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Assessment of the malnutrition-associated factors among children under five years in Khartoum State, Sudan

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Abstract

Nutrition is a cornerstone that affects and defines the health of all people, rich and poor. Conversely, malnutrition makes all more vulnerable to disease and premature death. The aim of this study was to assess the associated factors with malnutrition among less than five years children in Khartoum State, Sudan. A clinic base study funded by Saudi Red Crescent Authority was conducted on 100 children under five years who visit the health facility in the study area. Malnutrition was indicated by stunting, wasting and underweight. A structured questionnaire was also used to obtain the required data of the study participants and their mothers. The results shows that, about 8% of male children were wasted while 4% of female children were wasted. There was no significant association between sex of the child and nutritional status. Also, among under five years children's mothers, wasting was the most common malnutrition problem (12%). On the levels of education results indicate that wasting was higher among children of educated mothers and housewives mothers there was significant associations between mother education and child wasting. Also there were an obvious differences between some socio-economic factors and malnutrition parameters, but there were no significant association between sex of the child and nutritional status and between mother education and child wasting, also between married status, employment and education of mothers and weight for age indicator and also no relationship between family size and nutritional status. But there was a significant association between sex and weight for age indicator. This assessment should be considered seriously before the other relationships between socio-economic factors and nutritional status became significant.

Keywords: Malnutrition-Associated Factors; Children Under Five Years; Khartoum State; Sudan

1. Introduction

Food is an important and basic biological need of man. It is essential for life, growth and repair of the human body, regulation of body mechanisms and production of energy for work [1] Nutrition is a cornerstone that affects and defines the health of all people, rich and poor. Conversely, malnutrition makes all more vulnerable to disease and premature death [2]. A well-nourished population has a capacity to be productive and to improve its standard of living through hard work. Malnutrition adversely affects the cognitive and learning performance of children, later as adults, they will suffer functional impairments including reduced intellectual performance and working capacity [3].

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The WHO [4] estimates that there are 178 million children that are malnourished worldwide, and at any given moment, 20 million are suffering from the most severe form of malnutrition. Malnutrition contributes to between 3.5 and 5 million annual deaths among under-five children. Malnutrition among under five children is one of the most important public health problems in developing countries especially Sub-Saharan Africa. UNICEF [5] estimates that there are nearly 195 million children suffering from malnutrition across the globe. In 1997, the WHO had observed that 60% of the deaths occurring among all the under five children in developing countries were attributed to malnutrition [6].

In Sub-Saharan Africa, 41% of under-five children are malnourished and deaths from malnutrition are increasing on daily basis in the region. Malnutrition continues to be a significant public health problem throughout the low income countries, particularly in Sub-Saharan Africa and South Asia [7].

The development of childhood undernutrition coincides with the introduction of complementary weaning foods which are usually nutrient deficient [8]. There is a strong association between undernutrition and child mortality [9]. Over 90% of the stunted children below five years of age live in sub-Saharan Africa and South Central Asia. Although access to adequate food and improving nutritional intake is an obvious solution to tackling undernutrition in children, the progress in reducing children undernutrition is disappointing [10].

Researchers from the Centre for World Food [11] found that the gap between levels of undernutrition in men and women is generally small, but that the gap varies from region to region and from country to country. These small-scale studies showed that female undernutrition prevalence rates exceeded male undernutrition prevalence rates in South/Southeast Asia and Latin America and were lower in Sub-Saharan Africa [12].

During pregnancy and breastfeeding, women must ingest enough nutrients for themselves and their child, so they need significantly more protein and calories during these periods, as well as more vitamins and minerals (especially iron, iodine, calcium, folic acid, and vitamins A, C, and K). A review of interventions estimated that universal supplementation with calcium, iron, and folic acid during pregnancy could prevent 105,000 maternal deaths (23.6 percent of all maternal deaths) [13]. Malnutrition has been found to affect three quarters of UK women aged 16–49 indicated by them having less folic acid than the WHO recommended levels [14].

Globally, an estimated 165 million children under-five years of age, or 26%, were stunted, 16%, were underweight, 8% were wasted and 7% were overweight. High prevalence levels of stunting among children under-five years of age in Africa (36%) and Asia (27%) remain a public health problem, one which often goes unrecognized. More than 90% of the world's stunted children live in Africa and Asia [5].

Globally, over 10 million children under the age of 5 years die every year from preventable and treatable illnesses. At least half of these deaths are caused by malnutrition. Malnourished children have lower resistance to infection; they are more likely to die from common childhood illness such as diarrheal diseases and respiratory infections and children that survive are likely to suffer from frequent illness, which adversely affects their nutritional status, faltering growth and diminished learning ability [9].

Therefore, this study was design to assess the associated factors with malnutrition among less than five years children in Khartoum State, Sudan.

