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Nutritional status of patients hospitalized in pediatric clinic

Çocuk kliniğine yatırılan hastaların beslenme durumları

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Background/aims: *The aim of this study was to evaluate the nutritional status of children at the moment of their hospitalization and to investigate whether there is a relation between the diagnosis and nutritional status.* ***Methods:*** *Patients hospitalized in the Children's Clinic of Cerrahpasa Medical Faculty (excluding emergency, newborn intensive care and newborn special care units) between December 2003 and August 2004 were included in the study. All patients' height, weight, weight for height head circumference, arm circumference, triceps skin-fold thickness, and Z results of the height and weight were measured and, in accordance with the anthropometric measurements at the moment of hospitalization, each patient's nutritional status was evaluated. The average of the values was compared to diagnosis.* ***Results:*** *223 (42.2%) of a total of 528 patients were female. Patients' ages varied from one month to 23 years (5.8±5.3). The evaluated average height and weight Z scores of the patients were -0.6±1.9 and -0.7±1.5. Evaluation of height for age showed that in 27% of cases there was chronic malnutrition. Evaluation of weight for age and weight for height showed that in 52.4% and 40.9% of the cases, respectively, there was acute malnutrition. In 45.7% of the cases the body mass index was below -2 standard deviations. The evaluation of patients' diagnoses revealed 83 cases (15.7%) diagnosed as acute or chronic respiratory system disease. Malnutrition was most common among patients suffering from diseases from the following groups: chronic kidney insufficiency, genetic diseases, immune insufficiency and cystic fibrosis.* ***Conclusion:*** *Malnutrition among hospitalized children and especially those with chronic diseases is worth attention. Evaluation of the nutritional status and nutritional support are elements of the diagnostic and treatment process. In particular, closer observation and nutritional support are required in the cases of patients diagnosed with chronic kidney insufficiency, immune insufficiency, neurological diseases, and cystic fibrosis.*

Key words: Child, nutritional status, hospital, anthropometry, malnutrition

Amaç: *Bu çalışmanın amacı hastaneye yatırılan çocukların yatış anındaki beslenme durumlarını değerlendirmek ve tanı ile beslenme durumu arasında ilişki olup olmadığını araştırmak istedik.* ***Yöntem:*** *Aralık 2003-Ağustos 2004 tarihleri arasında Cerrahpaşa Tıp Fakültesi Çocuk Kliniği servislerine (acil servis, yenidoğan yoğun bakım, yenidoğan özel bakım servisleri hariç) yatırılan hastalar çalışmaya alındı. Tüm hastaların boy, ağırlık, boya göre ağırlık, baş çevresi, kol çevresi, triseps deri kıvrımı kalınlığı, boy ve ağırlık Z skorları ölçülerek yatış anındaki antropometrik ölçümlere göre beslenme durumları değerlendirildi. Ölçümlerin hepsi aynı kişi tarafından yapıldı. Değerlerin ortalamaları alınarak tanılar arası karşılaştırmalar yapıldı.* ***Bulgular:*** *Çalışmaya alınan 528 hastanın 223'ü (% 42,2) kızdı. Yaşları bir ay ile 23 yaş (5,8±5,3) arasında değişmekteydi. Hastalar genel olarak değerlendirildiğinde boy ve ağırlık Z skorları ortalamaları sırasıyla (-0,6±1,9) ve (-0,7±1,5) idi. Yaşa göre boy uzunluğu hesaplandığında olguların %27'sinde kronik malnütrisyon vardı. Yaşa göre vücut ağırlığı ve boya göre ağırlık hesaplandığında olguların sırasıyla %52,4 ve %40,9'unda akut malnütrisyon vardı. Olguların %45,7'sinde vücut kitle indeksi -2 standart sapmanın altında idi Tanılarına göre değerlendirildiğinde olguların 83'ü (%15,7) akut veya kronik akciğer hastalığı tanısı almıştı. Beslenme bozukluğu ise en sık kronik böbrek yetersizliği, genetik hastalık, immun yetersizlik ve kistik fibroz gibi hastalık gruplarında görülmekteydi.* ***Sonuç:*** *Beslenme yetersizliği hastaneye yatırılan çocuklar arasında özellikle kronik hastalığı olanlar arasında dikkati çekmektedir. Beslenmenin değerlendirilmesi ve beslenme desteği tanı ve tedavinin bir parçasıdır. Özellikle kronik böbrek yetersizliği, genetik hastalık, immun yetersizlik ve kistik fibroz tanılı hastalara daha yakın izlem ve beslenme desteği gerekmektedir.*

Anahtar kelimeler: Çocuk, beslenme durumları, hastane, antropometri, malnütrisyon

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INTRODUCTION

Growth depends on a constant supply of essential nutrients in sufficient amounts and proportions. Failure to thrive occurs when growth fails as a result of inadequate nutrition. Inadequate nutrition can be caused by inadequate intake, increased losses, or increased requirements (1). Malnutrition causes a decrease in the cellular and humoral immune response of patients suffering from either acute or chronic disease (2). The value of the protein energy malnutrition in hospitalized children was reported as varying between 21% and 80% in proportion with the level of development of the countries (3-6). As malnutrition rates change in regard to the patient's age at the moment of their hospitalization, they also vary in terms of the underlying diagnosis (7, 8). Anthropometric evaluation is very important for early discovery of the patients with high risk for malnutrition. For this reason, it is necessary to measure at least weight and height of the newly hospitalized patients, and to calculate the required anthropometric values (9). The aim of this study was to evaluate children's nutritional status at the moment of their hospitalization, and to research whether there is any relation between nutritional status and diagnosis.

