Arch Iran Med. June 2018;21(7):302-309

http www.aimjournal.ir

ARCHIVES OF IRANIAN MEDICINE

Open Access

Original Article

Assessing the Prevalence and Treatment of Malnutrition in Hospitalized Children in Mofid Children's Hospital During 2015–2016

Farid Imanzadeh, MD[1]; Beheshteh Olang, MD, PhD[1]; Katayoun Khatami, MD[1]; Amirhossein Hosseini, MD[1*]; Naghi Dara, MD[1]; Pejman Rohani, MD[1]; Fatemeh Abdollah Gorji, MSc[2]; Maryam Beheshti, PhD[3]; Elham Mousavinasab, MSc Candidate[4]; Masood Kiani, MD[5]; Nazanin Farahbakhsh, MD[6]; Batoolsadat Emadi, MD[1]; Ali Akbar Sayyari, MD[1*]; Yngve Agneta, MD, PhD[7]

[1]Pediatric Gastroenterology, Hepatology and Nutrition Research Center, Research Institute for Children Health, Shahid Beheshti University of Medical Sciences, Tehran, Iran
[2]Clinical Research Development Center of Mofid Children's Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran
[3]Department of Agriculture, Food, and Nutritional Sciences, University of Alberta, Edmonton, Canada
[4]Master Candidate in Medical Education, School of Medical Education,, Mofid Children's Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran
[5]Department of Pediatrics, Amirkola Children's Hospital, Babol University of Medical Sciences, Mazandaran, Iran
[6]Department of Pulmonology, Mofid Children's Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran
[7]Uppsala University, Disciplinary Domain of Humanities and Social Sciences, Faculty of Social Sciences, Department of Food, Nutrition and Dietetics, Uppsala, Sweden

Abstract

Background: Malnutrition in hospitalized patients causes problems in treatment and increases hospitalization duration. The aim of this research was to determine the prevalence of malnutrition in hospitalized children.

Methods: Children aged 1 month to 18 years (n = 1186) who were admitted to medical and surgery wards of Mofid children's hospital from November 2015 to February 2016, entered the study. We measured different anthropometric variables in patients with malnutrition. Also, nutritional counseling was performed and three months follow-up was done.

Results: Patient data were registered in questionnaires particularly for children 2 years old and less. 597 children under 2 years of age and 607 children over two years entered the study. The data analysis was done by SPSS version 22.0 (Chicago, IL, USA). The *t* test inferential method was used in comparing variables. *P* values less than 0.05 were considered statistically significant. Based on the body mass index (BMI) Z score, and in accordance with the World Health Organization (WHO) cut-off, among children over 2 years, 9% were diagnosed as overweight or obese, 54% were within the normal range and 37% were underweight at time of admission. In the underweight group, 43% were mildly, 21.2% were moderately and 35.8% were severely underweight. Based on the weight for length Z score in patients less than 2 years of age at time of admission, 6% were overweight, 60% were in normal range and 34% were underweight. Among children with malnutrition, 21% had mild, 3.0% had moderate and 10% had severe malnutrition. No significant meaningful relation was found between prevalence of malnutrition and severity of illness. In the moderate to severe undernutrition group, nutritionist counseling was done. Comparison of BMI and weight, before and after admission (the baseline and the follow up visits), was done by means of repeated measurements. Comparison of the patient's weight at time of admission with weight at 1, 2 and 3 months after the first nutritional consultation showed statistically meaningful difference (P value < 0.05).

Conclusion: Growth indices need to be evaluated in every hospitalized child. Nutritional consultation is useful in children with malnutrition. The main purpose of early diagnosis of malnutrition is to prevent its progression, and also to design a useful, applicable and cost-effective nutritional intervention for malnutrition treatment.

Keywords: Children, Hospitalization, Malnutrition, Nutritional intervention

Cite this article as: Imanzadeh F, Olang B, Khatami K, Hosseini A, Dara N, Rohani P, et al. Assessing the prevalence and treatment of malnutrition in hospitalized children in Mofid children's hospital during 2015–2016. Arch Iran Med. 2018;21(7):302–309.

Received: October 11, 2017, Accepted: January 17, 2018, ePublished: June 1, 2018

Introduction

Malnutrition is one of the most important causes of disease exacerbation in hospitalized children.[1] Hospital staff, including doctors, nurses and clinical nutrition experts, should have a determinant key role in early diagnosis and proper treatment of malnutrition in hospitalized children. Malnutrition is defined as suffering from lack or excess of energy, protein and other nutritional supplements, which will cause measurable complications, growth disorders or unwanted clinical outcomes.[2] According to the data available in medical references, and considering the developmental level of countries, 21%–

***Corresponding Authors:** Ali Akbar Sayyari, MD; Pediatric Gastroenterology, Hepatology and Nutrition Research Center, Research Institute for Children Health, Shahid Beheshti University of Medical Sciences, Tehran, Iran. Email: Dr.sayyari@hotmail.com.
Amirhossein Hosseini, MD; Pediatric Gastroenterology, Hepatology and Nutrition Research Center, Research Institute for Children Health, Shahid Beheshti University of Medical Sciences, Tehran, Iran. Email: ah_hosseini@sbmu.ac.ir