2. Material and methods

2.1. Study area

This study was conducted in Jabra locality which is one of seven localities of Khartoum State; it's strategically located in the center of the state with an estimated population of about 750000 of which 8000 being children under five years old.

2.2. Study design

A clinic base study was applied following the instruction of Saudi Red Crescent Authority.

2.3. Study population

The Children under five years old.

2.4. Inclusion criteria

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

2.5. Exclusion criteria

Children under five years old but not permanent resident of the study areas

Participants who refused to participate in the study

2.6. Sample

Since the study population were less than 10000 for this study the sample size will be 100. The children under five years who visit the health facility in the locality were selected through random systematic sampling technique and a written informed consent was obtained prior to participation.

2.7. Study Variables

Data on the following variables was collected:

2.7.1. Dependent variables

Malnutrition indicated by stunting, wasting and underweight

2.7.2. Independent variables

Two categories of factors were assessed as independent variables**;**

- **Child characteristics**; e.g. age, sex, weight, length, types of birth.
- **Socio- demographic variables**; e.g. marital status, family size, income, education, occupation.

2.8. Data Collection Tools

2.8.1. Questionnaire

A structured questionnaire was used to obtain the required data of the study participants.

2.8.2. Instruments of Anthropometric Measurements

The following instruments were used: a balance, with accuracy of 0.1 Kg for weight, height/length board with accuracy of 0.1 cm to measure height and length.

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

2.9. Data Analysis

Data were analyzed using statistical package for social sciences software (SPSS). Descriptive analysis, chi-square test and P-values were calculated and presented.

2.10. Ethical Considerations

Approval to carry the study was obtained from the University of Gezira, Ministry of Health research department and from health facilities.

3. Results

3.1. Sex, age and state of child at birth and nutritional status (Weight- for-height)

Table (1) shows that (2%) of male children were severely wasted and (6%) were moderately wasted. One percent of female children were severely wasted, while (3%) were moderately wasted. There was no significant association between sex of the child and nutritional status (P-values were bigger than 0.05).

Table 1 Association between sex, age and state of child and weight for-height

Variable	Severe wasting (%)	Moderate wasting (%)	Normal (%)	Overweight (%)	Total (%)
Gender					
Male	2	6	33	4	45
Female	1	3	48	3	55
χ^2= 3.287 *P-value* = 0.349					
Age (month)					
0 – 11	2	5	37	4	48
12 – 23	0	1	22	2	25
23 – 35	0	1	8	1	10
36 – 47	0	1	11	0	12
48 – 59	1	1	3	0	5
χ^2= 10.096 *P-value* = 0.608					
State of Child at birth					
Single	2	9	77	7	95
Twins	1	0	4	0	5
χ^2= 5.913 *P-value* = 0.116					

3.2. Socio-economic characteristics and nutritional status Weight- for-height

Table (2) indicated that, among under five years children's mothers, wasting was the most common malnutrition problem (12%). On the levels of education, results indicate that, wasting was higher among children of educated mothers and housewives mothers there was a significant association between mother education and child wasting. The study also reveal that income and family size has effects of wasting where it was high among households with income (1000 – 2000 SDG) and the households with family size less than five persons.

Table 2 Association between socio-economic characteristics and weight for-height

Variable	Severe wasting (%)	Moderate Wasting (%)	Normal (%)	Overweight (%)	Total (%)
Age of Mother (years)					
Less than 20	1	0	3	0	4
21-30	1	4	19	2	26
31-40	1	2	42	3	48
Above 41	0	3	12	2	22
χ^2= 11.60 *P-value* = 0.237					
Marital Status					
Married	3	9	77	7	96
Separated	0	0	2	0	2
Divorced	0	0	2	0	2

χ^2= 0.977 *P-value* = 0.986					
Mother Education					
Illiterate	0	0	1	2	3
Khalwa	0	0	1	1	2
Primary/basic	0	2	11	0	13
Secondary	1	1	20	1	23
University	2	6	48	3	59
χ^2= 25.583 *P-value* = 0.012*					
Mother Employment					
Employed	0	1	16	0	17
Business	0	0	3	0	3
Housewife	3	8	60	7	78
None	0	0	1	0	1
Others	0	0	1	0	1
χ^2= 4.335 *P-value* = 0.977					
Household monthly income (SDG)					
Less than 1000	0	0	14	3	17
1000 – 2000	2	7	44	3	56
3000 – 5000	0	1	12	1	14
5000 and above	1	1	11	0	13
χ^2= 8.299 *P-value* = 0.504					
Family size (person)					
Less than 5	2	7	51	5	65
5 – 10	1	2	29	2	34
More than 10	0	0	1	0	1
χ^2= 1.064 *P-value* = 0.983					

