Malnutrition is a broad term that refers to both under nutrition and over nutrition. Individuals are malnourished, or suffer from under nutrition if their diet does not provide them with adequate calories and protein for maintenance and growth or they cannot fully utilize the food they eat due to illness or when their diets contain too much nutrients that causes health problem [1]. Malnutrition increase the risk of infectious disease and moderate malnutrition weakens every part of the immune system, for example, it is a major risk factor in the onset of active tuberculosis [2]. Low energy and impaired function of brain also represent the downward spiral of malnutrition as victims are less able to perform the tasks the need to in order to acquired food earn an income or gain an education. Malnutrition and it is drastic effect are more prevalence among children.


Factors that contribute to malnutrition are many and varied. Studying the level of malnutrition and factors associated with under five children in White Nile State; Sudan, 100 women bearing under five children divided in two 50 children in each. Groups a (malnourished children group from Kosti, and Tandalty teaching hospitals and group B community control group. The objective of the present study is to evaluate the effect of maternal knowledge on malnutrition and the impact of some socio-economic and demographic factors of households on the nutritional status of children less than 5 years of age from Kosti, and Tandalty Hospitals. Factors included: family income, parental education, maternal nutritional knowledge, residence location, gender, and breastfeeding practices. The study was observation survey using a structured questionnaire. Hundred mothers of children under five participated in the study divided into two group, group A malnourished group and group B the control group enclosed healthy children. Study finding and show that the level of wasting, stunting, and underweight in children under five years of age was 34%, 14 %, and 52% respectively among the malnourished group. The prevalence of underweight decreased significantly as family income increased. And higher level of the mother's education. Then the frequencies of mother who are breastfeeding among studied groups. In group A the majority (21%) poor breastfeeding and about (29%) of them their children received acceptable level of breastfeed, For group B, community studied group the distribution was 5% & 45 for poor and good breastfeeding respectively, so breast fed children generally have lower incidence of malnutrition. As conclusion efforts for redressing child under nutrition should focus on factors associated with development outcomes such as household income, maternal education, and breastfeeding, and maternal nutritional knowledge, micronutrient requirement for both child and mother.

Keywords: Children; Malnutrition; Maternal Knowledge; Stunting; Socio-Economic; Breastfeeding

Introduction

Malnutrition is a broad term which refers to both under nutrition (sub-nutrition) and over nutrition. It is influenced by three broad factors: food health and care [1]. Optimal nutritional status results when children have access to affordable, diverse, nutrient-rich food; appropriate maternal and related factors in Kosti and Tandalty Hospital, White Nile State, Sudan

Eptihag Abdelrahman1, Kamal Abdelmokaram2, Sharafeldeen Idriss3 and Waleed Aboshora4*  
1Department of Community, Faculty of Nursing, University of El Imam Elmahdi, Kosti, Sudan  
2Department of Food Processing Engineering, Faculty of Engineering and Technical Studies, University of Ellmam Elmahdi, Kosti, Sudan  
3Department of Biochemistry, Faculty of Medicine, University of El Imam Elmahdi, Kosti, Sudan  
4State Key Laboratory of Food Science and Technology, Jiangnan University, Wuxi 214122, Jiangsu, P. R. China

Abstract

Malnutrition affects physical growth, morbidity, mortality, cognitive development, reproduction, and physical work capacity, and it consequently impacts on human performance, health and survival. Factors that contribute to malnutrition are many and varied. Studying the level of malnutrition and factors associated with under five children in White Nile State; Sudan, 100 women bearing under five children divided in two 50 children in each. In group A the majority (21%) poor breastfeeding and about (29%) of them their children received acceptable level of breastfeed, For group B, community studied group the distribution was 5% & 45 for poor and good breastfeeding respectively, so breast fed children generally have lower incidence of malnutrition. As conclusion efforts for redressing child under nutrition should focus on factors associated with development outcomes such as household income, maternal education, and breastfeeding, and maternal nutritional knowledge, micronutrient requirement for both child and mother.

