SMJ Saratov Medical Journal

ISSN 2712-8253, Saratov Medical Journal

2022. Volume 3. Issue 3 (September). Article CID e0304
DOI: 10.15275/sarmj.2022.0304

Original article

Reprint

Malnutrition in hospitalized children

Serhat Samanci [1], Osman Akdeniz [2]

[1] Diyarbakir Children's Hospital, Turkey
[2] Firat University, Turkey

Received 10 January 2022, Accepted 15 September 2022

Original Text © Samanci S, Akdeniz O, 2022, published in *Saratov Journal of Medical Scientific Research* 2022; 18 (2): 245–249

Abstract: Objective: Our study aimed to determine the prevalence and grade of malnutrition in patients hospitalized for various indications and to examine its relationship with comorbidities and socio-demographic factors.
Materials and Methods: This study enrolled children aged 1 month to 15 years old with a median age (Q25; Q75) of 1.8 (1.27–3.47) years, admitted to our hospital with various diagnoses between 1 January 2019 and 31 December 2019. Our study included 498 patients, 286 (57.4%) of which were male and 212 (42.6%) were female.
Results: Of all patients, 40 (19.7%) with a median age of 2.25 (1.27–3.48) years had a weight z-score of less than –2SD. Of our patients, 47.2% (n=235) had malnutrition sensu the Waterlow classification. There were significant differences between the groups in socioeconomic level and C-reactive protein (CRP) content.
Conclusion: Malnutrition is associated with a low socioeconomic status. It plays an important role in hospitalizations with various diagnoses.

Keywords: children, malnutrition, Waterlow classification, Gomez classification.

Cite as Samanci S, Akdeniz O. Malnutrition in hospitalized children. *Saratov Medical Journal* 2022; 3(3): e0304.

Correspondence to Serhat Samanci. Tel.: +90 534 382 4249, E-mail: samanciserhat@hotmail.com.

Introduction

Nutrition is the consumption and use of nutrients by humans in the amount necessary to achieve growth and development and to maintain a healthy life. The signs of malnutrition appear in people with inadequate nutritional status. Malnutrition is defined as a 'nutritional state that has measurable adverse effects on body shape, function, and clinical course as a result of a lack of energy, protein, or other nutrients' [1]. Nutritional status directly affects a child's growth and development, physical activity, intelligence, and social skills [2].

Healthy nutrition is important at any age. It is known to determine the risk of disease and death and to affect the quality of life. Malnutrition maintains its place at the top ranks of serious public health issues, especially in underdeveloped and developing countries. According to the data of the World Health Organization (WHO) and the United Nations International Children's Emergency Fund (UNICEF), one of four children worldwide is affected by malnutrition, and approximately half of child deaths under the age of 5 are directly or indirectly related to malnutrition [3,4]. While nutritional problems and infectious diseases have been pointed at as the cause of malnutrition in developing countries like ours, trauma, surgical interventions, and chronic diseases are the primary causes in developed countries [5].

The signs of malnutrition in children may vary by the duration and severity of nutritional deficiency, dietary content and quality, and individual factors. Whereas malnutrition is easily diagnosed in its severe grade, this task may be difficult in patients with malnutrition of a mild or moderate grade. In order to diagnose malnutrition, nutritional status should be checked, daily energy requirement should be calculated, and biochemical parameters should be measured [6,7].

Preliminary planning for early identification, correction and prevention of nutritional disorders in children could substantially lower morbidity and mortality rates. Although domestic studies, performed in different years, reported the reducing prevalence of malnutrition, the problem currently remains quite relevant [8].

Our study aimed to determine the prevalence and grade of malnutrition in patients hospitalized for various indications, and to examine its relationship with comorbidities and socio-demographic factors.

Materials and Methods

This study enrolled 498 children aged 1 month to 15 years with a median age (Q25; Q75) of 1.8 (1.27–3.47) years admitted to our hospital with various diagnoses between 1 January 2019 and 31 December 2019. Patients younger than 1 month old, intensive care patients, and patients under 2 years of age with a history of low birth weight and prematurity were excluded from the studied sample.

