The Medical Journal of Tikrit University (2025) 31 (2): 105 - 110
DOI: http://dx.doi.org/10.25130/mjotu.31.2.12

ISSN: 1813-1638

The Medical Journal of Tikrit University

Available online at:www.mjotu.com

IRAQI Academic Scientific Journals

MJTU

The Medical Journal of Tikrit University

Measurement of Skin Fold Thickness in Undernutrition and Normal Children Under Five Years

Noor Mahdi Shaman [(1)]; Bnar Qassim khorshed [(2)] Bahaa D. Muheealdeen [(3)]

[1,2]M.B.Ch.B, University of Kirkuk
[3]C.A.B.P Pediatric, Consultant pediatrician

Keywords: *Malnutrition, Skin fold thikness-Weight*.

ARTICLE INFO

Article history:

Received 01 Jul 2025
Accepted 01 Sep 2025
Available online 31 Dec 2025

Citation:

DOI: http://dx.doi.org/10.25130/mjotu.31.2.12

ABSTRACT

Background : In developing countries, malnutrition kills Three hundred thousand children under the age of 5 every year and is directly or indirectly responsible for more than half of all child deaths worldwide. Skinfold measurements are a common way to figure out one's body fat percentage. As a result, calipers are used to measure the thickness of skin at various points on the body.

Aim:

An investigation was conducted to determine the sensitivity and specificity of skin fold thickness in the early detection of undernutrition in children.

Patients and Methods

Normal and underweight children aged 2 months to 5 years old were randomly selected to participate in a cross-sectional hospital-based study at the Rehapelitation word of Pediatric Department at (Salahaddin General Hospital). The triceps area was used to measure skin fold thickness in all undernourished and normal weight children.

Results:

Unicef digital scales for children who cannot stand and Unicef digital scales for children who can stand were used to measure each child's weight, and the average of the two measurements was used to calculate the weight. Stabilometer was used for children over 2 years of age and infantometer was used for children under 2 years of age.

Corresponding author E mail:

INTRODUCTION:

Three hundred thousand children under the age of 5 die each year as a direct result of malnutrition in developing countries; more than half of all child deaths are caused by it. As a result, it raises the cost of healthcare (1). All aspects of an individual's health and well-being are dependent on a variety of factors. Other than diet and nutrition, there are a slew of other factors that can help keep people healthy and malnourished at bay. Environmental, sociodemographic, immunization, clean water supply, and even psychosocial initiatives can be included (2). Parental education, socioeconomic status, living standards, and child-rearing practices all play a role in a child's development (3). Breastfeeding practices, diet during illness for mother and child, maternal malnutrition, low birth weight babies with recurrent infections, etc. are examples of sociodemographic factors that influence health outcomes (4).

An imbalance between supply and demand for nutrients and energy is defined as malnutrition, according to the World Health Organization's (WHO) definition of malnutrition (1). More than half of all infant deaths in developing countries, particularly among children under the age of 5, are caused by malnutrition (5). Protein energy malnutrition (PEM), formerly known as protein calorie malnutrition, is the most common type of malnutrition in children (PCM). Protein and calorie deficiency in various degrees has also been defined as a pathological state associated with infections. When it comes to this condition, children between the ages of 6 and 36 months are most at a high risk, as they are more susceptible to infections, particularly gastrointestinal and measles. Among children with untreated PEM, death rates are high, and the risk of death increases as the condition worsens. These children die from electrolyte imbalance, hypothermia, and infection complications (6). Skinfold measurement is a method for determining a person's body fat percentage. A caliper is used to gently pinch the skin and the underlying fat in several places to remove excess skin and fat (7).

PATIENTS AND METHODS

Across Skin fold thickness was measured in a hospital-based sectional study on normal and underweight children aged 2 months to 5 years between 2nd January 2021 to 1st August 2021 in a randomly selected group from the Rehapelitation Department at Salahaddin General Hospital. Before beginning the study, the directorate of Salahaddin General Hospital obtained verbal and written consent from the child's parents.

a pre-written questionnaire to gather information on every participant in this study, whether they were overweight or underweight.

