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Research Article

Malnutrition: Already exist and is being overlooked?

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Abstract

Background: Malnutrition is defined as deficiency and or imbalance of nutrients and energy and may produce a negative effect on the growth, maintenance, and specific functions of the body. This study purposed to determine the nutritional situation, to define the presence of malnutrition, to detect the deficiencies of micronutrients of the children admitted to a pediatric tertiary hospital.

Methods: A retrospective, cross‐sectional, single unit-based study in pediatric patients admitted to the pediatric wards for differential diagnosis or treatment was conducted between November 2017 and December 2019. The anthropometric measurements were figured out on hospital admission of all pediatric patients. The pediatric patients diagnosed with malnutrition were assessed to detect their nutritional status/feeding habits and to identify any associated factors.

Results: A total of 1206 children were hospitalized with an acute illness diagnosis and/or treatment during the study period. One hundred fifteen patients were noted to have malnutrition; acute malnutrition (wasting) (weight for height z-score < - 2 SDS) (n=51/115, 44.3%) and chronic malnutrition (stunted) (height-for-age < −2 SDS) was detected in 64/115 (55.7%) patients; the prevalence of wasting, and stunting was 4.2% and 5.3%, respectively.

Conclusions: Our study suggests that it should be performed an assessment of nutritional status/ history and anthropometric measurements every admission to the hospital in order to provide healthy growth development in childhood, particularly under 2 of age and interventions should be strengthened for general child health.

Keywords: malnutrition; pediatric patients; nutritional status; anthropometric measurements

Background

Malnutrition is a clinicopathological entity that characterized a deficiency, excess, or imbalance of nutrients, occurs predominantly in children under five years old in particularly low-income and middle-income countries. According to data from the World Health Organization (WHO), there are 52 million wasted children under 5 years of age, 17 million severely wasted children, and 155 million stunted children in the world. It is known that around 45% of deaths among children under 5 years of age are associated with undernutrition in low- and middle-income countries [1]. A total of 1.300 children < 5 years of age were noted to be in an increased risk of death related to all types of undernutrition (stunting, wasting, and underweight) in ten longitudinal studies including ~54,000 child-years of follow-up [2]. Data from the Turkey Demographic and Health Survey in 2018 revealed the prevalence of acute malnutrition [weight for age <− 2 standard deviations (SDS)] in 17.9% and chronic malnutrition (height-for-age <− 2 SDS) in 6.9% of children aged ≤ 18 years in the general population [3]. An important condition together with malnutrition is also micronutrients deficiency that defines a lack of zinc, iodine, iron, selenium, copper, vitamins A, E, C, D, B2, B6, B12, and folic acid. Today, more than 2 billion people in the world suffer from malnutrition of micronutrients (collectively referred to as essential vitamins and minerals) that play a conductor role in the production of enzymes, hormones, and other substances and to be regulatory for growth activity, cognitive development, and functioning. Due to their major tasks, they should think to be as a blocking element the childhood morbidity and mortality [4, 5]. Micronutrients including iodine, vitamin A and iron intake under five years old children have been insufficient in 122 countries according to the WHO data. Most of the nutrition problems together with poverty and poor socioeconomic status in children result from their inability to supply the micronutrient requirements [6].

Several studies have shown that undernutrition has been an important problem primarily of hospitalized children with a declared prevalence of 5% in developed countries and up to 50% in developing countries [2]. Generally, the prevalence of undernutrition in hospitalized children has been reported with a range of 6%-30%; from 6% to 14% in Germany, France, UK, and the USA [7, 8]. The rates of malnutrition have been previously reported in our country as 31.8 to 56.6% in hospitalized pediatric patients [9].

There is no consensus for an optimum method of assessing the nutritional risk of children admitted to the hospital; however, the nutritional screening tools help to raise the clinician's awareness of nutritional risks and to detect early diagnosis of malnutrition, ideally on every admission to the hospital [10]. The evaluation of the nutritional risk of the pediatric patient via the most recent instruments known Screening Tool for Risk on Nutritional status and Growth (STRONGKids) tool is a comprehensive summary of commonly asked questions concerning nutritional issues and a clinical view of the child's status.

In the light of this informations, the aim of this study was to evaluate pediatric patients' nutritional status at the moment of their hospitalization in a pediatric hospital, to ascertain nutritional risk by application of the STRONGKids, to elucidate demographic, socio-economic factors associated with malnutrition and to define the deficient micronutrients in hospitalized children.