The medical records of the patients were retrospectively examined to extract personal data, such as body weight, height, parental educational level, family income, maternal gravidity and parity, history and duration of breastfeeding, hospitalization diagnosis, length of hospital stay, and

laboratory test results. For body weight and height measurements, the reference values used in our country were taken as the reference. We calculated z-scores for body weight and height measurements adjusted for age. For body weight and height z-scores, the reference standard deviation values for the same age and gender were used [9]. Patients with z-scores of −2SD or below were assumed malnourished. Anthropometric, demographic, and laboratory values were compared by patient malnutrition status.

Malnutrition was evaluated using Gomez and Waterlow classifications. Sensu Gomez classification, patients with an age-adjusted body weight of 90-110% were considered normal; those with the value within the range of 75-89% were assumed mildly malnourished; those with 60-74% were classified as moderately malnourished; and those with <60% were treated as severely malnourished [7]. Sensu the Waterlow classification, patients with a height-adjusted weight below 90%, and those with age-adjusted height above 95%, were classified as having acute malnutrition; those with height-adjusted weight above 90% and age-adjusted height below 95% were classified as having chronic malnutrition; and those with height-adjusted weight below 90% and age-adjusted height below 95% were considered having acute on chronic malnutrition [6].

This study complied with the principles of the Declaration of Helsinki. It was approved by Ethics Committee of the SBU Diyarbakır Gazi Yaşargil Training and Research Hospital (2019/390).

Statistical analysis. SPSS version 23.0 (software package for Windows) was used for the statistical analyses of our data. Parametric continuous variables were presented as mean ± standard deviation (SD), while nonparametric variables were presented as median (minimum – maximum). Conformity of the data to the normal distribution was evaluated with histograms, along with skewness and kurtosis values between −1.5 and +1.5. Chi-squared test was used for the comparison of categoric variables between paired groups, while Student's t-test for independent samples was employed for the comparison of normally distributed variables. Mann-Whitney U test was performed for non-normally distributed continuous variables. Multiple groups were compared first using one-way ANOVA test, and Tukey test as the post hoc test. P<0.05 implied statistically significant dependences.

Results

Our study included 498 patients with a median age (Q25; Q75) of 1.8 (1.27–3.47), 286 (57.4%) of which were male and 212 (42.6%) were female. Forty (19.7%) patients with a median age (Q25; Q75) of 2.25 (1.27–3.48) years had a weight z-score of less than −2SD. Based on Waterlow classification, 47.2% (n=235) of patients were malnourished; similarly, sensu Gomez classification, 47.2% (n=235) of patients were malnourished. Among patients who were malnourished, the mean maternal age was 27.6±5.6 years. The comparison of the demographic and laboratory data on the patients are presented according to the z-score (*Table 1*) and Waterlow classification (*Table 2*). The correlation analysis revealed a negative correlation between parity and maternal education status, paternal education status, and socioeconomic level, and a positive correlation between parity and duration of breastfeeding (p and r values of <0.001, <0.001, 0.007, <0.001, and −0.35, −0.25, −0.12, 0.23, respectively).

The patients were most commonly followed for acute gastroenteritis (40%) and respiratory tract infections (51.5%) (*Figure 1*). The mean length of their hospital stay was 4 (1–11) days (*Figure 2*). The length of hospitalization was longer in those with respiratory tract infection, compared with those who had acute gastroenteritis (5.1±2.2 days, 3.7±1.8 days; p<0.001), while there was no significant difference between other groups. A weak negative correlation was found between the duration of a hospital stay and maternal educational level (p=0.049, r= −0.11).

Sensu Gomez classification, 160 (32.1%) patients had mild malnutrition, 53 (10.7%) had moderate malnutrition, and 22 (4.4%) had severe malnutrition. Severe malnutrition was most commonly seen in patients aged 1 month to 6 years: 19 (3.8%) patients (*Table 3*).