80% of hospitalized children in developing countries suffer from malnutrition.[3-5] Despite recent advances in diagnosis and treatment of malnutrition, the prevalence of malnutrition in hospitalized children has shown no significant decrease.[6] Malnutrition in children, especially in hospitalized cases, leads to different unwanted outcomes including electrolyte-water disorders, poor response to respiratory supports, decreased therapeutic response to medical treatments and chemotherapies, immune deficiency and increased rates of septicemia, and wound and catheter infections.[7-9]

Loss of muscular bulk, wound healing disorders, prolonged hospitalization, increased post-operative complications, and morbidity and mortality are other outcomes.[8,9] Malnutrition will furthermore have worrisome effects on child growth in long term.[9] A child needs a positive balance of energy and nitrogen supply for proper growth. Disease-related injuries or injuries causing hospitalization in children, will lead to a competition between energy and nitrogen (protein) consumption that will cause malnutrition. Malnutrition primarily affects weight gain in children, and if not treated, it will also affect length growth in long-term. Obviously, the measurement of height for age index will be helpful in pediatric chronic malnutrition.[10]

Considering the harmful effects of malnutrition on children's quality of life, and the preventable short-term and long-term complications of malnutrition by early diagnosis and proper treatment, identification of children with malnutrition since their admission should be mandatory.[11,12] Therefore, including nutritional screening in hospital wards is logical and necessary.[13] Nutrition risk screening (NRS) means using a simple and rapid method at time of admission and also during hospitalization. It has the ability of identifying children with malnutrition or children at risk. In this screening method, 2–3 questions are asked about nutritional status, and anthropometric indices are measured. An educated healthcare provider, nurse or clinical nutritional expert can perform the screening process.[14]

Special Nutritional Screening tools such as NRS, STRONGkids, PYMS (Pediatric Yorkhill Malnutrition Score) and STAMP (Screening Tool for Assessment of Malnutrition in Pediatrics) have been used in many developed countries.[14] NRS is being used as a screening tool at time of admission in children and adults at risk of malnutrition.[15]

Despite the lack of a local nutritional screening tool for Iran, different studies have been conducted regarding the prevalence of malnutrition in hospitalized children. Anthropometric indices such as height for age, weight for age and weight for height, body mass index (BMI), mid upper arm circumference (MUAC) and triceps skin fold thickness (TSFT) have been used in such studies, and malnutrition prevalence has been estimated at 34%–58%.[16-19]

Also, in a children's hospital in Mashhad, Iran, in 2016, STAMP, PYMS and STRONGkids tools were compared in determination of malnutrition prevalence in hospitalized children.[20]

Since most of the studies about malnutrition have been performed in European countries, and the studies in Iran have used their specialized and localized tools, we decided to perform the present research.

A localized and standardized tool was prepared by the Center for Disease Control (CDC) in Ministry of Health and Medical Education (MOHME) section. It was necessary to perform a study to evaluate this nutritional screening tool. Thus, we designed the present study aiming at investigating the prevalence of malnutrition in hospitalized children 1 month to 18 years of age. The aim of this research was to determine the prevalence of malnutrition in hospitalized children. This study was performed in Mofid children's hospital in Tehran, Iran.

Patients and Methods

Subjects

Children aged 1 month to 18 years (n = 1186), admitted to medical and surgery wards of Mofid children's hospital from November 2015 to February 2016, were included in the study. The exclusion criteria were admission duration less than 48 hours, Ketogenic diet, neonatal intensive care unit (NICU) and pediatric intensive care unit (PICU) admission, and emergency department and neonatal department hospitalization. All patients of medical and surgical wards in Mofid children's hospital, except for those who met the exclusion criterion, entered the study. Underlying complications of the patients were numerous types of diseases such as pulmonary, rheumatologic, metabolic, infectious, gastrointestinal, hepatic, neurologic, immunologic, cardiologic diseases, and also orthopedic surgery, and neurosurgery. The patient data was entered in questionnaires. The questionnaire was inserted in the patient's admission file and was completed by the medical intern or resident who had admitted the patient after consent was obtained

The questionnaire was comprised of 3 parts: (1) the general demographic data (file number, age, gender, and the primary diagnosis, (2) anthropometric data (weight, height or length, head circumference in 2-year olds or younger children, weight for length z-score for 2 years old or younger children, and BMI for children over 2 years of age, and (3) questions about patient nutritional condition, loss of appetite, recent weight loss or any surgical operations. Patient appetite was a completely subjective question, which was asked from the parents of

children less than 5 years old; children over 5 years of age answered this question dependently. On the other hand, monitoring food intake was another way of assessing patient appetite in children over 2 years of age.