Methods

Study Setting and Design

We performed a retrospective, cross‑sectional, a single unit-based study in pediatric patients admitted to the pediatric wards for differential diagnosis or treatment, Ege University, Children's Hospital, a 200 bed, tertiary-care facility in İzmir, from November 2017 to December 2019. The children with malnutrition were enrolled in the study. Approval for the study was granted by the Local Clinical Research Ethics Committee of Ege University **(99166796-050.06.04/20-6.1T/72).**

Patients

A total of 1206 pediatric subjects were hospitalized consecutively in the Pediatric Hospital of Ege University of Medical Sciences for differential diagnosis/diagnosis and treatment from November 2017 to December 2019. When all patients were evaluated, 115 pediatric patients diagnosed with malnutrition (1 month–18 years of age) were included in the study. Patients with overweight and obesity, neurological sequelae, newborns, and those admitted to an emergency, neonatal intensive care, and the intensive care unit were not included in the study as there may have been associate factors with malnutrition. Those with recurrent hospitalizations or hospitalization of less than 24 h were also excluded. After application of exclusion criteria, the interview was undertaken with the parent or caregiver who had been with the patient for most of the time during the previous 48 h. The malnourished 115 children (aged 1 month to 18 years; of both genders) were screened by examination of detailed medical records, and physical examination.

A uniform questionnaire was administered to the parent or caregiver who had been with the patient for most of the time during the previous 48 h. Informed consent was obtained from the caretaker prior to undertaking the interview by trained medical personnel (health officers). The questionnaire comprised the following parts: demographic characteristics, health status, and diet factors. The following information regarding health status was collected during the interview: fever in the last 15 days and weight loss.

Within the first day of admittance to the General Pediatric Unit, measurements were taken of body weight, height, mid-upper arm circumference (MUAC), and triceps skinfold thickness (TSF). Body mass index (BMI) was calculated in all children over two years of age. Under-nutrition was defined according to WHO criteria. Malnutrition; together with demographic characteristics, health status, and nutrition factors was evaluated in the subjects. Socio-demographic and economic related determinants like maternal age, maternal religion, parents education, maternal occupation, family size, number of under-five children, sex, child age, maternal and child health care characteristics were also assessed in the index study.

The patients were separated into groups according to diagnosis as infection, gastrointestinal, endocrine, genitourinary, collagen tissue, chronic respiratory system, malignancy, and non-malignant hematological diseases and others. Peripheral blood samples were obtained from all patients for blood count and biochemical measures of micronutrients, and other biomarkers of nutrition. The nutritional assessment consisted of the following features: Biochemical analysis, including glucose, pre-albumin, albumin, total lymphocytes, total cholesterol, triglycerides, and the serum ferritin test. The hematological assessment included a complete blood cell count [hemoglobin level, hematocrit, mean corpuscular volume, and mean corpuscular hemoglobin concentration, red blood cell (RBC)], serum ferritin, vitamin B12, folate, and albumin. Anemia was defined as a hemoglobin level of ≤11.5 g/dL. A value <13 indicates thalassemia trait and >13 indicates iron deficiency. A structured proforma for data collection was developed with input and contribution from all investigators. Categories and criteria were defined to ensure uniformity in data collection. All investigators were assessed regarding their understanding of the methods and all were trained in the correct ways to measure heights and weights. Subsequently, the STRONGKids tests were applied, according to anthropometric measurements.

The primary outcome was to determine the prevalence of malnutrition with respect to anthropometric measurements. The secondary outcome was to determine the status of daily intake/micronutrient/vitamin of the patients and to detect whether there was a difference between acute and chronic malnutrition in the nutritional intakes.

Definition of Malnutrition

Pediatric patients aged below 2 years were weighed unclothed on a 16 kg capacity baby scale with 10 g sensitivity (Seca 334, Hamburg, Germany) and aged over 2 years were weighed on an adult scale with 100 g sensitivity (Seca 769, Germany). The height of children aged below 2 years was measured with a 1 m measurement scale of 0.1 cm sensitivity, with the child supine on a flat surface, the head held still, and the feet together. Those aged over 2 years were measured standing upright with a fixed measurement scale of 0.2 cm sensitivity. Mid-upper arm circumference was assessed with a non-elastic measuring tape with 1 mm gradations, with the left elbow joint in mild flexion from the acromion notch to the center of the olecranon notch. Skinfold thickness was measured at two sites (tricipital and subscapular) to the nearest 0.2 mm using a Holtain caliper (Holtain Ltd., Crymch, SA41 3UF, UK) [11]. Malnutrition was evaluated based on anthropometric measurements ((weight, length/height, MUAC, TSF that were performed by the same ward staff. For acute malnutrition, Weight-for-Height (WFH) SD ≥-3 to <-2 were considered moderate malnutrition, and <-3 SD as severe malnutrition. For chronic malnutrition, Height-for-Age (HFA) <-2 SD were named chronic malnutrition in accordance with WHO classification. Mid-upper arm circumference Z scores were calculated for patients aged ≤60 months only, in compliance with WHO standards.