Table 1. Demographic data vs. malnutrition rates

Parameters	Malnourished patients	Normal patients	P-value
Age, years; median (min-max)	2.25(1.1-13.5)	1.67(1 -13)	**0.02¥**
Gender, M/F	21/19	265/193	0.5π
Weight z-score, median (min-max)	-2.29((-5.4)-(-2.0))	-0.12((-1.93)-(3.2))	**0.001¥**
Height z-score, median (min-max)	-0.97((-6.7)-(0.83))	0 ((-7.8)-(3.76))	**0.001¥**
Parity, mean ± SD	3(1-9)	3(1-11)	0.74¥
Gravidity, mean ± SD	3(1-9)	3(1-11)	0.57¥
Maternal educational level, primary school or below /secondary school or above	36/4	372/86	0.16π
Paternal educational level, primary school or below /secondary school or above	31/9	304/154	0.15π
Income level, minimum wages or below /above minimum wages	36/4	362/96	0.097π
Duration of breastfeeding, months, mean ± SD	14.6 ±8.1	14.3 ±7.3	0.8†
Length of hospitalization, days, median (min-max)	4(1-11)	4(1-15)	0.72¥
Total protein, median (min-max)	6.9(1.4-9.5)	6.9(5.5-8)	0.08¥
Albumin, median (min-max)	3.9(3-5)	3.9(2-9)	0.55¥
Creatinine, median (min-max)	0.46(0.33-0.74)	0.43(0.18-1.5)	0.51¥
Uric acid, median (min-max)	3.6(2-11)	4.2(1-11)	
Hemoglobin, mean ± SD	11.6 ±1.3	11.4 ±1.4	0.46†
CRP, median (min-max)	40.8 ±61.7	25.5 ±48.5	0.2¥
Calcium, median (min-max)	9.7(8.8-11)	9.7(4-11.9)	0.42¥
Phosphorus, mean ± SD	4.6 ±1.0	4.6 ±0.8	0.850†
Iron, median (min-max)	29(9-94)	23(3-100)	0.26¥
Total iron-binding capacity, mean ± SD	278.8 ±81.8	317.8 ±63.9	**0.006†**

π Chi-squared test, † Student's *t*-test, ¥ Mann-Whitney U test.

Table 2. Malnutrition and demographic parameters sensu Waterlow classification

Parameters	Normal patients	Acute malnutrition	Chronic malnutrition	Acute on chronic malnutrition	P-value
Age, years, median (min-max)	1.68(0.08-10.2)	1.45(1-10.6)	2.29(1.24-12.9)	2.1(0.1-13.5)	**0.001**[£]
Sex, M/F	168/95	80/76	12/10	26/31	**0.017**[€] **(a, b)**
Weight z-score, median (min-max)	-0.12((-1.93)-(3.2))	-1.1((-176)-(1.3))	0.0((-1.6)-(0.9))	-1.6((-5.4)-(0.4))	**0.001**[£]
Height z-score, median (min-max)	0 ((-7.8)-(3.76))	0.0((-1.8)-(1.7))	-0.4((-2.2)-(0.0))	-1.3((-7.9)-(0.0))	**0.001**[£]
Parity, mean ±S D	2.9 ±1.7	3.2 ±1.9	3.1 ±1.6	3.1 ±1.7	0.4[Ø]
Gravidity, mean ± SD	3.0 ±1.7	3.3 ±1.9	3.2 ±1.8	3.2 ±1.8	0.25[Ø]
Maternal educational level, primary school or below / secondary school or above	208/55	133/23	18/4	49/8	0.35[€]
Paternal educational level, primary school or below / secondary school or above	158/105	113/43	16/6	45/12	**0.006**[€] **(a, b)**
Income level, minimum wages or below/above minimum wages	197/66	129/27	19/3	53/4	**0.009**[€] **(b)**
Duration of breastfeeding, months, mean ± SD	14.7 ±7.0	13.3 ±7.5	15.7 ±10.4	15.0 ±7.5	0.18[Ø]
Length of hospitalization, days, median (min-max)	4.0(1-15)	4.0(1-10)	4.0(3-10)	4.0(1-11)	0.77[£]
Total protein, median (min-max)	6.9(5.5-8)	6.9(6-8)	6.8(6-8)	7 (6-8)	0.29[£]
Albumin, median (min-max)	3.9(2-9)	3.9(3-9)	4.0(3-4)	3.9(3-5)	0.29[£]
Creatinine, median (min-max)	0.43(0.18-1.5)	0.43(0.33-1.1)	0.45(0.39-0.59)	0.45(0.18-1.5)	0.19[£]
Uric acid, median (min-max)	4.2(1-11)	4.1(1-11)	4.1(1-7)	3.9 (1-11)	0.20[£]
Hemoglobin, mean ± SD	11.4 ±1.4	11.3 ±1.5	12.0 ±1.4	11.3 ±1.4	0.27[Ø]
CRP, median (min-max)	6.1 (0.0-284)	5.6(0.0-320)	12.4(0.7-161.3)	10.0(0.2-232.9)	**0.008**[£]
Calcium, median (min-max)	9.7(4-11.9)	9.7(4-11.9)	9.8(9.2-10.2)	9.7(8-10.9)	0.44[£]
Phosphorus, mean ± SD	4.6 ±0.8	4.5 ±0.7	4.7 ±0.8	4.6 ±0.8	0.8[Ø]
Iron, median (min-max)	23(3-100)	24(5-100)	24.5(6-40)	20(5-94)	0.28[£]
Total iron-binding capacity, mean ± SD	319.3 ±67.4	305.6 ±68.6	331.2 ±66.3	312.1 ±50.5	0.33[Ø]