Table of Contents Patients were considered to be undernourished if their weight was less than 5th percentile for their age and gender on a standard growth chart. W/h measurements were taken to confirm the diagnosis of undernutrition by placing the measurements on a centile chart for w/h in relation to age and gender..

Weight between the 5th and 95th percentiles on growth charts for six-year-old patients is considered normal.

For both groups of normal and undernourished children, the Harpenden devise was used to measure skin thickness .

Diagnoses were made using the w/h chart, which included both weight and height.

RESULTS

The study showed that most children enrolled in this study were below 12 months followed by the age group 13-24 month, Table 1

The study showed no significant difference between males and females in regard to undernutrition, Table 2.

The study demonstrated that, most of underweight children were from rural area (60 of 100) compared with normal children, Table 3.

The study showed that high rates of children were belonged to mothers with illiterate and primary school level (P: 0.001), Table 4.

The study also showed that the lowest rates of children with underweight were belonged to mothers feed them by breastfeeding and the high rate was solid feeding, Table 5.

In this study, children with undernutrition in all age groups have much lower mean of SFT than normal children (P. value: 0.001), Table 6.

DISCUSSION

Malnutrition of the 10.8 million children under five who die each year are caused directly or indirectly by and contribute to one-third of the infectious disease-related deaths among children under five (53 percent) in developing countries (8).

The study found that the majority of participants were under the age of 12 months, followed by the 13-24-month-old age group. In terms of malnutrition, there was no discernible gender difference, according to the findings.

This is in line with the findings of the Sharghi et al. Iraq study (9). When it comes to malnutrition, this age group is the most vulnerable because of delayed feeding or families not starting to feed until after the first year of life, which is why the majority of cases occurred in the first year of life. Males were more likely than females to be underweight or malnourished. Ndemwa has made similar findings in previous studies in Kenya (10). It's possible that this is due to the fact that men and women have different feeding and care practices.

Most of the mothers in the study were illiterate or had a low level of education. The majority of cases have illiterate mothers as a result of improper milk or food preparation or sterilization methods, respectively. Parents who are illiterate are more likely to be unaware of health issues affecting their children, and this has been linked to under nutrition in children under the age of five. Poorly educated parents have a harder time explaining their child's symptoms to a doctor, which can make it more difficult for their child to get the best care possible (11).

Breast milk contains biological compounds that are anti-infective in nature, one of the advantages of breastfeeding over formula feeding. Breastfeeding has been shown to protect against underweight and malnutrition in studies. Breastfeeding appears to protect against malnutrition, according to a study by Dhami et al (12)

Undernourishment prevalence among the children studied, based on their gender, age, and ethnicity.

Following chronic disease (24%) and emotional deprivation (16%) and mental health problems (12%), inadequate intake

was found to be the most common cause of undernutrition in children in this study. Children's undernutrition is most often caused by inadequate feeding, followed by infections-related causes, as found by Dapi et al (13) and Wemakor et al (14). This could be because chronic disease and inadequate protein intake are the most common causes of immudeficiency, and immudeficiency worsens with increasing severity of malnutrition (15).

Over half of undernourished children (48.5%) in this study were found to have wasting as their primary symptom, followed by poor growth (44.5%), poor appetite (44.4%), and apathy (28%). According to Ghosh-Jerath et al. (16), the majority of severely malnourished children suffer from wasting and poor growth, and only 35 percent have a poor appetite.

To calculate body fat indices like percentage body fat and fat-free mass, skinfold thickness values can be incorporated into mathematical formulas (17). Argent et al (18) found that the skin fold thickness in children who were undernourished was significantly lower than that of healthy children. They also found that undernourished children in all age groups had a significantly lower standard deviation (SFT) than normal children. There is a correlation between skin fold thickness and early malnutrition, which indicates that skin fold thickness should be used as an indicator of malnutrition (19).