Patient age range was from 30 days to 18 years. They were divided into 2 groups: one group consisted of patients 2 years old and younger, and the second group consisted of patients older than 2 years. The "2 years old" cut-off point was chosen because before 2 years of age, rapid changes in weight makes the BMI parameter an unreliable way for monitoring nutritional status.[21]

Although the measurements of length or height, weight, and head circumference were a part of the routine and frequent physical examination, we obtained the consent from their parents or their caregiver.

Anthropometric Measurements

The length was measured for children younger than 2 years and height for 2 years old and older children to the nearest 0.1 cm. For children 1–24 months old, the length was measured in the supine position by infant meter Seca 417 with a fixed cephalic piece and a horizontal back piece and a mobile end piece. The height of the patients was measured in the upright position with Stadiometer 213 with a fixed back piece and a cranial mobile piece. The patient weights were measured to the nearest 0.1 kg using Seca scales. A digital scale was used for infants and Seca 760 for older children.

BMI was calculated for all children older than 2 years, and the charts were completed totally matched to WHO and CDC standards.[22] Finally, the BMI Z score for children older than 2 years, and the weight for length index for 1–24 months old children were calculated using the Medscape application (CDC Epi Info 3.2.2 software for children older than 2 years, and WHO AnthroPlus 1.0.4 software for 1–24 months old children).

Nutritional Condition Evaluation

According to the comprehensive database of WHO, Z score <-2 (weight for length, weight for age, height for age, and BMI) was defined as moderate under-nutrition, and Z score <-3 was defined as severe under nutrition. Also, Z score above 2 was defined as overweight. It should be noted that Z score between -1 and 2 is considered normal.[22]

Patients who had severe malnutrition (Z score <-2 in general cases and Z score <-1 in CF and malignancies), underwent nutritional interventions after an accurate and complete nutritional consult. By means of referral charts and tables based on needed calorie, lipids, proteins, and micronutrients, a complete and applicable enteral diet was designed for each case based on patient's age and gender.

The follow-up programs were designed based on patient age: every 2 weeks for patients less than 2 years old and monthly for patients over 2 years of age. In each medical visit, weight, mid-upper arm circumference, limb edema, nutritional daily consumption volume, and appetite were monitored.

Nutritional Screening Tools

In this study, the office of hospitalization management used a locally developed tool, which was standardized. Malnutrition severity was classified as mild, moderate or severe.

The patients were divided into 2 groups according to the chronicity and acuity of the underlying disease/s. All details about evaluating anthropometric indices and hospitalization-induced malnutrition were calculated in both groups of acute and chronic diseases.

Data Analysis

The data was entered into SPSS version 22.0 (Chicago, IL, USA). Quantitative variables were expressed as mean, standard deviation, and domain. Qualitative variables were expressed as descriptive statistics such as numbers and percentages. The relation between chronicity of underlying disease/s and undernutrition was analyzed by Fisher exact test. Comparison of BMI and weight before and after admission (the baseline and the follow-up visits) was done with repeated measurements. *P* values less than 0.05 were considered statistically significant.

Results

In this study, 2467 patient admission files (November 2015 - February 2016) were reviewed. Among them, 1281 cases were omitted from the study by exclusion criteria (age less than 30 days, emergency or neonatal department or NICU admission, hospitalization less than 48 hours, and ketogenic diet). Finally, 1186 patients entered the study. 579 cases were under 2 years old and 607 cases were 2 years old and older. In the group of children who were 2 years old and older, 257 (42.3%) cases were female and 350 (57.7%) were male.

Patients ≥2 Years

In 565 patient admission files (93.1%), the primary nutritional evaluation questionnaires were available, but 42 patients (6.9%) had no primary evaluation questionnaire in their admission files. The questionnaires were filled completely for 525 patients (86.5%), and 82 patients (13.5%) were not asked about their primary nutritional condition. The questionnaires were filled incompletely for 40 patients.

The mean age of the patients over 2 years was 77.1 ± 14.3 months with the range of 25–216 months. In

these patients, the mean weight was 22.7 ± 11.5 kg with the range of 6–37 kg and the mean height was 114.7 ± 21.9 cm with the range of 69–175 cm and the mean BMI score at time of admission was 16.4 ± 4.4 kg/m^2.

The mean Z score in these patients was -0.27 ± 2.7 with the range of -3.22–6.7; and the mean percentile was 44.2 ± 1.37 with the range of 0.1–99.9.

Overall, based on the BMI Z score at the time of admission, 53 (9%) were overweight, 328 (54%) were within the normal range, and 226 (37%) were underweight. In the group of 226 underweight patients, 97 (43%) had mild, 48 (21.2%) had moderate and 81 (35.8%) had severe malnutrition (Figure 1).

Among patients ≥2 years who entered the study, 176 (29%) suffered from chronic disease/s, and 431 (71%) had an acute illness. In the group of chronic patients, 39% were underweight, and in the group of acute patients, 36.5% were underweight (Figure 2). No significant meaningful relation was identified between malnutrition prevalence and chronicity of the illness (P = 0.215).