[€] Chi-square Bonferroni correction, [£] Kruskal-Wallis H test, [Ø] one-way ANOVA test, [a] significant between normal and acute malnutrition

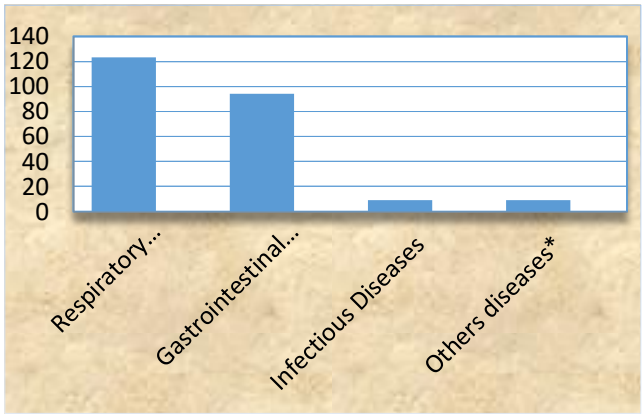

Figure 1. Reasons for hospitalization. Respiratory system diseases: pneumonia, bronchitis, asthma, upper respiratory tract infections; gastrointestinal diseases: acute gastroenteritis, cow milk protein allergy, liver toxicity; infectious diseases: urinary tract infection, fever; other diseases: convulsion, anemia

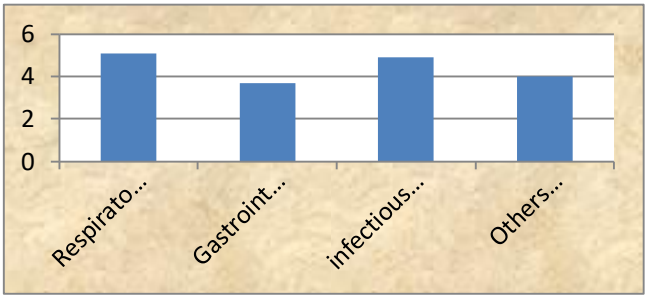

Figure 2. Length of hispitalization (days). Respiratory system diseases: pneumonia, bronchitis, asthma, upper respiratory tract infections; gastrointestinal diseases: acute gastroenteritis, cow milk protein allergy, liver toxicity; infectious diseases: urinary tract infection, fever; other diseases: convulsion, anemia

Table 3. Distribution of nutritional grades sensu age and Gomez classification

Grade of malnutrition	Age range: 1 month – 6 years		Age range: 7 – 15 years		Total	
	n	%	n	%	n	%
Normal	238	47.8	25	5	263	52.8
Mild malnutrition	146	29.3	14	2.8	160	32.1
Moderate malnutrition	47	9.5	6	1.2	53	10.7
Severe malnutrition	19	3.8	3	0.6	22	4.4
Total	450	90.4	48	9.6	498	100