- WFH = [observed weight/median height (same height and sex)] × 100.
- HFA = [observed height/median height (same age and sex)] × 100; [12].

Nutritional risk screening tool Screening Tool for Risk on Nutritional status and Growth (STRONGKids)

The risk for malnutrition was evaluated via the STRONGKids questionnaire, which was completed by physicians via the face to face method. STRONGKids is a malnutrition "risk assessment tool" that consists of 4 items (Supplementary file). The first 2 items were assessed by a pediatrician and the second 2 items were discussed with the parents or caregivers. Questions answered with 'unclear' were classified as 'no'. Patients with STRONGKids score 0 were classified as "low risk", whereas those with a score of 1–3 were classified as "medium risk" and those with a score of 4–5 were classified as "high risk" [13].

Socio-economic status

The socio-economic index for areas was calculated for all patients using their postal code as recorded at admission. This area-based approach is inexpensive, objective and the required information is readily accessible. A low index value reflects relative disadvantage and occurs where there is a large proportion of low-income families, people with low skilled occupations, and high proportions of the population without training, whilst a high value reflects a lack of disadvantage in an area. According to these index values, Izmir city is one of the most developed provinces in Turkey [14].

Dietary intake

Dietary intake data were collected using a uniform questionnaire that was administered to the parent or caregiver who had been with the patient for most of the time during the previous 48 h. Portion sizes were estimated using measuring cups and spoons. Pictorial food models of commonly eaten foods were also used to closely estimate the amount consumed. Micronutrient intakes were compared to Estimated Average Requirement and Recommended Nutrient Intake to evaluate nutrient adequacy according to age and sex.

The statistical analyses

The statistical analyses of the study were made using the Statistical Package for the Social Science for Windows (SPSS) v. 21.0 statistics program (SPSS Inc, Chicago, IL, USA, 2006). By calculating the mean and standard deviation values for the distribution of measurable variables, a comparison of the grouped data with defined numbers was made with the Chi-square test, and a comparison of the mean values of the measurements of the independent two groups was made using the Mann–Whitney U test. The Pearson correlation was used to analyze the statistical relationship between demographic and laboratory parameters. A value of $p<0.05$ was accepted as statistically significant for all results.

Results

Patient demographics and basic clinical features

During the study period, in total 1206 children were considered for enrollment and hospitalized for diagnosis or/differential diagnosis and for treatment in the medical ward of Ege Childrens' Hospital. To evaluate the nutritional status of the patients; WFH and HFA and were calculated and the final study population comprised 115 children with malnutrition fulfilled the study criteria and completed the evaluation. The demographic and socio-economic features have been shown in Table **1**. The prevalence of acute and chronic malnutrition was 9.5% over the study period. The patients included 56 (48.7%) males and 59 (51.3%) females with a median age of 15 (61) months (range, 1 month–18 years). Sixty-eight patients (59.1%) were aged less than 2 years of age. The highest percentage of children (52.6%) in the undernourished group were aged <60 months. In the 7-12 months group, 60.4% of children were either moderate or severe malnutrition, whereas none in >60 months age group was deteceted as severe malnutrition.