Keywords: Children; Malnutrition; Maternal Knowledge; Stunting; Socio-Economic; Breastfeeding

Introduction

Malnutrition is a broad term which refers to both under nutrition (sub-nutrition) and over nutrition. Individuals are malnourished, or suffer from under nutrition if their diet does not provide them with adequate calories and protein for maintenance and growth or they cannot fully utilize the food they eat due to illness or when their diets contain too much nutrients that causes health problem [1]. Malnutrition increase the risk of infectious disease and moderate malnutrition weakens every part of the immune system, for example, it is a major risk factor in the onset of active tuberculosis [2]. Low energy and impaired function of brain also represent the downward spiral of malnutrition as victims are less able to perform the tasks the need to in order to acquired food earn an income or gain an education. Malnutrition and it is drastic effect are more prevalence among children.

Factors affecting nutrition status includes Gender factors maternal factors such as nutritional knowledge, education levels and breast feeding, socioeconomically factors and environmental factors such as infection diseases, sanitation and hygiene [3]. The UNICEF (2010) conceptual framework defines malnutrition and captures the malt factorial causality of under nutrition. Nutritional status is influenced by three broad factors: food health and care [1]. Optimal nutritional status results when children have access to affordable, diverse, nutrient-rich food; appropriate maternal and related factors in Kosti and Tandalty Hospital, White Nile State, Sudan.

*Corresponding author: 1. Sharaf Eldine Idriss, Department of Food Processing Engineering, Faculty of Engineering and Technical Studies, University of Ellmam Elmahdi, Kosti, Sudan, Tel: 00249122452028; E-mail: sharafdm@yahoo.com
2. Waleed Aboshora, State Key Laboratory of Food Science and Technology, Jiangnan University, Wuxi 214122, Jiangsu, P. R. China, Tel: 00249122452028; E-mail: aboshora15@mahdi.edu.sd


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and child-care practices; adequate health services; and a healthy environment including safe water, sanitation and good hygiene practices [4]. These factors directly influence nutrient intake and the presence of disease. The interaction between under nutrition and infection creates a potentially lethal cycle of worsening illness and deteriorating nutritional status [4]. Food, health and care are affected by social, economic and political factors.

Unfortunately, there are few studies and international reports about maternal and children health and nutrition and the more recent one was conducted by UNICEF [1]. Even so for political events these few articles focusing only on south part the country before it separation in 2011, moreover there are some important issues were missed in these reports Sudan federal ministry of health (2014) acknowledged that the percentage of malnutrition among child in Sudan has become higher than the global figures.

The methods of assessing nutritional status of children are; anthropometric methods, biochemical tests, clinical signs and symptoms and dietary assessment methods used either alone or more effectively in combination [5]. Increasingly, nutritional assessment systems are now applied to define multiple lives of nutrient status and not just the level associated with a nutrient deficiency [6]. Thus, only anthropometric and dietary methods were used in this study because they yield satisfactory results within due ceiling of the available resources.

Anthropometry is the most useful tool for assessing the nutritional status of children. There are many anthropometric indicators in use, such as mid upper arm circumference (MUAC), weight for age, weight for height and body mass index. Most of these indicators need to be used along with specific reference tables, e.g. National Centre for Health Statistics (NCHS) tables, for interpreting data [7]. The global prevalence in children under the age of 5 has declined 36 per cent over the past two decades-from an estimated 40 per cent in 1990 to 26 per cent in 2011 [4].

Prevalence of malnutrition among under-five children is very high in many developing countries of the World [8]. In developing countries, approximately 183 million children are underweight-for-age, 67 million are underweight-for-height (wasted), and 226 million are low height-for-age (stunted). An estimated 230 million under-five children are believed to be chronically malnourished in developing countries [9].