Sensu the Waterlow classification, 263 (52.8%) patients were normal, 156 (31.3%) had acute malnutrition, 22 (4.4%) had chronic malnutrition, and 57 (11.5%) had acute on chronic malnutrition (*Table 2*). When the patients were divided into the normal, acute malnutrition, chronic malnutrition, and acute on chronic malnutrition groups, based on Waterlow classification, the chronic malnutrition group had a greater mean age, compared with other groups. There were no significant differences between the groups in terms of length of hospitalization, duration of breastfeeding, gravidity, and parity ($p>0.05$). There were significant differences between the groups regarding socioeconomic level and CRP level ($p=0.09$; $p=0.07$, respectively). In post-hoc Tukey test, the economic income of the acute on chronic malnutrition group was significantly lower than in those without malnutrition ($p=0.011$); CRP content was significantly higher in the patients with acute on chronic malnutrition than the normal and acute malnutrition groups (median values of 10, 6, 1, and 5.6 g/dL and $p=0.008$ and $p=0.004$, respectively).

A weak negative correlation was found between the weight z-score and gravidity, parity, whereas a weak positive correlation was detected with maternal educational status, paternal educational status, and socioeconomic level (p and r values: 0.002, 0.005, <0.001, <0.001, 0.044 and 0.14, –0.12, 0.16, 0.19, 0.1, respectively). We discovered a negative correlation between duration of breastfeeding and maternal educational status, paternal educational status, while a positive correlation was found between the age at hospitalization and weight (p and r values: 0.01, 0.009, <0.001, <0.001 and –0.11, –0.12, 0.22, 0.18, respectively).

Discussion

Malnutrition is responsible for over 50% of all child deaths worldwide. It is the foremost risk factor leading to morbidity and mortality especially among children under 5 years old. Nearly 13 million children under the age of 5 die each year due to malnutrition [10]. Congenital developmental anomalies, malformations, persistent infections, and low socioeconomic level are important risk factors for developing malnutrition [11]. Among other important risk factors, parental educational level is of special importance. Since the mother assumes a greater role in the nutrition of children in our region, maternal educational level is particularly important. In our study, the correlation analysis between weight z-score and parental educational level revealed that malnutrition prevalence increased with decrease in parental educational level. This suggests that malnutrition is a social problem beyond being purely medical problem. The socioeconomic status of the family, access to food, and hygienic conditions are important factors in the occurrence of malnutrition as well [12]. A study conducted in Malaysia reported that children who died in the region with the highest number of child deaths under the age of 5 years were the children of mothers who did not have any income source, and malnutrition prevalence was higher in children of low-income mothers [13]. Our study revealed that family income was lower in patients with malnutrition vs. those without it, although the difference was not statistically significant ($p=0.09$). The lack of statistical significance may have resulted from our small sample size. An analysis of malnourished groups indicated that patients with acute on chronic malnutrition had significantly lower income than normal patients. This indicates the effect of income on the access to nutritional sources.

Malnutrition significantly increases morbidity and mortality among hospitalized children. In a study conducted on children under 3 years of age in 2011, Güleç et al. reported a malnutrition prevalence of 47.3%, and Özer et al. discovered a malnutrition prevalence of 55.1% among children aged 1-6 years [11]. A study by Genel et al. from Izmir revealed a malnutrition prevalence of 56.6%; among these, 21.3% had acute malnutrition, 24.2% had chronic malnutrition, and 11.9% had acute on chronic malnutrition [14]. According to publications from other countries, Merrit et al. from the United States of America reported acute malnutrition in 26% of hospitalized children, chronic malnutrition in 38% of those, and acute on chronic malnutrition in 10.2% of children [15]. Looking at other countries, 16.5% of acute malnutrition and 38.2% of chronic malnutrition were reported in North Korea; 7.4% patients with acute malnutrition and 60% chronic malnutrition subjects were reported in Nigeria; and in Jamaica, 31% were reported having mild malnutrition, 9% with a moderate malnutrition, and 1.6% with severe malnutrition [16]. In a malnutrition evaluation study on hospitalized children in Malaysia, nutritional deficiency was detected in 46% of youths [13]. In a study dated 2017, which covered all states of India, malnutrition was reported as the predominant risk factor for death among children under the age of 5, and the cause of death at a rate of 68.2% was confirmed [17]. Similar to those studies, we detected a malnutrition prevalence of 47.2% among children hospitalized for various reasons. Sensu Gomez classification, 10.7% of our patients had moderate malnutrition and 4.4% had severe malnutrition. Sensu the Waterlow classification, 156 (31.3%) patients had acute malnutrition, 22 (4.4%) had chronic malnutrition, and 57 (11.5%) had acute on chronic malnutrition. In the light of the presented data, we propose that global malnutrition prevalence remains high among hospitalized patients, particularly among children under the age of 5; it shows some regional variations; and the level of socioeconomic development of the country and region is its underlying determinant.

