, education, marital status, and occupation. The mean age of mother in the study sample was 28.66±6.368, with the majority of mothers happened to be between ages 26 to 34 years old. A significant relationship was spotted between age of the mother and nutritional status of the child ($P < 0.05$). The majority of wasted children belonged to mothers aging 26 to 34 with 15.8% of these children suffered from severe wasting and 53.8% were moderately wasted. This result is not yet conclusive since the majority of mother in this study belonged to this age group. Further descriptive studies with a much larger and more selective sample is recommended. However, A study conducted in Southern Ethiopia by Gamecha R in 2017, reported that the maternal age group was not associated with the nutritional status of the children under the age of five [78]. A significant relationship was marked between education level of the mother and nutritional status of the child, with mothers at high school level scoring 18.3% for moderate wasting

and 5.5% for severe wasting. 21.8% of the mothers in the current study were illiterate. While the majority of them (25%), stopped perusing education past high school. This result is still less than the one found in a study conducted in Afghanistan by Aminee A in 2017, which reported that 83.1% of mothers were illiterate and 13.6% had merely primary education [70].

There was a significant association between family's income and wasting (P = 0.038); as majority of children belonging to families securing 50 to 100 thousand Ryals monthly (62.5%), suffered from moderate wasting. In the study carried on in Sana'a by Gawad M. A. Alwabr in 2021, 85.3% of the participants' mothers reported that their households monthly income was less than 300$. This might be attributed to the economic situation resulting from the current conflict in Yemen [73]. This result was in contrast with a study conducted by Aminee A in Afghanistan in 2017, which reported that 49.2% of their household monthly income was less than 150$, and only 2.3% over 300$ per month [70].

Vaccination among children had a large portion of focus in this study. Initially, the state of completion, or the lack there of, was investigated; along with the reasons behind any delay or incompliance. It turned that 82% of children under study received full vaccination regimen, with 69.3% being on time. This result was higher than a study done in Nigeria in 2019 by Okari T. G. and West B. A, where in a sample of 410 under-fives, the proportion of fully vaccinated children of 53.4% [80]. Yet, this result was much higher than the 40-45.5% reported in studies carried out in India, but lower than the 85.7% reported by Oyefara et al in 2015 in an urban community in Lagos State, Nigeria [82]. Most incompliances emerged from the fact most children not reaching the proper time for vaccination, was the distance between families' residences and vaccine centers. Another reason with high frequency in this study was fathers or whole family refusal; which is mostly emerging from Yemenis' generated public opinions and assumptions, and lack of proper education about the crucially beneficial aspects of vaccination. There was not any obvious significant relationship between vaccination and nutritional status of children at first glance; although, it was somewhat anticipated. That was a cornerstone result in a study done in India in 2017 by Pyrianka R et al, who also reported a statistically significant increased risk of underweight malnutrition in unvaccinated children,

demonstrating the protective effect of vaccination on malnutrition [79]. However, with using a different perspective while analyzing data, a significant association was noted between the prevalence of malnutrition and vaccination when correlating on the basis of the demographic factors of children in the study. Both parents' occupational statuses along with monthly income, housing, area of residence, maternal education level, and marital status were all assessed to obtain a proper verdict. The results shed the light on prevalence of malnutrition conditions among children of parents of low return jobs, such as worker, which is unsettling or inefficient to maintain proper household etiquette. Higher counts were also encountered with illiterate mothers, or that of low levels of education, along with those living in rural settings. These factors indicate how quality of life, education, and income status can have large effects on the prospects children growth and overall wellbeing. It seems logical that vaccination may play an important role in preventing malnutrition. The 10 best evidence-based nutrition-specific interventions are estimated to reduce stunting by only 20%, meaning that adjunctive interventions, including infection control, are probably required to prevent growth faltering in early life [84]. The most successful reductions in stunting prevalence have been achieved through multi-sectorial approaches [85, 86], but dissecting out the specific contribution of vaccination is difficult. Vaccines against single pathogens are unlikely to have a substantial impact on growth; it is increasingly recognized that packages of interventions are the key to reducing malnutrition [87]. For example, a recent study undertook anthropometry in 1033 Bangladeshi children 1 year after enrolment to a placebo-controlled trial of rotavirus vaccination and found no differences in underweight, wasting or stunting between randomized groups [88]. However, it would have been surprising to see a major effect on nutritional status following administration of a single vaccine, given the range of pathogens that cause enteric infections in this setting. On such similar study in India and Bangladesh by Banerjee et al in 2021, it revealed that women having better wealth index have a higher chance to have regularly immunized children 1.399 times, than women belong to poor wealth index. Similar result is observed in case of underweight. The chance of being stunted is less among non-poor children (1.512 times) than poor children and it is significant. The chance of underweight is higher among non-poor children (1.404 times) than children belong to poor wealth index group [82]. Observational analyses across countries showed an association between coverage of vaccination and prevalence of wasting and stunting, but there is potential for ecological bias in these findings [83].