In Sub-Saharan Africa, 41% of under-five children are malnourished and deaths from malnutrition are increasing on daily basis in the region [10]. The 2008 Kenya Demographic and Health Survey showed that 35.3% of under-five children were stunted nationwide, 6.7% were wasted, and 16.3% were underweight [11]. Due to intensive an effort of international organizations in north and some of east central Africa the levels and trends in child malnutrition from 1990-2011 show that the global prevalence of stunting has decreased 36 % from an estimated 40 % in1990 to 26 % in 2011. The global prevalence of underweight has declined from 37 % in 1990 to 25 % in 2011 [12].

The UNICEF [13] conceptual framework defines malnutrition and captures the malt factorial causality of under nutrition. Nutritional status is influenced by three broad factors: food health and care. Optimal nutritional status results when children have access to affordable, diverse, nutrient-rich food; appropriate maternal and child-care practices; adequate health services; and a healthy environment including safe water, sanitation and good hygiene practices [14]. These factors directly influence nutrient intake and the presence of disease. The interaction between under nutrition and infection creates a potentially lethal cycle of worsening illness and deteriorating nutritional status [14]. Food, health and care are affected by social, economic and political factors. The combination and relative importance of these factors differ from country to country. Understanding the immediate and underlying causes of under nutrition in a given context is critical to delivering appropriate, effective and sustainable solutions and adequately meeting the needs of the most vulnerable people [14]. The global conceptual framework of the causes of malnutrition presents a useful generalized understanding of how malnutrition and/or child death are the outcomes of a multispectral development problem that can be most effectively analyzed in terms of immediate, underlying and basic causes [13].

There are two main types of children malnutrition: Kwashiorkor known as protein energy malnutrition (PEM), a result of deficiencies in any or all nutrients (includes micronutrients, as well as macronutrients) characterized by: nutritional oedema, loss of appetite, hair changes, Skin lesions and de-pigmentation, children are usually apathetic, miserable and irritable [15].

Marasmus

Micronutrient deficiency diseases (MDD’s) occur as a result of deficiencies in specific micronutrients (vitamins or minerals) with the following sign: A thin ‘old man’ face, ‘baggy pants’ loose skin around the buttocks, no nutritional oedema, prominent ribs, the children are usually active and may appear to be alert in their condition[15]. Marasmus Kwashiorkor: in this type of malnutrition child shows combined symptoms of Marasmus and Kwashiorkor [15].

Child malnutrition impacts cognitive function and contributes to poverty through impending individual's ability to lead productive lives. In addition, it is estimated that more than one-third of under-five deaths are attributable to under nutrition [12]. Under nutrition can cause various diseases such as blindness due to vitamin A deficiency and neural tube defects due to folic acid deficiency [14]. Malnourished children have a delayed motor development and lower cognitive function and school performance. In adulthood, individuals who were malnourished as children have impaired work capacity and worse reproductive performance. Malnutrition can have negative effects not only on those afflicted but also on their offspring [16].

Materials and Methods

Ethical Consideration

Research clearance will be taken from the Dean's Office Faculty of nursing, University of El Imman Elmahdi. Permission letter must be taken from Kosti and Tandaltly hospital medical manger through application letter from the Dean's Office Faculty of nursing
University of El Imam Elmahdi before undertaking the research.

**Study Design:** A cross-sectional survey study used structured questionnaire to collect qualitative and quantitative data was collected, by using convenience sample, in which all mothers bearing under-five years’ old children with malnutrition are inclusion and all mothers bearing under-five years’ old children without malnutrition are exclusion.

**Study Site:** The study was conducted in Kosti teaching hospital in Kosti, City located nearly to 350 kilo meters from Khartoum city the capital of republic of Sudan, and Tandalty hospital is a village which located nearly to 100 kilo meters eastern Kosti.

**Samples Collection:** 50 samples were collected from mothers bearing under-five years (6-59 months) of age children with malnutrition in Kosti, and Tandalty hospitals to wise per week between NOV – DEC 2016, and 50 samples were collected from mothers bearing under-five years (6-59 months) of age children with no sign of malnutrition as a control group in community, which are divided in two groups

**Group A:** Malnourished children (50 children)

**Group B:** Children with no sign of malnutrition as a control group (50 children), then the data were collected from five phases.