It is known that lifestyle variability between countries, socioeconomic indicators, distribution of foods, food quality, nutritional habits, and educational and cultural levels play important role in malnutrition development rates. Intervening infections are another factor that could aggravate the malnutrition process. As malnutrition affects many systems, it also causes impaired cellular and humoral immunity, phagocyte dysfunction, dysfunctional complement system, reduced cytokine production, decreased protein

production and destruction, and especially a decrease in secretory immunoglobulin A antibody level in the immune system [18]. The longer the process, the more severe the immune system is affected. It is known that chronic malnutrition increases the susceptibility of children to infections and causes a more aggravated disease course. In our study, a more prominent increase in C-reactive protein content was observed in children with acute on chronic malnutrition; we believe that this finding could be explained in terms of augmented susceptibility to infections in the chronic process.

Infections, especially acute gastroenteritis, respiratory infections, recurrent infections, and chronic disorders may result in malnutrition by impairing a child's nutrition and causing catabolism. Güleç SG et al. reported that they detected infection in 74.7% of cases with malnutrition. In our study, infections existed in 68.1% of our malnourished patients. At the same time, most frequent hospital admissions were due to respiratory system infections with a rate of 51.5%, which can be explained by suppressed immunity and reduced secretory IgA levels [8].

The length of hospitalization appears longer in patients with malnutrition than in those without it. In a study conducted in the United States of America in 2010, the length of a hospital stay was 2.5 times longer and hospital costs were threefold in children with malnutrition [19]. In our study, the mean length of hospitalization was 4 days, with patients admitted for respiratory system diseases having the longest hospitalization duration (5.1 days).

A comparison of maternal educational level showed that as maternal educational level decreased, the length of hospitalization increased. The number of pregnancies also plays an important role in the development of malnutrition. Aykut et al. reported that the rate of malnutrition was higher in regions where the socioeconomic level was lower, and the number of previous pregnancies was higher, compared with other regions [20]. Our study yielded similar results, so that parity and gravidity values were higher in the groups with malnutrition. It was shown that the cases with higher numbers of gravidity and parity were breastfed for a longer period of time. Here emerges a paradox of having more children and longer breastfeeding as education levels drop and families become poorer. When the number of children is high and the parents are uneducated and poor, breastfeeding for a long time seems a necessity due to economic reasons rather than a conscious approach. A positive correlation was found between the duration of breastfeeding and the age, weight, and hemoglobin level at hospitalization. Patients who are breastfed for a long time suffer malnutrition at a later age, have higher hemoglobin levels, are overweight, and become ill later. These findings highlight the protective effect of breastfeeding.

Conclusion

Malnutrition is associated with low socioeconomic status. It causes hospitalizations for different reasons. Parental educational level, breastfeeding status, gravidity and parity play an important role in its development. It is necessary to raise family awareness of nutrition, to encourage breastfeeding of infants, to ensure the transition to complementary foods at the right time, and to inform people about the rules of hygiene. Anthropometric measurements should be made and evaluated periodically in family medicine offices and pediatric outpatient clinics. Early detection and treatment of malnutrition could reduce morbidity and mortality as well as hospitalization rates and patient costs.

Conflict of interest: The authors have no conflicts of interest to declare.