3.5% of the patients had lost more than 10% of their bodyweight. Nearly13% of the patients had lack of appetite or decreased food consumption secondary to nausea or severe vomiting. Nutritional consultation was done for 29 patients. Among them, 7 patients (1.2%) were given nutrition/diet therapy, 2 patients (0.3%) were asked to follow dietary recommendations, and 20 patients (3.3%) were given both diet therapy and dietary advice.

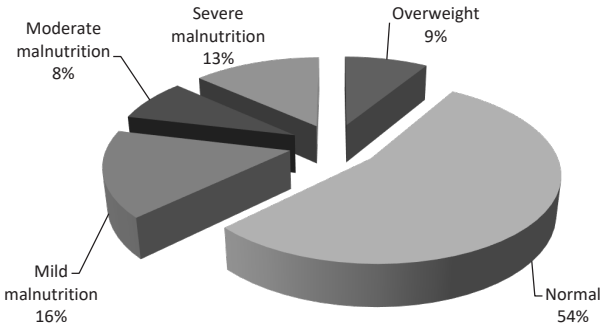

Figure 1. Distribution of frequency Percentage of Malnutrition Prevalence and its Severity In Children Over 2 Years of Age at Time of Admission Based on Body Mass Index (BMI) Z Score.

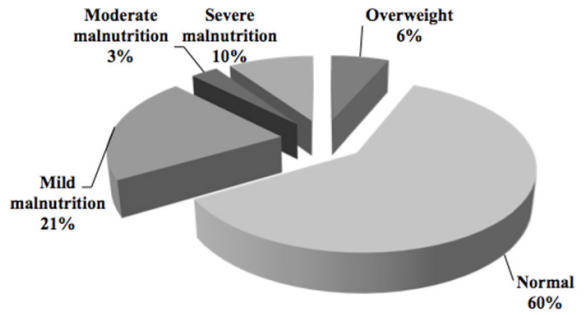

Figure 2. Distribution of Frequency Percentage of Malnutrition Prevalence and its Severity in Children Under 2 Years of Age at Time of Admission Based on Weight for Length Z Score.

Comparison of patients' weights at time of admission with their weights 1, 2 and 3 months after the first nutritional consultation showed a statistically meaningful difference (P < 0.001).

Comparison of BMI score at time of admission with the BMI calculated 1 month after nutritional consultation, showed no significant difference. But the comparison of admission BMI with the BMI calculated 2 and 3 months later, showed significant statistical difference (P < 0.001).

In evaluating patients less than 2 years of age, among 578 cases, 213 (36.8%) were female and 365 (63.2%) were male.

Patients <2 Years

The primary nutritional evaluation questionnaire was available in 542 patient admission files (93.8%). For 36 patients (6.2%), the primary nutritional evaluation was not available. This questionnaire had been filled completely for 496 patients (91.5%) and it was incomplete for 46 patients (8.5%). The mean age of the patients less than 2 years was 9.5 ± 6.8 months. In this group the mean weight was 8.4 ± 5.9 kg and the mean length was 68.9 ± 12.2 cm. The mean age of the girls less than 2 years of age was 9.8 ± 6.8 months. In this group of girls, the mean weight was 7.6 ± 2.6 kg, and the mean length was 68.0 ± 11.5 cm. The mean age of the boys less than 2 years of age was 9.3 ± 6.6 months. In this group of boys, the mean weight was 8.8±7.1 kg, and the mean length was 69.5 ± 12.5 cm.

The weight for length Z score was calculated in 192 girls and 322 boys in which for 28 girls (14.6%) and 21 boys (6.5%) the weight for length Z score was less than -2, and in 164 girls (85.4%) and 301 boys (93.5%) it was more than -2.

According to the weight for length Z score at time of admission, 32 patients (6%) were overweight, 298 patients (60%) were within the normal range, and 166 patients (34%) were underweight. Among 166 patients with malnutrition, 104 (21%) had mild, 15 (3.0%) had moderate, and 47 (10%) had severe malnutrition (Figure 3).

Overall, 176 patients (35.5%) had chronic disease/s and 320 patients (64.5%) had an acute illness. In the group of chronic diseases, 35.6%, and in the group of acute illnesses, 33.8% were suffering from malnutrition (Figure 4). There was no statistically meaningful relation between malnutrition prevalence and chronicity of the disease (P = 0.715).

Three girls (1.4%) and 14 boys (3.8%) had significant weight loss more than 10% of body weight in recent 3

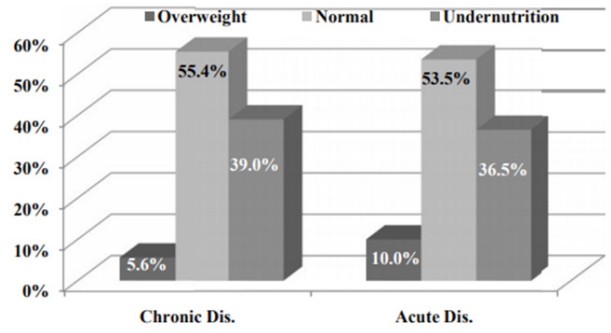

Figure 3. Distribution of Frequency Percentage of Malnutrition in Children Over 2 Years of Age According to Disease Condition (Acute or Chronic). Dis. = disease.