Nutritional knowledge data Nutritional knowledge data collected using a structured questionnaire from mothers. The information was nutrition messages such as mother background about child nutrition (Types requirements per age, breastfeeding & time of weaning,)Socioeconomic status data

Health & Hygiene data

Child morbidity data

**Anthropometric data**

The anthropometric data collected using the procedure stipulated by the WHO (2006) for taking anthropometric measurements. Before taking anthropometric data for children; their age should first be determined in order to ensure the target population. A local event used to establish the birth period. The mothers were asked whether the child was born before or after certain major events until a fairly accurate age was pinpointed.

**Data Management:** Data entry templates developed before data collection using. Since the sample size was small a modified biostatistics analytic program known as Graphpad Prism.

### Results and Discussion

The present study reports on the level of maternal knowledge on malnutrition and the impact of some socioeconomic and demographic characteristics of households on the nutritional status of children under-five years of age in (Kosti, and Tandalty hospital) White Nile State. Hundred mothers of under-five children divided into group (A) malnourished children from Kosti, and Tandalty hospital and group B community control group.

A number of similar studies have been conducted in various parts of the world [12,17,18]. In studying the correlates of under nutrition in children under three years of age, our findings revealed that strong relationship between, maternal nutritional knowledge, family income, maternal education and the nutritional status of children exists in this study, Findings in Table 1, correlate to study on children attended Mohamed Alamin Pediatric Hospital Khartoum Sudan, said that malnutrition was more prevalent in males than in females [19]. In Studies in Ethiopia done by Christiansen and Alderman [20] found that more boys than girls younger than five years old had malnutrition. Finally, more recent UNICEEL report regarding effect of gender on the distribution of malnutrition among children showed that girls and boys are almost likely to be stunted globally, but in Africa stunting affects more boys than girls [4].

| Table 1: Gender Distribution among the Studied Group |

<table>
<thead>
<tr>
<th>Variable</th>
<th>GROUP A</th>
<th>GROUP B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender Distribution</td>
<td>No.</td>
<td>Percentage (%)</td>
</tr>
<tr>
<td>Female</td>
<td>21</td>
<td>21%</td>
</tr>
<tr>
<td>Male</td>
<td>29</td>
<td>29%</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>50%</td>
</tr>
</tbody>
</table>

**Note:** GROUP A: Malnourished children group, GROUP B: Community children group

Presenting malnutrition measures among group A. The children with stunting were 14% (8% male and 6% female) and underweight children were 52% (34% male and 18% female) and that whom were those with wasting were accounted for 34% (22% male and 12% female). The prevalence of Anthropometric measures beyond the standard level was higher among males compared to females. For the (B group), anthropometric measures obtained from the group reflect the absent of abnormal anthropometric measures among the children.

| Table 2: Anthropometric measures; distribution of among malnourished studied group |

<table>
<thead>
<tr>
<th>SEX</th>
<th>Anthropometric Measures</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stunting</td>
<td>Under weight</td>
</tr>
<tr>
<td></td>
<td>Height/Age</td>
<td>Weight/Age</td>
</tr>
<tr>
<td>Male</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Female</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>7</td>
<td>14%</td>
</tr>
</tbody>
</table>
Although Sudan is rich in natural and human resources, (77.5%) of the households surveyed in north Sudan were on or below the poverty line [21]. A correlation between the household income and the children’s nutritional status found in this study in Table 3 is the strongest one among all factors influence child nutrition status. In this table no family with higher income present among the malnourished group while the majority 41 out of 50 have low income. These findings seem to be significant when compared with the control group in the same table. On the same side these results matching to an existing theory that malnutrition is largely due to poverty [22]. Study done in northern Sudan by Coulter, et al [23] revealed that poor family income has been found as a risk factor for severe acute malnutrition. On the other hand, we have to take in account the total family income spent on food or food allocation in the family. For example, even if a husband earned a sufficient income for the family, he may choose to spend it on things other than food for the family. Thus, an expenditure on nutrition, rather than income, might have measured poverty more accurately [24].