References

1. Joosten KF, Hulst JM. Malnutrition in pediatric hospital patients: Current issues. *Nutrition* 2011; 27: 133-137. https://doi.org/10.1016/j.nut.2010.06.001
2. King C, Davis T. Nutritional treatment of infants and children with faltering growth. *Eur J Clin Nutr* 2002; 64: 11-13. https://doi.org/10.1038/ejcn.2010.41
3. World Health Statistics 2018: Monitoring Health for the SDGs. Geneva: WHO; 2018.
4. UNICEF. Malnutrition in Children. Available at: http://data.unicef.org/topic/nutrition/malnutrition/
5. Meakins JL, Pietsch JB, Bubenick O, et al. Delayed hypersensitivity: Indicator of acquired failure of host defenses in sepsis and trauma. *Ann Surg* 1997; 186:241-6. https://doi.org/10.1097/00000658-197709000-00002
6. Waterlow JL. The presentation and use of height and weight data for comparing the nutritional status of groups of children under the age of 10 years. *Bull WHO* 1977; 5:489.
7. Gomez SF, Ramos GR, Frenk S, et al. Mortality in second and third degree malnutrition. *J Trop Pediatr* 1956; 2:77-87. https://doi.org/10.1093/oxfordjournals.tropej.a057419
8. Güleç SG, Urgancı N, Polat S, Yağar G, Hatipoğlu N. Hastanede yatan üç yaş altı çocuklarda malnütrisyon durumunun değerlendirilmesi. Ş.E.E.A.H. *Tıp Bülteni* 2011;45(4):124-129.[In Turk]
9. Neyzi O, Günöz H, Furman A, et al. Türk Çocuklarında vücut ağırlığı, boy uzunluğu, baş çevresi ve vücut kitle indeksi referans değerleri. *Çocuk Sağlığı ve Hastalıkları Dergisi* 2008; 51:1-14. [In Turk]
10. Blossner, Monika, de Onis, Mercedes. Malnutrition: Quantifying the Health Impact at National and Local Levels. Geneva, Switzerland: World Health Organization; 2005.
11. Özer N, Urgancı N, Usta A, Kayaalp N. Hastanede yatan çocuklarda malnütrisyon durumunun değerlendirilmesi. *T Klin J Pediatr* 2001; 10:133-8. [In Turk]
12. Oztürk Y, Büyükgebiz B, Arslan N, Ellidokuz H. Effects of hospital stay on nutritional anthropometric data in Turkish children. *J Trop Pediatr* 2003; 49:189-90. [In Turk]
13. Ong SH, Chee WSS, Lapchmanan LM, et al. Validation of the Subjective Global Nutrition Assessment (SGNA) and Screening Tool for the Assessment of Malnutrition in Paediatrics (STAMP) to identify malnutrition in hospitalized Malaysian children. *J Trop Pediatr* 2019 Feb 1;65(1):39-45. https://doi.org/10.1093/tropej/fmy009.
14. Genel F, Athıhan F, Bak M. Hastanede yatan olgularda malnütrisyon ve anemi prevalansı. *T Klin Pediatr* 1997; 6:173-7. [In Turk]
15. Merritt RJ, Suskind RM. Nutritional survey of hospitalized pediatric patients. *Am J ClinNutr* 1979; 32:1320-5. https://doi.org/10.1093/ajcn/32.6.1320
16. Katana-Apte J, Mokdad A. Malnutrition of children in the Democratic People's Repuplic of North Korea. *J Nutr* 1998; 128:1315-19. https://doi.org/10.1093/jn/128.8.1315
17. India State-Level Disease Burden Initiative Malnutrition Collaborators. The burden of child and maternal malnutrition and trends in its indicators in the states of *India: the Global Burden of Disease Study* 1990-2017. Lancet Child Adolesc Health 2019 Dec; 3(12): 855–870. https://doi.org/10.1016/S2352-4642(19)30273-1
18. Savino W, Dardenne M. Nutritional Imbalances And Infections Affect The Thymus: Consequences on T-cell-mediated immune responses. *Proc Nutr* Soc 2010; 69:636-43. https://doi.org/10.1017/S0029665110002545
19. Abdelhadi RA, Bouma S, Bairdain S, et al. Characteristics of hospitalized children with a diagnosis of malnutrition: United

States, 2010. *J Parenter Enteral Nutr* 2016 Jul; 40(5):623-35. https://doi.org/10.1177/0148607116633800

20. Aykut M, Ceyhan O, Öztürk Y, Günay O. Kayseri sağlık grup başkanlığı bölgesinde 3-36 aylık çocuklarda malnütrisyon durumu. *Türk Hijyen ve Deneysel Biyoloji Dergisi* 1987; 44(2): 223-39. [In Turk]

Authors:
Serhat Samanci – Diyarbakir Children's Hospital, Turkey;
Osman Akdeniz – Department of Pediatric Cardiology, Firat University, Turkey.