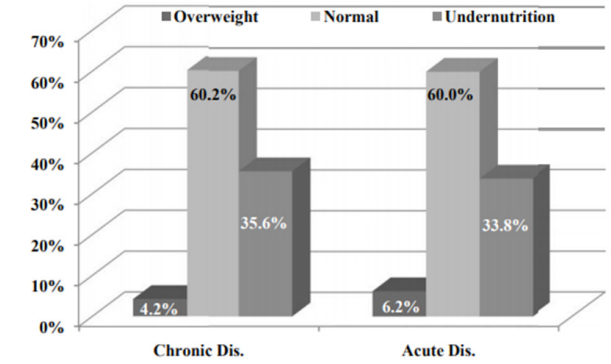

Figure 4. Distribution of Frequency Percentage of Malnutrition in Children Less Than Years of Age According to Disease Condition (Acute or Chronic). Dis. = disease.

months; and 21 girls (9.9%) and 30 boys (8.2%) had loss of appetite or decreased food consumption secondary to nausea or severe vomiting in recent weeks.

Twenty-two patients (4.4%) were referred for nutritional consultation in which 3 of them were given nutrition diet therapy; fourteen patients (2.8%) were recommended nutritional advice, and 5 patients (1%) had both.

Discussion

The present study was performed to determine the prevalence of malnutrition and nutritional interventions in hospitalized patients admitted to Mofid children's hospital. The main purpose of the present study was to evaluate the nutritional screening tool which was standardized by the CDC at the MOHME to be used as a local nutritional screening tool in Iran.

597 children less than 2 years of age and 607 children 2 years and older entered the study. Based on the BMI Z score at the time of admission, 9% of 607 children 2 years and older children were overweight, 54% were within normal range, and 37% were underweight. Among 226 children with malnutrition, 43% had mild, 21.2% had moderate and 35.8% had severe malnutrition. Based on the weight for length Z score in patients less than 2 years of age at the time of admission, 6% were overweight, 60% were within normal range and 34% were underweight. Among 166 children with malnutrition, 21% had mild, 3.0% had moderate and 10% had severe malnutrition.

Different tools have been designed, used, and locally adapted in other countries which were introduced and evaluated in previous studies.

NRS tool has 4 score points including appetite, weight (BMI Z score for adults and children older than 2 years, and weight for length for 2 years old children and younger), and underlying disease/s.[15]

STRONGkids is another tool and its ease of use has made it famous. In STRONGkids, a questionnaire is used to determine the present condition of patient's nutrition, underlying disease/s, nutritional intake and loss, and recent history of weight loss. This tool was used and introduced in 2007 in a study in Netherland for hospitalized children 1–16 months.[24] STRONGkids has already been used in different countries, and several standardization studies have been done.[25-28] PYMS is another tool which was introduced and used in England in 2008 for hospitalized children 1–16 years old. It has three parts: reviewing the current nutritional condition by using BMI, determining any recent differences in nutritional habits of hospitalized patients, and probability estimation of nutritional loss caused by underlying disease/s.[29] STAMP is another tool used in England by McCarthy in 2008 in the hospitalized children 2–17 years old during 4 weeks of hospitalization in internal medicine and surgery wards. It is similar to previous tools in determination of nutritional condition, underlying disease/s, and anthropometric data.[29]

Five studies have been conducted recently to determine the prevalence of malnutrition in children. These studies were similar to our study in case sampling, data collection and analysis method.[16]

In a study by Taheri et al, 360 children 1–36 months old admitted to Birjand hospital during a 3-month period in 2004 were included. The rate of malnutrition was 32.4% based on the index of weight for length, 58.6% based on the index of height for age, and 68.6% based on the index of weight for age.[30] The data analysis by the study of Taheri et al[30] was similar to ours, but the sample size was larger in our study which makes our results more reliable and trustworthy. Furthermore, we used different and diverse anthropometric indices in evaluating hospitalized induced malnutrition. On the other hand, in our study, the chronicity of illness that is an important variable effective in both anthropometric indices and loss of appetite leading to malnutrition was considered as an important finding.

Mahdavi and colleagues studied 140 2–12 years old patients in Tabriz Children's hospital in 2008. The

prevalence of malnutrition was 32.2% based on the index of weight for length, 30.7% based on the index of height for age, 48.6% based on the index of weight for age, and 14.3% based on TSFT.[16] This index is absent in our research and seems to be a positive point in their study. The other variables were the same in both studies. The different results in determining prevalence are due to different sample sizes, different study groups, and also different duration of studies.