Table 1: Socio-demographic and anthropometric characteristics of subjects with malnutrition
IQR interquartile range, LOS Length of stay in hospital, * Turkish lira

Demografic characteristics	
Age, months, [median, (IQR)]	15 (61)
Age disturbution, months, n (%)	
1-6	19 (16.6)
7-24	49 (41.9)
25-60	18 (15.9)
> 61	29 (25.6)
Gender, n (%)	
Male	56 (48.7)
Female	59 (51.3)
Passive smoking exposure, n (%)	37 (32.2)
Mother's education, years, [median, (IQR)]	8 (7)
Father's education, years, [median, (IQR)]	8.1 (6.9)
Family/householdsize, person, n (%)	
< 4	92 (80)
≥ 5	23 (20)
Household income, n (%)	
Low	50 (43.5)
Moderate	38 (33)
Good	27 (23.5)
Paternal occupation, n (%)	
Working	108 (93.6)
Maternal occupation, n (%)	
House wife	98 (85.2)
Mothers' age, years, (mean ± SD)	31.2 ± (6)
LOS, days, [median (IQR)]	9 (8)

"Prevalence of undernutrition/Anthropometric measuraments results//Medical Diagnosis"

Upon admission, the prevalence rates of acute and chronic malnutrition were 95/1000. According to the WHO criteria, 51 (44.3%) patients were wasting, and 64 patients (55.7%) were stunted. Severe malnutrition has been detected in 18 (15.7%) patients of the children diagnosed with wasting (Table **2**). The medical diagnoses leading to hospitalization have also shown in Table **2**. Approximately one-third of (38.3%) of the patients had an underlying chronic medical illness. Two major groups of medical conditions leading to hospitalizations were acute

infectious diseases and respiratory/gastrointestinal disorders followed by neurologic and cardiovascular diseases.

Table 2: Prevalence of undernutrition in 115 children requiring hospitalization and their underlying medical diagnosis
MUAC mid-upper arm circumference, BMI Body mass index, SDS Standard deviations, IQR interquartile range

Anthropometric measurements	
Weight for height z-score < - 2 SDS, (wasting) n (%)	51 (44.3)
Height for age z-score < - 2 SDS, (stunting) n (%)	64 (55.7)
BMI < - 2 SD, (mean ± SDS)	-1.7 ± [-1.9]
MUAC 11,6-12.5 cm, n (%)	24 (20.9)
MUAC < 11.5 cm, n (%)	18 (15.7)
Triceps skinfold thickness, mm, median (IQR) z score Subscapular skinfold thickness, mm, median (IQR) z score	8 (4.5) -1.2 6 (3) -1
Acute malnutrition, n (%) Moderete Severe	 33 (28.6) 18 (15.6)
Chronic malnutrition with acute malnutrition, n (%)	45 (70.3)
Chronicity of illnessy, n (%)	
Acute	82 (71.3)
Chronic	33 (28.7)
Underlying medical diagnosis, n (%)	
Infectious diseases	25 (21.7)
Gastrointestinal patologies	22 (19.1)
Respiratory	21 (18.3)
Neurological disorders	21 (18.3)
Cardiac	18 (15.7)

STRONGKids risk classifications

When the patients were evaluated with the nutritional risk scoring system-STRONGKids-, high risk was found in 26 (22.6%) patients; 79 (68.6%) of the children were classified as having medium risk, and the low risk was found in 10 (8.6%) patients. For all patients hospitalized with any disease or diseases, the median STRONGKids score was 2 (2) in the malnutrition accompaniment group compared to the groups with and without malnutrition accompaniment system, whereas in the malnutrition accompaniment group, this score was 0 and was statistically significant ($p < 0.001$). Thirty-three (28.7%) of children had chronic disease; the children (n=21; 11 [52.3%]) with neurological disorders and 8 patients (38%) with respiratory problems had high risk for nutrition. The STRONGKids results indicated that the proportion of the high malnutrition risk patients with an underlying chronic disease was higher than the patients with a medium or low risk (91% compared with 47% or 45%, respectively). There was a significant negative correlation between the z score of weight for height and STRONGKids z scores ($p < 0.001$, r=-0.3) in malnutrition patients. With regard to STRONGKids risk scores, there were no differences in the gender distribution, mean age in months, and age categories between the high and low nutritional risk group (data not shown).

Risk factors for undernutrition

Various sociodemographic factors were analyzed to determine the risk factors leading to undernutrition in children requiring hospital care. There were no associations between risk factors and malnutrition via univariate analysis. In addition, children with severe malnutrition were more likely to have a lower quality of life, and a more frequent occurrence of gastrointestinal disorders (data not shown).

Dietary intake and suplementations

The nutritional data, supplementations, and dietary intake have been summarized in Table **3**. As shown in Table **3**, macro protein intake has been found insufficient in 44 (38.2%) patients. Even, 21.7% of the 115 patients can not reach the source of macro protein sources.