Underneath-nutrition cases are distributed according to the SFT in terms of Wt/Ht Children with low Wt/Ht ratios had a low SFT level, while children with high Wt/Ht ratios had a normal SFT level (P. value: 0.001), Table 3.14. Most children with normal Wt/Ht ratios had a normal SFT level. According to Argent et al. (19), children with low skin fold thickness index were significantly associated with a weight-to-height ratio of Wt/Ht.

CONCLUSION:

This study highlights that undernutrition is most prevalent among children aged 2–12 months, confirming that infancy is a critical period for nutritional vulnerability. Male children and those residing in rural areas were more commonly affected, suggesting the influence of both biological and socioeconomic factors. Low maternal educational level, particularly illiteracy, was prominent among the study population, emphasizing the role of maternal knowledge in child nutrition.

Inadequate dietary intake was identified as the leading cause of undernutrition, with wasting being the most common clinical manifestation. Anthropometric assessment revealed that weight-based indices, specifically weight-for-age and weight-for-height, along with skinfold thickness, were more sensitive and specific indicators for diagnosing undernutrition than height-for-age. A significant association was found between weight-for-height and skinfold thickness, whereas height showed no significant correlation with age. These findings indicate that acute forms of malnutrition predominate in the study population and that height-based measurements alone may underestimate undernutrition in young children.

RECOMMENDATION

Strengthen early detection and screening programs for undernutrition, particularly among children under five years of age, as they represent the most vulnerable group. Equip hospitals and primary health care centers with standardized and accurate anthropometric tools, including digital weighing scales, stadiometers, and

Happened skinfold calipers, to facilitate early and accurate diagnosis. Implement community-based nutritional education programs targeting caregivers, especially in rural areas, to improve feeding practices and dietary intake. Encourage further research with larger sample sizes and longer follow-up periods to identify the most sensitive and specific screening tools for childhood undernutrition. Lastly, Enhance the focus on malnutrition in undergraduate and postgraduate curricula, integrating both theoretical knowledge and practical training in nutritional assessment and management.

REFERENCES

1- Goudet, SM, Griffiths, PL, Bogin, BA et al. (2019) Nutritional interventions for preventing stunting in children (0 to 5 years) living in urban slums. Cochrane Database Syst Rev 2015, .

2- Pun VC, Dowling R, Mehta S. Ambient and household air pollution on early-life determinants of stunting—a systematic review and meta-analysis. Environmental Science and Pollution Research. 2021 Apr 9:1-9.

3- Scheffler C, Hermanussen M, Bogin B, Liana DS, Taolin F, Cempaka PM, Irawan M, Ibbibah LF, Mappapa NK, Payong MK, Homalessy AV. Stunting is not a synonym of malnutrition. European journal of clinical nutrition. 2020 Mar;74(3):377-86.

4- Bain LE, Awah PK, Geraldine N, Kindong NP, Siga Y, Bernard N, Tanjeko AT. Malnutrition in Sub–Saharan Africa: burden, causes and prospects. Pan African Medical Journal. 2013;15(1).

5- Karlsson O, Kim R, Bogin B, SV S. Maternal height-standardized prevalence of stunting in 67 low-and-middle-income countries. Journal of Epidemiology. 2021:JE20200537.

6- Lezo A, Diamanti A, Capriati T, Gandullia P, Fiore P, Lacitignola L, Gatti S, Spagnuolo MI, Cecchi N, Verlato G, Borodani S. Italian pediatric nutrition survey. Clinical nutrition ESPEN. 2017 Oct 1;21:72-8.

7- D'Amico F, Biagi E, Rampelli S, Fiori J, Zama D, Soverini M, Barone M, Leardini D, Muratore E, Prete A, Gotti R. Enteral nutrition in pediatric patients undergoing hematopoietic SCT promotes the recovery of gut microbiome homeostasis. Nutrients. 2019 Dec;11(12):2958.

8- Liu H, Xu X, Liu D, Rao Y, Reis C, Sharma M, Yuan J, Chen Y, Zhao Y. Nutrition-related knowledge, attitudes, and practices (KAP) among kindergarten teachers in Chongqing, China: A cross-sectional survey. International journal of environmental research and public health. 2018 Apr;15(4):615.