### Table 3: Socio-economic status of the studied groups

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>GROUP A</th>
<th>GROUP B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income\month</td>
<td>No Percentage (%)</td>
<td>No Percentage (%)</td>
</tr>
<tr>
<td>High income&gt;10000</td>
<td>0 0</td>
<td>4 4</td>
</tr>
<tr>
<td>Moderate income &lt;4000</td>
<td>9 9</td>
<td>29 29</td>
</tr>
<tr>
<td>Weak income &lt;1500</td>
<td>41 41</td>
<td>17 17</td>
</tr>
<tr>
<td>Total</td>
<td>50 50%</td>
<td>50 50%</td>
</tr>
</tbody>
</table>

Note: GROUP A: Malnourished children group, GROUP B: Community children group

Asghar, et al. [25] asserted that education affects health not because of the knowledge and practices one can learn at school, but rather it shapes an individual’s life and can alter the characteristics of an individual to be healthier. After controlling for employment, individual characteristics, socio-economic status, they still found education to be a significant determinant of the Self-Reported Health (SRH). Also education increases the knowledge about prevention methods; including hygienic behavior, improved home sanitation to fight insects and vectors carrying diseases…. etc. This was confirmed by many studies such as that of Emina et al. [26] Their results correlate with our finding in table 3, on association of maternal education with a lower prevalence of simultaneous multiple-malnutrition.

Also our study; table 4 supported by study conducted by of Abdalla et al. [27], who found strong relation between mother’s awareness and their children nutritional status this agree with us.

Regarding maternal nutrition knowledge, the study agrees with Webb and Block [28], they used household survey data from Central Java, Indonesia; found that a mother’s nutritional knowledge is a determinant of child short-term nutritional status (weight-for-height) whereas her schooling is a determinant of long-term nutritional status (height-for-age). Also same output obtained by Appoh and Krekling [29], using data from the Volta Region in Ghana, found that mother’s nutritional knowledge is more important than mother’s schooling in determining child weight–for-age.

However, these authors accounted neither for the simultaneity of inputs choices, nor the endogeneity of mother’s health knowledge. For social or economic events maternal nutrition knowledge substitutes for schooling, particularly at lower levels of income and schooling this was seen clearly in our groups and agree with the study of Block [30].

### Table 4: Levels mothers Education

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>GROUP A</th>
<th>GROUP B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mothers’ Education</td>
<td>NO.</td>
<td>Percentage (%)</td>
</tr>
<tr>
<td>No education</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>Primary</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Secondary</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>University</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>50%</td>
</tr>
</tbody>
</table>

Note: GROUP A: Malnourished children group, GROUP B: Community children group

### Table 5: Frequencies of nutritional knowledge among mothers of studied groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>GROUP A</th>
<th>GROUP B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mothers Nutritional Knowledge</td>
<td>NO.</td>
<td>Percentage (%)</td>
</tr>
<tr>
<td>Moderate</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Week</td>
<td>47</td>
<td>47</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>50%</td>
</tr>
</tbody>
</table>

Note: GROUP A: Malnourished children group, GROUP B: Community children group
Table 6, reflects the anthropometric measures on group A, the prevalence of under-weight was the highest among both sex followed by wasting while stunting had the lowest percentage. Regarding this parameter there is wide variation among studies focusing on them. This why we are agree with some such as study conducted on food Surplus region of Ethiopia [31], while we are disagree with other as study applied in rural Kebeles of Haramaya district, Ethiopia revealed that, the prevalence of stunting and wasting were higher than under-weight [32]. This may be varies due to socioeconomic, sample size, study subjects and periods as compared with present study.