In 2001, Vahidi et al divided 1120 children 6–24 months of age into 2 groups of inpatients and outpatients at Kerman Children's Hospital. The malnutrition prevalence was 76.6% according to Gomes index in the inpatient group and 60.5% in the outpatient group. However, the prevalence of malnutrition based on Waterlow index was 73.3% in inpatients and 57.5% in outpatients.[31] This research also was performed on outpatient cases and also the indices used were different from ours. Also, the age spectrum was limited to infants 6–24 months old and the chronicity of the underlying disease/s was not reviewed.

In a research by Ghaljaei et al,[32] 360 children 1-36 months of age in Zahedan hospital were evaluated during 6 months of hospitalization in 2006. The malnutrition prevalence was reported at 38.4% according to weight for length index, 60.1% according to height for age index, and 68.6% according to weight for age index.[32] The result of this study, regardless of sample size and evaluation of acuity and chronicity of the disease, was similar to our study.[16-19,30]

In a study by Sayyari and colleagues, 322 patients aged 1 month and older admitted to Mofid children's hospital, were evaluated during 3 months hospitalization in 2006. They came to the conclusion that if the patients experience more than 2% weight loss during hospitalization, the rates of hospitalization duration, medical costs, and severe diseases and diarrhea will increase.[19] Although his study had a smaller sample size in comparison with ours, the hospital was the same. The positive point of this article was that they evaluated hospital-induced diarrhea that was not studied before. Also, the study of Sayyari et al[19] adapted the results according to the duration of hospitalization that makes the results more reliable and valuable.

Marginean et al evaluated 400 children admitted to French hospitals during a 1-month period in 2014. In this research, malnutrition prevalence was reported at 58% in the moderate risk group, and 24% in the high-risk group based on weight for length Z score.[33] Berkley et al studied 8190 patients 12–59 months of age in a sub-Saharan African hospital during 1999–2002.[5] Severe malnutrition prevalence in this study was 16% based on weight for height Z score, and 16% based on MUAC.[5] Kapci et al evaluated 511 children with the mean age of 5.8 ± 4.9 years in Turkey, in 2015.[4] The prevalence of malnutrition in the acute illnesses group was 23.9%, in the chronic diseases group was 21.1%, and in the acute conditions superimposed on chronic diseases was 7.3%.[4] The main goal of the study of Kapci et al[4] was to evaluate the chronicity categories of different diseases and to compare them in different groups. The malnutrition conditions were obviously mostly in the acute illness group. But the relation between age and malnutrition was not studied in this report which seems to be an important variable according to previous studies.

Cao and colleagues evaluated 1,325 children older than 2 years admitted to Chinese hospitals in 2013. The malnutrition prevalence based on STRONGkids tool was 9.1% in the group at risk, 43.3% in the group of moderate risk and 47.6% in the high-risk group. They concluded that more hospitalization duration would increase the medical costs and weight loss in children.[34] The positive point of this study was the calculation of medical costs other than anthropometric indices.

In a study by Munoz-Esparza et al, the effect of hospitalization duration on children nutritional condition was evaluated in 2014.[35] The children with an experience of hospitalization with a minimum duration of 24 hours were entered this study and were followed up to 19 years of age. The anthropometric indices (weight for age, height for age, weight for length, BMI, head circumference, triceps and subscapular skin fold thickness) were calculated at time of admission, at the seventh day of admission and at the time of discharge. 206 cases entered the study (40% infant, 25% pre-school children, 15% school children and 20% teenagers). The infants had a significant decrease in their weight for length index during hospitalization. The teenagers had a decrease in BMI. Also, prolonged hospitalization more than 10 days decreased the anthropometric indices. Among different groups, the infant group had more loss and damage.[35]

In comparison with our study, the study of Munoz-Esparza et al calculated the anthropometric indices at the time of admission and discharge. Also the effect of prolonged hospitalization on anthropometric indices was evaluated in this study.[35]

In conclusion, according to the results of our study, children admitted for different indications should be evaluated from the point of view of growth indices to prevent or treat undernutrition. Nutritional consultations and interventions are available in hospitals for children with malnutrition. The main purpose of malnutrition diagnosis is to follow patients to prevent disease progression.

There were some limitations in our study that should be considered in future studies:

1) In acute illnesses, appetite is mostly affected by the

condition and also medical treatments. As a result, nutritional interventions may be less acceptable by the children due to poor appetite.

2) Some patients, mostly in the acute illness group, did not take part in follow-up visits.
3) Some of the hospital wards did not cooperate well in filling the nutritional questionnaires or did not perform nutritional consultation for patients.

Authors' Contribution

FI: Study consultant, supervising manuscript preparation. BO: Study consultant, data gathering, nutritional consultation. KK: Study consultant, data gathering. ND and PR: Scientific advice in performing the study. AH: data collection, manuscript preparation. FAG: Methodologic and statistical consultant. MB: Nutritional consultation. EM: Data collection from medical files. MK, NF and BE: data collection. AAS: Study designer and chief advisor of the study. YA: International study consultant

Conflict of Interest Disclosures

None.