DISCUSSION

Regarding feeding in the first 2 years of life, there was a significant association between stunting and feeding in the first two years (P = 0.018). Breast Feeding coupled with Artificial Milk scoring the highest (50%), followed by Breast Feeding (40%), and lastly, Artificial Milk alone (9.5%). Breast milk is a potent component of child's diet as aids in improving growth and maturation of immune system.

There was a significant association between using additional methods for feeding and prevalence of stunting (P = 0.02), with 43.5% of families reported the use of other feeding methods. This denotes the importance of learning about proper weaning, and the addition of complementary nutrition at the right time to siege from the incidence malnourishment.

Children appetite was split into Good, Moderate, and Poor to assess the level of nutrition and the presence of malnutrition among sample. A significant association was found ($P<0.05$), as the majority of the sample (177 child) suffered from moderate stunting. Further study is needed to elaborate and predict the influence of nutritional disease on appetite and vice versa.

There was a significant correlation between family's knowledge about weaning and prevalence of being underweight ($P < 0.05$). In a study conducted in Afghanistan by Aminee A in 2017 reported that about 3% to 4% of mother does not have any knowledge/information about key health and nutrition issues [70]. Thus, a proper health education program is required to enhance the awareness of mother to the proper practices in order to mitigate such preventable issue.

There was a significant association between Receiving Complementary Nutrition and prevalence of wasting ($P = 0.02$). Among children in the sample, 59.5% reported to be receiving complementary nutrition after weaning; whereas 40% noted to not receiving any complementary nutrients after weaning. With 177 child of whom complementary nutrition was given, suffer from moderate wasting. This ending could be attributed to poor weaning and complementary feeding practices, which contribute to inadequate energy and protein intake. Further research is required on assessing complementary feeding practices, and its associated disadvantages.

DISCUSSION

Chapter 6

Conclusion and Recommendations

6.1 Conclusion:

In this study, we concluded the following:

- In Yemen, the deteriorating nutritional status has become a major problem of children, especially children under 5 years of age, which is in continuous increasing because of the current conflicts that have led to several economic factors affecting the living standards of families.

- With the rich literature, the research resources regarding factors influencing nutritional status in children are still sparse.

- Severe acute and chronic malnutrition rates were identified among children seeking care in health facilities within Sana'a. These higher malnutrition rates exceeded the WHO indicators of malnutrition, and have been classified as very high among all three main types.

- There is a significant correlation between vaccination and prevalence of malnutrition; as the former is widely affected by various demographic and financial factors, along with collective social belief of the unimportance or stigma of the vaccines in such children. Although, a series of research aimed to emphasize how the benefits of vaccines in malnourished children outweigh the negatives, most of these results remain juvenile, and still require further research.

- This study especially showed that, parents' education, age of mothers, housing, income, numbers of children per household, the child's weight at birth, and weaning age, were as contributing factors to malnutrition of the children under the age of five.

- Multiple intervention strategies based on these risk factors can reduce early malnutrition of the children under the age of five.

- A Profound study should be conducted to assess the effect of breastfeeding and complementary feeding practices on the nutritional indicators.