Table 3: The nutritional data, supplementations, and dietary intake of the subjects

IQR interquartile range

Supplementation Data	
Currently given iron supplementation, n (%)	48 (41.7)
Currently given D vitamin supplementation, n (%)	44 (38.3)
Currently given multivitamin supplementation, n (%)	29 (25.2)
Nutritional data under 1 years of age, n (%)	
Only breast milk	21 (18.2)
Breast milk+ Complementary feeding	35 (30.4)
Formula	20 (17.4)
Other	13 (11.3)

Duration of only breast milk, months, median (IQR)	5 (3)
Total duration of breast milk, months, median (IQR)	11 (14)
Percentage of diary calori intake	70 (20)
Distribution of dairy intake	
Main protein sources (egg, meat, fish, chicken)	
Never	25 (21.7)
1 time/one month	13 (11.3)
1 time/15 days	6 (5.2)
1-2 time/one week	12 (10.4)
4-5 time/one week	28 (24.3)
Every day	32 (27.8)
Milk and milk products	
Never	30 (26)
1 time/one month	6 (5.2)
1 time/15 days	6 (5.2)
1-2 time/one week	12 (10.4)
4-5 time/one week	15 (13)
Every day	52 (45.2)

Laboratory data

The levels of the blood parameters of the children were detailed in Table **4**. Iron deficiency and anemia were identified as the most important factors leading to micronutrient malnutrition The lower prevalence of anemia among the children may be due to national programs implemented by the Ministry of Health, such as the Programme on the Iron supplementation. Under this program, food baskets containing essential food items, as well as Fe, D vitamin, and multivitamin supplements, are distributed to eligible recipients on a monthly basis. Family Health Clinics also routinely disseminate nutrition education

Table 4: The laboratory data of the malnourished subjects
IQR interquartile range

Hemoglobin, g/l, median (IQR)	10.9 (2.2)
Mean corpuscular volume, f/L, median (IQR)	78.2 (10)
Iron, µg/dL, median (IQR)	42 (38)
Ferritin µg/dL, median (IQR)	58.1 (126)
Total protein, g/L, median (IQR)	6.5 (1)
Albumin, g/L, median (IQR)	3.9 (0.8)
Parathormon, ng/L, median (IQR)	20 (12)
D vit, ng/L, median (IQR)	54 (50)
A vit, µg/L median (IQR)	356 (183)
E vit, µg/L median (IQR)	11.5 (4.6)
B12 vit, ng/L, median (IQR)	454 (145)
Folic acid, µg/L, median (IQR)	12.6 (10.9)

Table 5: Comparisons of the demographic, clinical and nutrition parameters according to malnutrition classification of the subjects
LOS Length of hospital stay, NS Not significant, IQR interquartile range

Parameters	**Acute malnutrition Weight for height z-score < - 2 SDS, (wasting) (n=51)**	**Chronic malnutrition Height for age z-score < - 2 SDS, (stunting) (n=64)**	**p**
Gender, n (%) Male Female	 26 (51) 25 (49)	 30 (46.9) 34 (53.1)	NS
Age, months, median (IQR)	12.5 (40)	26 (81)	0.001
LOS, days, median (IQR)	7 (5)	10 (8)	0.002
Household number, n (%)			0.044
Core family	45 (88.2)	46 (71.8)	
Extended family	6 (11.8)	18 (28.2)	
Household income, n (%)			NS
500-1900	27 (52.9)	39 (60.9)	
2000-5000	21 (41.1)	21 (32.8)	
> 5100	3 (6)	4 (6.3)	