The analysis show that breast fed children generally have lower incidence of malnutrition health problems. Our study revealed that group A mothers show poor breastfeeding practice but somewhat better than the control group B this may attribute to many factors such they may has lower incomes and food availability so they may have prolonged breastfeeding periods while group B were more educated and have other options to stop breast feeding early such having more food options or being employed ladies. We need to strengthen health related institutions in order to create awareness and educate women on breast-feeding should be emphasized. This will help some women to discard some cultural views that a lazy woman's baby is the one that sucks breast to satisfaction. The protective effects of breastfeeding on children's nutritional status observed in this study suggest that breastfeeding is an important part of child care. However, there is need to educate mothers on safe breastfeeding and timely introduction of complementary foods because poor breastfeeding practices such as prolonged breastfeeding or failure to introduce adequate complementary foods as recommended places children at risk for stunting or underweight [33]. Regarding to our groups, the majority of mothers were breastfeeding their children (Table 7), this finding is supported the study conducted by Farhia and Fardows [34] in Sudan and their finding was revealed that the majority of respondents were having an idea of beneficial toward breastfed. This is one of good practices among Sudanese mothers as the constituents of breast milk is very nutritious and contains antibodies and lymphocyte from the mother that help child resist infection. As a global public health recommendation, infants should be exclusively breastfed for the first six months of life to achieve optimal growth, development and health. Non-exclusive breastfed children in the first 4 months had 3.95 times higher incidence of underweight and thereafter, to meet their evolving nutritional requirements, infants should receive nutritionally adequate and safe complementary foods while breastfeeding continues up to two years or beyond [35].

In the literature, micronutrient deficiencies are cited as the most common direct cause of children malnutrition [36]. More deep multiple micronutrient deficiencies during pregnancy may contribute to poor fetal growth and stunting since maternal iron deficiency, or micronutrients under nutrition is critical to the nutritional status of children under age 5, as it increases the probability of low-birth weight. The study reveals the clear association between vitamin A and iron deficiency and occurrence of malnutrition among group A when related to the control group. Our findings in (figure 1)match Huy, et al. [37] on important micronutrients required for maternal and child nutrition on other side regarding the gender the study shows the higher prevalence of vitamin A and iron deficiency sign among female in group A; malnourished group. Maternal iron deficiency, anemia or under nutrition is critical to the nutritional status of children under age 5, as it increases the probability of low-birth weight, which in turn increases the probability of neonatal deaths due to infections and asphyxia [38].

Sanitation and hygiene which consider as minor factors among factors associated with malnutrition by the most but real represent the backbone of the factor effect. Overcrowded and unsanitary living conditions are closely linked to poverty [39]. Similar study was conducted in Brazil by Ferrari et al. [40], which had shown that environmental and social factors as well as hygiene habits are important risk factors associated with nutritional status. This study revealed that the adjustment of sanitation and hygiene were weak among group A; malnutrition children than group B healthy group. Moreover malnutrition health outcomes are more prominent among children that had suffered from one or more sanitation and hygiene related diseases. Specifically, diarrhea presents the most serious threat, by significantly increasing stunting, wasting and underweight among the children. There is need to ensure that health institutions strengthen their in-house education of mothers on the causes of these diseases and ways of prevention. A major step is to educate them to treat all food items meant for little babies with utmost and strict hygiene. Available water (especially in the rural areas) may not always be clean, but women must cultivate the habit of boiling the water meant for children under-five. Also, ensuring that children are prevented from fever/malaria is a necessary step.

Conclusions and Recommendations

In conclusion, the present study confirms the observations of other studies that show higher levels of under nutrition in children under
five years’ households with low earnings, low parental education or households in rural areas. It can also be concluded that the high level of malnutrition observed in this study is unlikely to be attributed to challenges households may have. The study findings imply that efforts for redressing child under nutrition issues in should focus on factors associated with development outcomes such as family income, maternal education, and breastfeeding sanitation and micronutrient requirement for mothers as well as children. Such efforts should also have clearly thought out strategies for targeting efforts on elucidating factors that place boy children at greater risk for malnutrition compared to girl children.

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