3. Sex, age and state of child at birth and nutritional status (Weight- for- age)

Table 3 Association between sex, age and state of child and weight for-age

Variable	**Severe underweight (%)**	**Moderate underweight (%)**	**Normal (%)**	**Total (%)**
Gender				
Male	3	8	34	45
Female	3	5	47	55
χ^2= 1.797 *P-value* = 0.407				
Age (month)				
0 – 11	4	9	35	48
12 – 23	0	1	24	25

23 – 35	1	1	8	10
36 – 47	0	0	12	12
48 – 59	1	2	2	5
χ^2= 14.422 *P-value* = 0.071				
State of Child at birth				
Single	6	12	77	95
Twins	0	1	4	5
χ^2= 0.515 *P-value* = 0.773				

Table (3) show that, (3%) of male children were severely underweight, while (8%) were found moderately underweight. Among females (3%) children were severely underweight and (5%) were moderately underweight. There was a significant association between sex and weight for age indicator.

3.3. Socio-economic characteristics and nutritional status weight- for- age

Table (4) shows that, (6%) of children's mothers were severely underweight, (13%) were found moderately underweight. There was no significant association between married status of mothers and weight for age indicator. On mother education the malnutrition was high among children of secondary school mothers where (5%) found moderately underweight and (2%) severely underweight. Regarding mother employment and underweight, (10%) found moderately underweight and (6%) severely underweight among housewives.

Table 4 Association between socio-economic characteristics and weight for-age

Variable	**Severe underweight (%)**	**Moderate underweight (%)**	**Normal (%)**	**Total (%)**
Age of Mother (years)				
Less than 20	0	2	2	4
21-30	1	4	21	26
31-40	3	4	41	48
Above 41	2	3	17	22
χ^2= 6.561 *P-value* = 0.363				
Marital Status				
Married	6	12	78	96
Separated	0	0	2	2
Divorced	0	1	1	2
χ^2= 2.962 *P-value* = 0.564				
Mother Education				
Illiterate	0	0	3	3
Khalwa	0	0	2	2
Primary/basic	1	1	11	13
Secondary	2	5	16	23
University	3	7	49	59
χ^2= 3.710 *P-value* = 0.882				
Mother Employment				

Employed	0	2	15	17
Business	0	0	3	3
Housewife	6	10	62	78
None	0	0	1	1
Others	0	1	0	1
χ^2= 9.177 *P-value* = 0.328				
Household monthly income (SDG)				
Less than 1000	0	0	17	17
1000 – 2000	3	10	43	56
3000 – 5000	1	2	11	14
5000 and above	2	1	10	13
χ^2= 7.440 *P-value* = 0.282				
Family size (person)				
Less than 5	4	8	53	65
5 – 10	2	5	27	34
More than 10	0	0	1	1
χ^2= 0.351 *P-value* = 0.986				

3.4. Association between sex, age and state of nutritional status (Height- for-age)

Table 5 Association between sex, age and state of child and height for-age

Variable	Severe stunting (%)	Moderate Stunting (%)	Normal (%)	Total (%)
Gender				
Male	6	10	29	45
Female	8	5	42	55
χ^2= 3.366 *P-value* = 0.186				
Age (month)				
0 – 11	8	12	28	48
12 – 23	4	1	20	25
23 – 35	1	2	7	10
36 – 47	0	0	12	12
48 – 59	1	0	4	5
χ^2= 13.021 *P-value* = 0.111				
State of child at birth				
Single	13	15	67	95
Twins	1	0	4	5
χ^2= 0.985 *P-value* = 0.611				

Table (5) shows that, (8%) of females were severely stunted and (5%) were moderately stunted, while (6%) of male children were severely stunted and (10%) were moderately stunted. The age of (0-11 months) showed the majority of severe and moderate stunting. There was no significant association between sex of the child and nutritional status height for age.

3.5. Socio-economic characteristics and nutritional status height- for-age

Most of the severely stunted children were of the mothers aged 31-40 years. Married mothers had highest number of severely stunted children compared to people with other marital status. Although families with less than five members had the highest proportional of children who were severely stunted, the test of significance showed no relationship between family size and nutritional status. While mothers with university education had high severely stunted children. There was no relationship between socio-economic factors and nutritional statuses (Table 6).