Dairy intake percentage, n (%)	70 (21.3)	62.5 (10)	0.013
Weight, kg, median (IQR)	9.2 (6.7)	11.9 (6.3)	<0.001
Height, cm, median (IQR)	112 (49)	101 (31)	<0.001
MUAC, cm, median (IQR)	12.5 (3)	11.5 (3)	<0.001
Body mass index z-score, median (IQR)	-2.1 (1.6)	-2.8 (2)	< 0.001
Distribution of nutritional intakes, n (%)			
Major protein sources (egg, meat, fish, chicken, etc.)			<0.001
< 1-2 time/one week	36 (70.5)	58 (90.7)	
> 3-4 time/one week	15 (29.5)	6 (9.3)	
Milk and milk products			0.004
< 1-2 time/one week	34 (66.6)	52 (81.2)	
> 3-4 time/one week	17 (44.4)	12 (18.8)	
Vegetable oils and green leafy vegetables			0.037
< 1-2 time/one week	22 (43.1)	19 (29.6)	
> 3-4 time/one week	29 (56.9)	45 (70.1)	
Ferritin, µg/dL, median (IQR)	65.9 (95)	47.7 (152)	NS
Vitamin D, ng/L, median (IQR)	55 (42)	35 (18)	NS
Vitamin A, µg/L median (IQR)	447 (284)	356 (263)	NS
Vitamin E, µg/L median (IQR)	14.8 (5)	11.5 (2.5)	0.048
B12 vitamin, ng/L, median (IQR)	363 (595)	458 (355)	NS
Folic acid, µg/L, median (IQR)	19.6 (8.9)	12 (12.1)	0.005
Hemoglobin, g/L, median (IQR)	11.2 (2.3)	10.6 (2.2)	NS
Total protein, g/L, median (IQR)	6.6 (0.9)	6.4 (1)	0.038
STRONGKids score	2 (2)	3 (2)	0.011
Underlying medical diagnosis, n (%)	22 (43.1)	31 (48.4)	NS

Comparison of anthropometric measurements at the hospital admission with patient characteristics

There were no gender differences in the wasting/stunting group. At the time of admission, 55.7% of the participants had an HFA standard deviation score of less than −2. Children with chronic malnutrition were older than those with acute malnutrition. A total of 32.8% of patients with acute malnutrition were younger than 24 months of age. Patients with low-income levels and a high number of siblings were noted to have high in the chronic malnutrition group. The underlying chronic disease prevalence rates were not found statistically between the groups. The length of stay in hospital was significantly higher ($p < 0.002$) in patients with HFA SD < -2. There was a high prevalence of vitamin E and folic acid deficiency in chronic malnourished children compared with patients with acute malnutrition.

Discussion

This current study has revealed again that malnutrition is still an annoyance for children that should be assessed an accurate and adequate nutritional in the clinical management to be ensured their normal growth and development in a having high socio-economic index values city. It is essential that the evaluation of the nutritional status of children for being a healthy person and to prevent the adverse interactions between nutritional status and the patient's medical condition in any admission to the hospital. Our study purposed to define the nutritional conditions of the patients via anthropometric measurements at hospital admission and to define the related concomitant factors. SD −2 or less for WFH and HFA were indicators of acute and chronic malnutrition, respectively [10]. We found the acute and chronic malnutrition rate to be 9.5%. Previous small-scale and local studies performed in Turkey found higher acute and chronic malnutrition rates (31.8% and 27.7%), respectively, when weight for height parameter was used and the cutoff value is accepted as −2 [15, 16]. We believe that the primary reason for reported lower rates was related to the number of undernutrition patients for assessing the nutritional status of the patients. Most of the patients do not need to be hospitalized for undernutrition, therefore our rate was lower than the several studies. In addition, there is significant variability in the declared incidence of malnutrition due to differences in patient populations, and the method or nutritional marker used for diagnosis. During the hospitalization, it is essential that the detection of the patients' nutritional status and anthropometric measurements that can provide the correction of nutritional behavior, improve the patient's prognosis, and shorten the length of hospitalization soon after admission. Supplying balanced nutrition and adequate micronutrients is an important effective factor for continuous growth and development that occur throughout the childhood

period and it provides to avoid mortality and morbidity associated with malnutrition.

As in previous studies, most of the patients were younger than 2 y of age in the study [17, 18]. The children with chronic malnutrition were older than those acute malnutrition; and it was found that they had a longer length of stay hospitalization, with a higher rate of STRONGKids scores. In our study, we also found that the patients with chronic malnutrition at hospital admission could not reach the main protein sources and dairy intake percentage was low than those of acute malnutrition. Additionally, the patient with chronic malnutrition at hospital admission had a crowded family.

It has been known that the prevalence of acute and chronic malnutrition of children admitted to the hospital since the 1980s, particularly in developing countries [19]. Black RE, et al. stated a study - is an important global review of the epidemiology, major risk factors, and consequences of malnutrition 875,000 deaths were related to wasting that cause of death of 12.6% of children <5 years of age and 516,000 deaths were attributable to severe wasting that cause of death of 7.4% of children <5 years of age [20].