Ethical Statement

This study was approved at the Clinical Research Development Center of Mofid Children's Hospital affiliated with Shahid Beheshti University of Medical Sciences, Tehran, Iran (Ethics code No. IR.SBMU.SM.REC.1394.211).

Acknowledgments

We are grateful to the head nurse of the Pediatric Gastroenterology ward at Mofid Children's Hospital, Ms. Elham Mousavinasab, and also Ms. Sayeh Hatefi, the Nutrition Expert who cooperated in data collection and also in sorting and categorizing data for SPSS analysis. The authors would like to acknowledge the generous contributions of Pediatric Gastroenterology, Hepatology and Nutrition Research Center and Clinical Research Development Center of Mofid Children's Hospital and also Research Institute for Children Health.

References

1. Pawellek I, Dokoupil K, Koletzko B. Prevalence of malnutrition in paediatric hospital patients. Clin Nutr. 2008;27(1):72-6. doi: 10.1016/j.clnu.2007.11.001.
2. Aurangzeb B, Whitten KE, Harrison B, Mitchell M, Kepreotes H, Sidler M, et al. Prevalence of malnutrition and risk of undernutrition in hospitalized children. Clin Nutr. 2012;31(1):35-40. doi: 10.1016/j.clnu.2011.08.011.
3. Barker LA, Gout BS, Crowe TC. Hospital malnutrition: prevalence, identification and impact on patients and the healthcare system. Int J Environ Res Public Health. 2011;8(2):514-27. doi: 10.3390/ijerph8020514.
4. Kapci N, Akcam M, Koca T, Dereci S, Kapci M. The nutritional status of hospitalized children: Has this subject been overlooked? Turk J Gastroenterol. 2015;26(4):351-5. doi: 10.5152/tjg.2015.0013.
5. Berkley J, Mwangi I, Griffiths K, Ahmed I, Mithwani S, English M, et al. Assessment of severe malnutrition among hospitalized children in rural Kenya: comparison of weight for height and mid upper arm circumference. JAMA. 2005;294(5):591-7. doi: 10.1001/jama.294.5.591.
6. Shaughnessy EE, Kirkland LL. Malnutrition in Hospitalized Children: A Responsibility and Opportunity for Pediatric Hospitalists. Hosp Pediatr. 2016;6(1):37-41. doi: 10.1542/hpeds.2015-0144.
7. Hulst J, Joosten K, Zimmermann L, Hop W, van Buuren S, Buller H, et al. Malnutrition in critically ill children: from admission to 6 months after discharge. Clin Nutr. 2004;23(2):223-32. doi: 10.1016/s0261-5614(03)00130-4.
8. Agostoni C, Axelson I, Colomb V, Goulet O, Koletzko B, Michaelsen KF, et al. The need for nutrition support teams in pediatric units: a commentary by the ESPGHAN committee on nutrition. J Pediatr Gastroenterol Nutr. 2005;41(1):8-11.
9. Secker DJ, Jeejeebhoy KN. How to perform Subjective Global Nutritional assessment in children. J Acad Nutr Diet. 2012;112(3):424-31.e6. doi: 10.1016/j.jada.2011.08.039.
10. Sissaoui S, De Luca A, Piloquet H, Guimber D, Colomb V, Peretti N, et al. Large scale nutritional status assessment in pediatric hospitals. ESPEN J. 2013;8(2):e68-72. doi: 10.1016/j.clnme.2013.02.002.
11. Joosten KF, Hulst JM. Malnutrition in pediatric hospital patients: current issues. Nutrition. 2011;27(2):133-7. doi: 10.1016/j.nut.2010.06.001.
12. Pacheco-Acosta JC, Gomez-Correa AC, Florez ID, Cortes JE, Velez D, Gomez J, et al. Incidence of nutrition deterioration in nonseriously ill hospitalized children younger than 5 years. Nutr Clin Pract. 2014;29(5):692-7. doi: 10.1177/0884533614533122.
13. Karagiozoglou-Lampoudi T, Daskalou E, Lampoudis D, Apostolou A, Agakidis C. Computer-based malnutrition risk calculation may enhance the ability to identify pediatric patients at malnutrition-related risk for unfavorable outcome. JPEN J Parenter Enteral Nutr. 2015;39(4):418-25. doi: 10.1177/0148607114529161.
14. Huysentruyt K, Vandenplas Y, De Schepper J. Screening and assessment tools for pediatric malnutrition. Curr Opin Clin Nutr Metab Care. 2016. doi: 10.1097/mco.0000000000000297.
15. Reilly HM, Martineau JK, Moran A, Kennedy H. Nutritional screening--evaluation and implementation of a simple Nutrition Risk Score. Clin Nutr. 1995;14(5):269-73.
16. Mahdavi AM, Ostadrahimi A, Safaiyan A. Nutritional status of children hospitalized in Tabriz Paediatric Hospital, Islamic Republic of Iran, 2008. East Mediterr Health J. 2011;17(1):36-40.
17. Beheshti M, Imanzadeh F, Shahidi N. Evaluation of the nutritional status in children admitted to the neurology ward of mofid children's hospital. Iran J Child Neurol. 2010;3(4):51-7. doi: 10.22037/ijcn.v3i4.1538.
18. Sharifzadeh G, Mehrjoofard H, Raghebi S. Prevalence of Malnutrition in under 6-year Olds in South Khorasan, Iran. Iran J Pediatr. 2010;20(4):435-41.
19. Sayyari AA, Imanzadeh F, Moradi M, Javaherizadeh H, Shamshiri AR. Evaluation of nutritional status in children hospitalized in Mofid Children's Hospital, Tehran, Iran. Prz Gastroenterol. 2013;8(2):120-5. doi: 10.5114/pg.2013.34837.
20. Hosseini Nasab M, Gholampour Z, Imani B, Norouzy A. Prevalence of malnutrition risk based on three nutritional risk scores in hospitalized iranian children. Int Res J Appl Basic Sci. 2016;10(4):438-443.
21. Vanessa S, Helen M. Nutritional assessment, dietary requirements, feed supplementation. In: Vanessa S, ed. Clinical Pediatric Dietetic. 4th ed. Oxford: Wiley Blackwell; 2015: 6-17.
22. Anthropometry Procedures Manual Available from: http://www.cdc.gov/nchs/data/nhanes/nhanes_09_10/bodymeasures_09.pdf. Accessed August 2014.
23. Laillou A, Prak S, de Groot R, Whitney S, Conkle J, Horton L, et al. Optimal screening of children with acute malnutrition requires a change in current WHO guidelines as MUAC and WHZ identify different patient groups. PLoS One. 2014;9(7):e101159. doi: 10.1371/journal.pone.0101159.
24. Joosten K, Meyer R. Nutritional screening and guidelines for managing the child with faltering growth. Eur J Clin Nutr. 2010;64 Suppl 1:S22-4. doi: 10.1038/ejcn.2010.44.
25. Ling RE, Hedges V, Sullivan PB. Nutritional risk in hospitalised children: An assessment of two instruments. E Spen Eur E J Clin Nutr Metab. 2011;6(3):e153-7. doi: 10.1016/j.eclnm.2011.01.007.
26. Moeeni V, Day AS. Nutritional risk screening tools in hospitalised