- Maternal knowledge about feeding and care during illness are all important determinants of nutritional indicators that need further study to explore their association.

6.2 Recommendations:

1. Further research delving deeper into the factors that affect the nutrition and health of children.
2. Establishing nutritional care centers for children with moderate to severe malnutrition along with giving primary preventive measures for high risk individuals.
3. Humanitarian community must adopt alternative strategies to improve food security and nutrition status in Yemen. Moreover, action needs to be taken in order to improve socio-economic conditions such as wealth index, food for work program, improved maternal education along with developing social and health programs for parents to raise awareness of existing nutritional problems with their factors and combat them, and by strengthening new coping and resilience systems for households' productivity

6.3 Limitations:

1. This Study's Cross-sectional design posed as a limitation due to its lack of temporality.
2. The Short duration of sample collection hindered research team from collecting a larger sample size to ensure results that are more representative of study population.
3. Refusal of certain specialized pediatric tertiary hospitals to grant access hindered research team in data collection and sample selection.

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APPENDIX

الخلاصة

خلفية الموضوع:

تحدد الحالة التغذوية للأطفال صحتهم ونموهم البدني وأدائهم التعليمي وتقدمهم في الحياة .هناك سنوياً أكثر من 10 ملايين حالة وفاة بين الأطفال دون سن الخامسة، أكثر من 33% منهم بسبب سوء التغذية المرتبط بعدم كفاية التغذية .وبما أن اليمن في صراعات مستمرة، فإن تقييم الرعاية الصحية للأطفال أمر إلزامي .هدفت هذه الدراسة إلى تقييم الحالة التغذوية والعوامل المرتبطة بها للأطفال دون سن الخامسة في صنعاء، اليمن.

المنهجية:

تم إجراء دراسة وصفية مقطعية في المستشفى الجمهوري ومستشفى الكويت ومركز الزهراوي الطبي ومستشفى هاني طومر خلال الفترة من 1 مايو 2024 إلى 20 مايو 2024 على جميع الأطفال المقبولين في أجنحة الأطفال. تم جمع البيانات من خلال استبيان متعدد القطاعات ومقابلة وجهاً لوجه، إلى جانب القياسات البشرية. تمت ترقيم البيانات باستخدام Microsoft Excel الإصدار 2013 وتصديرها إلى SPSS الإصدار 26 من برنامج للتحليل الإحصائي. تم تحويل قياسات الطول والوزن إلى درجات Z. تم تقييم البيانات للخصائص الديموغرافية والسريرية الأخرى كمتغيرات محددة. تم تطبيق اختبار تشي سكوير وفيشر الدقيق بين العرض الديموغرافي والسريري (المتغيرات المستقلة)، والأمراض المرضية المصاحبة، والقياسات البشرية باعتبارها (المتغيرات التابعة)

النتائج:

من أربعمائة طفل شاركوا بالبحث تراوحت أعمارهم بين 1 إلى 59 شهرًا، و المقبولين في أجنحة الأطفال، وكان متوسط العمر 22.1 شهرًا و الانحراف المعياري 15.68، وكان أغلبهم من الذكور (53%) ويعيش معظمهم في المناطق الحضرية (63%). تم الحصول على الوزن عند الولادة بمتوسط 2.947 ± 0.40. أشارت قراءات محيط منتصف الذراع في الغالب إلى سوء تغذية معتدل، حيث كان 35.1% منهم يعانون من سوء تغذية حاد. تم تقديم جميع أشكال سوء التغذية الثلاثة ضمن التصنيف المرتفع جدًا وفقًا لمنظمة الصحة العالمية، حيث بلغ معدل الهزال والتقزم ونقص الوزن 17.4% (95% CI: 8.6% ،95% CI: 38.75%) (25% 35.1%، (44.9%، و42.1% (95% مجال الثقة: 16.2%، 24.3%) على التوالي. تصادف أن للتطعيم ارتباطًا كبيرًا، متأثرًا بالجوانب الاقتصادية والديموغرافية لدى الأطفال المصابين بسوء التغذية ($P < 0.05$). على الرغم من العديد من الدراسات التي تقيم ارتباط اللقاحات بالتغذية، إلا أن النتيجة لا تزال غير حاسمة. كان ايضا هناك العديد من الارتباطات المهمة بين الهزال وعوامل مستقلة متعددة؛ مثل حالة الدخل وعمر الأم ووجود أمراض مصاحبة وهي أمراض الإسهال. ارتبط التقزم بعوامل مثل الإقامة وحالة التغذية في أول عامين ونقص المعرفة حول الفطام. ومع ذلك، كان نقص الوزن مرتبطًا بشكل كبير بعمر الطفل؛ وخاصة بين 0 إلى 2 سنة، وشهيتهم بشكل عام.