The prevalence of malnutrition was reported from 10% to 50% in children under the age of five in our country [15, 16]. Data from the Turkey Demographic and Health Survey in 2018 revealed the prevalence of acute malnutrition (weight for age <-2 SD) in 17.9% and chronic malnutrition (height-for-age <-2 SD) in 6.9% of children aged ≤18 years in the general population. In the index study, the prevalence rate of malnutrition has found in 95/1000 pediatric patients in inpatient clinics. The study has not included outpatient groups.

Today, the malnutrition has been separated to three main types that called undernutrition [wasting (low weight-for-height), stunting (low height-for-age) and underweight (low weight-for-age)]; micronutrient-related malnutrition (a lack of important vitamins and minerals) or micronutrient excess; an overweight, obesity and diet-related non-communicable diseases (such as heart disease, stroke, diabetes, and some cancers) [21-23]. Micronutrient-related malnutrition could be an occasion for morbidity and mortality in children. Based on the prevalence of the vitamin deficiencies in both groups of acute and chronic malnourished children, there is a need for all pediatric patients that present to hospitals and clinics to be assessed for this nutrient. Unexpectedly, there were no statistically significant differences and deficiencies in the vitamin status for the two groups in this study. With regard to D vitamin, the deficiency is likely to be highly prevalent among children presenting to hospitals in this region that is rich with sunshine all year round, due to the possibility of under-reporting or under diagnosing. Deficiencies of folic acid and vitamin B12 are often part of general malnutrition. Folic acid, also known as folate and vitamin B9, is a water-soluble vitamin that must be obtained either through the diet or from supplementation. [24]. Its absence leads to megaloblastic anemia, and it has also been determined that the nutritional status of folic acid may be associated with chronic diseases and information dysfunctions. Despite other micronutrient levels, folic acid was found to be low in patients with chronic malnutrition compared to patients with acute malnutrition. It could be explained with an inadequate intake of pulses and pulses products for our cohort. Major dietary sources of E vitamin are vegetable oils, nuts, whole grains, and green leafy vegetables. According to the Food and Nutrition Board of the Institute of Medicine, vitamin E deficiency in normal is defined by a plasma α-tocopherol concentration < 12 μmol/L (0.5 mg/dL) based on the association of greater concentrations [25]. The primary manifestations of prolonged vitamin E deficiency include spinocerebellar ataxia, skeletal myopathy, and retinopathy. Similarly, our chronic malnourished patients had lower vitamin E levels than acute malnourished subjects; however, no study patients manifested the neurological deficits associated with deficiency of Vitamin E. Multivitamin preparations are generally given by general practitioner for patients with underweight; it could be explained with normal reference levels of other micronutrients and vitamins in these children. In order to reduce or prevent the malnutrition that may cause mental and motor disabilities complications in children in developing countries, European Society Clinical Nutrition and metabolism has suggested early identification of nutritional status in children should be considered during the hospitalization for any diagnosis [26].

In conclusion, in the present-days, to control the COVID-19 pandemic, it could be a high probability of neglected and/or overlooked the diagnosis of several diseases (malignancies, obesity, etc.) and malnutrition due to the several strategies. Healthy living is defined as a state of good health in physical, mental, spiritual, and social aspects, and directly affects maintaining a healthy life. When adequate and balanced amounts of each of the essential nutrients are available, the children may be protected from several nutrition problems such as protein-energy deficiency, iron deficiency anemia, iodine deficiency disorders, rickets, tooth decay, obesity, etc. Therefore, the establishment of healthy nutrition policies, the evaluation of the nutritional status of each patient should be made a habit and considered as part of the examination.

Abbreviations

BMI = Body mass index

COVID-19 = Corona Virüs Disease 2019

HFA = Height-for-Age

MUAC = Mid-Upper Arm Circumference WHO = World Health Organization

SD = Standard Deviation

SPSS = Statistical Package for Social Science

STRONGKids = Screening Tool for Risk on Nutritional status and Growth

TSF = Triceps Skinfold Thickness

WFH = Weight-for-Height

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Availability of Data and Materials

The datasets analyzed during the current study are available from the corresponding author upon reasonable request.

Authors' Contributions

ŞG, AA, and FK conceived and designed the study, performed analysis, interpreted the data. ŞG prepared the manuscript, and all authors read and approved the final manuscript.

Ethics

The study was approved by the institutional review board named The Ethics Committee of Ege University **(99166796-050.06.04/20-6.1T/72).**

Consent for Publication

This manuscript does not report personal data such as individual details, images, or videos; therefore, consent for publication is not necessary.

Competing Interests

The authors declare that they have no competing interests.

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