9- Carter LE, Shoyele G, Southon S, Farmer A, Persad R, Mazurak VC, BrunetWood MK. Screening for pediatric malnutrition at hospital admission: which screening tool is best?. Nutrition in Clinical Practice. 2020 Oct;35(5):951-8.

10- Bouma S. Diagnosing pediatric malnutrition: Paradigm shifts of etiology-related definitions and appraisal of the indicators. Nutrition in Clinical Practice. 2017 Feb;32(1):52-67.

11- Caselli TB, Lomazi EA, Montenegro MA, Bellomo-Brandão MA. Assessment of nutritional status of children and adolescents with spastic quadriplegic cerebral palsy. Arquivos de gastroenterologia. 2017 Jul;54(3):201-5.

12- Hulst JM, Huysentruyt K, Joosten KF. Pediatric screening tools for malnutrition: an update. Current Opinion in Clinical Nutrition & Metabolic Care. 2020 May 1;23(3):203-9.

13- Triarico S, Rinninella E, Cintoni M, Capozza MA, Mastrangelo S, Mele MC, Ruggiero A. Impact of malnutrition on survival and infections among pediatric patients with cancer: a retrospective study. Eur Rev Med Pharmacol Sci. 2019 Jan 1;23(3):1165-75.

14- Phillips CA, Bailer J, Foster E, Dogan P, Flaherty P, Baniewicz D, Smith E, Reilly A, Freedman J. Implementation of an automated pediatric malnutrition screen using anthropometric measurements in the electronic health record. Journal of the Academy of Nutrition and Dietetics. 2019 Aug 1;119(8):1243-9

15- Namara R. Evaluation of Local Government Policy Frameworks for Stunting Reduction in Uganda: A Case Study of Ntumgamo, Sheema and Kabale Districts. University of Washington; 2020.

16- Stein AD, Obrutu OE, Behere RV, Yajnik CS. Developmental undernutrition, offspring obesity and type 2 diabetes. Diabetologia. 2019 Oct;62(10):1773-8.

TABLES

Table 1: Distribution of study cases in regard to age

Age (month)	Normal SFT	Undernutrition SFT	P. value
2-12	6 ± 0.82	4 ± 0.89	0.001
13-24	9 ± 0.86	7 ± 0.91	0.001
25-36	11 ± 0.47	8 ± 0.73	0.001
37-48	12 ± 0.82	9 ± 0.5	0.001
49-60	12 ±0.81	9 ± 0.43	0.001

Table 2: Distribution of studied children according to educational level of mothers

Residence	Normal		Under weight		Total
	No.	%	No.	%	
Urban	53	26.50%	40	20.00%	93
Rural	47	23.50%	60	30.00%	107
Total	100	50.00%	100	50.00%	200

Table 3: Distribution of studied children according to educational level of mothers

Educational level	Normal weight		Under weight		Total
	No.	%	No.	%	
illiterate	29	14.5	41	20.5	70
Primary school	11	5.5	46	23	57
Secondary school	28	14	9	4	37
College	31	15.5	4	2	35
higher education	1	0.5	0	0	1
Total	100	50	100	50	200

Table 4 : Distribution of studied children according to type of feeding

Type of feeding	Normal weight		Underweight		Total
	No.	%	No.	%	
Breast feeding	12	7.89	3	1.97	15
Bottle feeding	28	18.42	28	18.42	56
Mixed feeding	28	18.42	32	21.05	60
Solid food	72	47.37	80	52.63	152

Table 5: Distribution of study cases according to SFT in regard to age.

Age (month)	Normal SFT	Undernutrition SFT	P. value
2-12	6 ± 0.82	4 ± 0.89	0.001
13-24	9 ± 0.86	7 ± 0.91	0.001
25-36	11 ± 0.47	8 ± 0.73	0.001
37-48	12 ± 0.82	9 ± 0.5	0.001
49-60	12 ±0.81	9 ± 0.43	0.001