خاتمة:

أصبح تدهور الحالة التغذوية مشكلة كبيرة للأطفال، وخاصة الأطفال دون سن الخامسة، وهي في تزايد مستمر بسبب الصراعات الحالية التي أدت إلى عدة عوامل اقتصادية تؤثر على المستوى المعيشي للأسر. ولا تزال نسبة سوء التغذية بين الأطفال دون سن الخامسة مرتفعة بشكل كارثي. يمكن لاستراتيجيات التدخل المتعددة القائمة على عوامل الخطر أن تقلل من سوء التغذية المبكر لدى الأطفال دون سن الخامسة في اليمن.

الكلمات المفتاحية : الحالة التغذوية ، الأطفال ، اليمن

APPENDIX

استبيان مشروع بحث تخرج بعنوان
الحالة التغذوية للأطفال تحت سن الخامسة – صنعاء اليمن

تعليمات المشاركين:

- **يرجى قراءة التعليمات بعناية .**
- **يرجى الإجابة على جميع الأسئلة الواردة في الاستبيان .**
- **سيتم الاحتفاظ بالتفاصيل بسرية تامة ولأهداف بحثية فقط .**

الجمهورية اليمنية

وزارة التعليم العالي والبحث العلمي

الجامعة الإماراتية الدولية

استبيان لدراسة بحثية

خاصة ببحث التخرج لطلاب الطب البشري

الدفعة الخامسة – المجموعة (B)

الحالة التغذوية للأطفال تحت سن الخامسة – صنعاء اليمن

أولاً: الخصائص الديموغرافية للأطفال المرضى المشاركين في الدراسة				
1. جنس الطفل				
□ ذكر		□ أنثى		
2. عمر الطفل بالشهور.				
3. مكان الإقامة				
□ الريف		□ المدينة		
4. حجم الأسرة (عدد افراد الاسرة)				
5. وزن الطفل عند الولادة بالكيلوجرام				
6. هل اللقاحات مكتملة بحسب عمر الطفل				
□ نعم		□ لا		
اذا نعم				
في الموعد المحدد للأخذ اللقاح	□ قبل الموعد.....		□ بعد الموعد	
السل	□ نعم	□ لا	□ لا اعلم	□ لا أتذكر
الشلل	□ نعم	□ لا	□ لا اعلم	□ لا أتذكر
الخماسي	□ نعم	□ لا	□ لا اعلم	□ لا أتذكر
المكورات	□ نعم	□ لا	□ لا اعلم	□ لا أتذكر
الروتا	□ نعم	□ لا	□ لا اعلم	□ لا أتذكر
الحصبة	□ نعم	□ لا	□ لا اعلم	□ لا أتذكر
فيتامين الف	□ نعم	□ لا	□ لا اعلم	□ لا أتذكر
اذا لا ؟ لماذا .....اذكر الأسباب				
ثانياً: العوامل المتعلقة بالوالدين				