children. Int J Child Health Nutr. 2012;1(1):39-43.
27. Huysentruyt K, Alliet P, Muyshont L, Rossignol R, Devreker T, Bontems P, et al. The STRONG(kids) nutritional screening tool in hospitalized children: a validation study. Nutrition. 2013;29(11-12):1356-61. doi: 10.1016/j.nut.2013.05.008.
28. Hulst JM, Zwart H, Hop WC, Joosten KF. Dutch national survey to test the STRONGkids nutritional risk screening tool in hospitalized children. Clin Nutr. 2010;29(1):106-11. doi: 10.1016/j.clnu.2009.07.006.
29. Gerasimidis K, Keane O, Macleod I, Flynn DM, Wright CM. A four-stage evaluation of the Paediatric Yorkhill Malnutrition Score in a tertiary paediatric hospital and a district general hospital. Br J Nutr. 2010;104(5):751-6. doi: 10.1017/s0007114510001121.
30. Taheri F, Sharifzadeh G, Nasiri A. Prevalence of malnutrition in 1-36 month old children hospitalized in Valiyy-e-Asr Hospital of Birjand. J Birjand Univ Med Sci. 2006;13(2):77-83.
31. Vahidi AA, Torabinezhad MH, Ahmadi A, Ghazanfaripour F. Prevalence of malnutrition in hospitalized 6-24 months old infants in Kerman university hospital NO.1. J Kerman Univ Med Sci. 2001;8(2):81-7.
32. Ghaljaei F, Nadrifar M, Ghaljeh M. Prevalence of Malnutrition among 1-36 Month Old Children Hospitalized at Imam Ali Hospital in Zahedan. Iran Journal of Nursing. 2009;22(59):8-14.
33. Marginean O, Pitea AM, Voidazan S, Marginean C. Prevalence and assessment of malnutrition risk among hospitalized children in Romania. J Health Popul Nutr. 2014;32(1):97-102.
34. Cao J, Peng L, Li R, Chen Y, Li X, Mo B, et al. Nutritional risk screening and its clinical significance in hospitalized children. Clin Nutr. 2014;33(3):432-6. doi: 10.1016/j.clnu.2013.06.009.
35. Munoz-Esparza NC, Vasquez-Garibay EM, Romero-Velarde E, Troyo-Sanroman R. Risk of malnutrition of hospitalized children in a university public hospital. Nutr Hosp. 2017;34(1):41-50. doi: 10.20960/nh.974.