Table 6 Association between socio-economic characteristics and height for-age

Variable	Severe stunting (%)	Moderate stunting (%)	Normal (%)	Total (%)
Age of Mother (years)				
Less than 20	0	1	3	4
21-30	3	2	21	26
31-40	8	8	32	48
Above 41	3	4	15	22
χ^2= 2.858 *P-value* = 0.826				
Marital Status				
Married	14	14	68	96
Separated	0	0	2	2
Divorced	0	1	1	2
χ^2= 2.889 *P-value* = 0.577				
Mother Education				
Illiterate	1	0	2	3
Khalwa	1	1	0	2
Primary/basic	0	1	12	13
Secondary	3	5	15	23
University	9	8	42	59
χ^2= 10.246 *P-value* = 0.248				
Mother Employment				
Employed	3	2	12	17
Business	0	0	3	3
Housewife	10	13	55	78
None	0	0	1	1
Others	1	0	0	1
χ^2= 8.282 *P-value* = 0.406				
Household monthly income (SDG)				
Less than 1000	1	1	15	17

1000 – 2000	7	11	38	56
3000 – 5000	3	0	11	14
5000 and above	3	3	7	13
χ^2= 8.060 *P-value* = 0.234				
Family size (Person)				
Less than 5	11	10	44	65
5 – 10	3	5	26	34
More than 10	0	0	1	1
χ^2= 1.708 *P-value* = 0.789				

4. Discussion

The results shows that, about 8% of male children were wasted and 4% of female children were wasted. There was no significant association between sex of the child and nutritional status (P-value were more than 0.05). Also, among under five children's mothers, wasting was the most common malnutrition problem (12%). On the levels of education results indicate that wasting was higher among children of educated mothers and housewives mothers there was a significant association between mother education and child wasting. The study also reveal that income and family size has effects of wasting where it was high among households with income (1000 – 2000 SDG) and the households with family size less than five persons.

It was found that, undernutrition most commonly results from a lack of access to high-quality, nutritious food. The household income is found to be a socio-economic variable because it influences the access to nutritious food and the probability of under and overnutrition in a community [15]. The probability of overnutrition is significantly higher in higher-income families than in disadvantaged families. High food prices is a major factor preventing low income households from getting nutritious food. For example, Khan and Kraemer found that in Bangladesh, low socioeconomic status was associated with chronic malnutrition since it inhibited purchase of nutritious foods (like milk, meat, poultry, and fruits)[16]. Food shortages may also contribute to malnutrition in countries which lack technology. However, in the developing world, 80% of malnourished children live in countries that produce food surpluses, according to estimates from the Food and Agriculture Organization [17]**.** Famine has always been a problem of food distribution, purchasing power, and/or poverty, since there has always been enough food for everyone in the world [18]. This similarity might be due to the fact that high socio-economic households can get enough food for children to feed and households with low economic status are not able to afford the nutritious foods for their child.

The results also show that, 11% of male children were underweight, while 8% of female's children were underweight. There was a significant association between sex and weight for age indicator.

(19%) of children's mothers, were underweight. There was no significant association between married status, employment and education of mothers and weight for age indicator.

Social conditions have a significant influence on the health of people [19]. The social determinants of undernutrition mainly include poor education, poverty, disease burden and lack of employment. Identifying and addressing these determinants can eliminate undernutrition in the long term. Identification of the social conditions that causes malnutrition in children under five has received significant research attention as it is a major public health problem [13].

(13%) of females children were stunted, while (16%) of male children were stunted. The age of (0-11 months) showed the majority of severe and moderate stunting. There was no significant association between sex of the child and nutritional status height for age.

Some similar researchers found that, age of the mother may influence the nutritional status of a child in various ways that, the mother's age independently correlated with stunting. Mothers aged above 30 years had significantly more children with stunting compared to those aged below 30 years. Very young mothers are known to have psychological feelings that they are not knowledgeable enough to take good care of their children [20], something that may lead to

poor caring of their children. Moreover, older mothers have more experience in child care than young mothers and are likely to find solutions to their problems. Family/household income was a significant predictor of underweight in this study.

Most of the severely stunted children were of the mothers aged 31-40 years. Married mothers had highest number of severely stunted children compared to those with other marital status. Although families with less than five members had the highest proportional of children who were severely stunted, the test of significance showed no relationship between family size and nutritional status. While mothers with university education had high severely stunted children. This assessment should be considered seriously before the other relationships between socio-economic factors and nutritional status became significant.

There are also sociopolitical causes of malnutrition, e.g., the population of a community might be at increased risk for malnutrition if government is poor and the area lacks health-related services. On a smaller scale, certain households or individuals may be at an even higher risk due to differences in income levels or levels of education [21]. For example, communities with high social support and knowledge sharing about social protection programs can enable better public service demands. It is argued that commodity speculators are increasing the cost of food. As the real-estate bubble in the United States was collapsing, it is said that trillions of dollars moved to invest in food and primary commodities, causing the 2007–2008 food price crisis [22].

5. Conclusions

Also there were an obvious differences between some socio-economic factors and malnutrition parameters, but there were no significant association between sex of the child and nutritional status and between mother education and child wasting, also between married status, employment and education of mothers and weight for age indicator and also no relationship between family size and nutritional status. But there was a significant association between sex and weight for age indicator. This assessment should be considered seriously before the other relationships between socio-economic factors and nutritional status became significant.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to disclosed.

Statement of ethical approval

Approval to carry the study was obtained from the University of Gezira, Ministry of Health research department and from health facilities.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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