الحالة التغذوية للأطفال تحت سن الخامسة – صنعاء اليمن

7. عمر الأم (سنوات)
8. المستو التعليمي للأم
□ لا تقرأ ولا تكتب □ ابتدائي □ إعدادي □ ثانوي □ جامعي
9. المستوى التعليمي للأب
□ لا يقرأ ولا يكتب □ ابتدائي □ إعدادي □ ثانوي □ جامعي
10. الحالة الاجتماعية الحالية للأم
□ متزوجة □ مطلقة □ أرملة
11. عمل الأب
□ أعمال حرة □ الزراعة □ وظيفة حكومية □ موظف قطاع خاص □ أخرى .....
12. عمل الأم
□ ربة بيت □ مزارعة □ طالبة □ موظفة □ أخرى .....
13. دخل الأسرة الشهري
□ أقل من 50 ألف □ 50- 100 ألف □ 100- 150 ألف □ 150- 200 ألف □ أكثر من 200 ألف
14. البيت الذي تعيش فيه الأسرة
□ ملك للأسرة □ إيجار
15. المصدر الرئيسي لمياه الشرب للطفل
□ مشروع مياه □ حنفية عامة □ بئر محمي (نظيف) □ بئر غير محمي □ مياه أمطار □ أخرى
ثالثاً: عوامل التغذية الخاصة للطفل
16. نوع الرضاعة في العامين الأولين من عمر الطفل
□ طبيعية □ حليب صناعي □ طبيعية وحليب صناعي □ لم يرضع
17. كم استمرت الرضاعة الطبيعية للطفل بالشهر....
□ أقل من 4 أشهر □ 4 أشهر □ 4- 6 أشهر □ أكثر من 6 أشهر
18. عمر الطفل عند الفطام بالشهور.....
□ أقل من 6 أشهر □ أكبر من 6 أشهر
19. شهية الطفل الحالية
□ جيدة □ متوسطة □ فاقد الشهية
20. استخدام غذاء آخر بجانب الرضاعة الطبيعية (إذا كان لايزال مستمراً على الرضاعة الطبيعية)
□ نعم □ لا

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21. هل لديك معرفة عن الفطام والغذاء التكميلي (فيتامينات)
□ نعم □ لا
22. عدد مرات الرضاعة الطبيعية باليوم الواحد
□ 1- 4 مرات □ 5 مرات □ 3- 6 مرات □ أكثر من 6 مرات
23. هل يتم إعطاء الطفل أي غذاء تكميلي
□ نعم □ لا
رابعاً: الأمراض المصاحبة للأطفال المشاركين في الدراسة
24. هل يعاني الطفل من الآتي
□ إسهال □ انيميا □ اضطرابات تنفسية □ تورم في الطفل □ فقدان في وزن الطفل □ حمى □ انخفاض درجة الحرارة □ طفح جلدي
خامساً: أنثروبوميتري (القياسات الجسمانية)

25. وزن الطفل بالكيلوجرام	kg .....
26. طول أو ارتفاع الطفل	cm .....

27. قياس محيط منتصف الذراع (MUAC)
□ > 13.5 cm □ (12.5 -13.4) cm □ (11.5 -12.4) cm □ < 11.5 cm
28. Z – score
□ > 1 □ > -2 to ≤ 1 □ >-3to ≤ 2- □ ≤ 3-
□ نوع سوء التغذية .....

الجمهورية اليمنية
الجامعة الامارتية الدولية

كلية الطب والعلوم الصحية
قسم طب المجتمع

الحالة التغذوية للأطفال دون سن الخمس سنوات – صنعاء اليمن

بحث مقدم لقسم طب المجتمع - كلية الطب والعلوم الصحية - الجامعة الامارتية الدولية

لاستكمال نيل درجة البكالوريوس في الطب العام والجراحة

الباحثون

عمار علي علي هلال
حامد صالح علي الاحمدي
هشام حسن قحطان الذيفاني
علي احمد علي محمد جعلل
معاذ فوزي ناصر سلعان
إسماعيل حمود محمد الشاحذي
علي حسن الصغير
فارس شوقي علي ادريس
عادل علي محمد الموشكي
بهاء الدين فهد السلمي
هايل سعد احمد الوصابي

تحت اشراف

د. نورا احمد العواضي
مدرس مادة - طب المجتمع
كلية الطب والعلوم الصحية
جامعة صنعاء
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