MATERIALS AND METHODS

Patients hospitalized in the Children's Clinic of Cerrahpasa Medical Faculty (excluding emergency, newborn intensive care and newborn special care units) between December 2003 and August 2004 were included in the study. All patients' height, weight, weight for height (W/H), head circumference, arm circumference, triceps skin-fold (TSF) thickness, height for age Z scores (HAZ) and weight for age Z scores (WAZ) were measured and, in accordance with the anthropometric measurements at the moment of hospitalization, each patient's nutritional status was evaluated. The given diagnoses were recorded. All measurements were done by the same physician. Comparisons between the calculated average values of the measurements and the diagnoses were done. In order to evaluate a patient's nutritional status, weight for age (W/A), height for age (H/A), W/H, HAZ, WAZ and body mass index (BMI) were calculated. In the case of determining nutritional status of children between the ages of one and four in particular, the parameters of upper arm and head circumferences were calculated. When chronic malnutrition was determined, the parameters of H/A and HAZ were considered essential, whereas W/A, W/H, and WAZ were fundamental for establishing acute malnutrition. Full anthropometric calculation was done according to following formulae:

WAZ: [observed weight - median weight (same age and sex)] / standard deviation

HAZ: [observed height - median height (same age and sex)] / standard deviation

H/A: [observed height / median height (same age and sex)] x 100

W/A: [observed weight / median weight (same age and sex)] x 100

W/H: [observed weight / median weight (same height and sex)] x 100

Circumference of the head was measured with a tape around the head at the most protruding points of the occiput and forehead. TSF thickness was measured to the nearest 0.1 cm with a Harpenden skin fold caliper, using the mean of three separate readings.

Statistical Analyses

All values for statistical analysis were calculated using Student's t test in SSPS program and according to a patient's sex and duration of the disease. A p value <0.05 was considered statistically significant.

RESULTS

Of the 528 patients, 223 (42.2%) were female and 305 (57.8%) male. Their ages varied between one month and 23 years (5.8±5.3). One hundred and

Table 1. Malnutrition rates according to sex and duration of disease

		W/A	H/A	W/H	HAZ	WAZ
Sex	Female	89.5%	96.8%	95.9%	-0.65	-0.75
	Male	88.4%	96.9%	94.2%	-0.71	-0.7
Duration of disease	Acute	93.8%	99.3%	94.3%	-0.06	-0.3
	Chronic	86.5%	95.7%	95.2%	-0.9	-0.8
P value	Sex	0.59	0.93	0.28	0.72	0.70
	DD	0.001	0.000	0.586	0.000	0.001

W/A: Weight for age, H/A: Height for age, W/H: Weight for height, HAZ: Height for age Z score, WAZ: Weight for age Z score, DD: Duration of disease

Table 2. Malnutrition rates according to various anthropometric measurements in acute and chronic diseases

Duration of disease (case number)	W/A No (%)	H/A No (%)	W/H No (%)	HAZ No (%)	WAZ No (%)
Acute (167)	70 (41.9)	24 (14.4)	59 (35.3)	17 (10.2)	18 (10.8)
Chronic (361)	207 (57.3)	119 (33)	157 (43.5)	92 (25.5)	84 (23.3)
P value	0.001	0.000	0.6	0.000	0.001

W/A: Weight for age, H/A: Height for age, W/H: Weight for height, HAZ: Height for age Z score, WAZ: Weight for age Z score

sixty-seven (31.6%) of the cases were hospitalized with acute and 361 (68.4%) with chronic disease. In the evaluation of the patients in regard to sex, no statistically significant difference was determined regarding the average values of W/A, H/A, W/H, HAZ, and WAZ ($p>0.05$). In the evaluation in terms of disease duration, the analysis of W/A, H/A, HAZ and WAZ clearly showed a statistical difference between cases with acute and chronic diseases ($p<0.05$), whereas the W/H values did not show any statistically significant difference (Tables 1, 2). By calculating the W/H values, a nutritional disturbance in 216 of the cases (40.9%) was found, whereas the W/A (according to Gomes) analysis showed changes in nutritional status in 277 of the cases (52.5%) (Table 3). The calculation

Table 3. Nutritional status of cases according to W/A and W/H

Nutritional status	W/A No (%)	W/H No (%)
Severe malnutrition	50 (9.5)	45 (8.5)
Moderate malnutrition	143 (27.1)	104 (19.2)
Mild malnutrition	84 (15.9)	67 (12.7)
Normal	163 (30.9)	228 (43.2)
Overweight	47 (8.9)	45 (8.5)
Obese	41 (3.8)	39 (7.4)

W/A: Weight for age, W/H: Weight for height

Table 4. Nutritional status of the cases according to H/A and HAZ

Cases	H/A	HAZ
Very short	15 (2.8%)	48 (9.1%)
Short	128 (24.2%)	57 (10.8%)
Normal	276 (52.3%)	386 (73.1%)
Tall	109 (20.6%)	37 (7%)

H/A: Height for age, HAZ: Height for age Z score

of H/A showed lower height in 143 (27%) of the cases (Table 4). Evaluation of both types of malnutrition - acute and chronic - according to the well measured of the BMI, showed malnutrition in 45.7% of the cases (Table 5). Especially in the evaluation of the nutritional status of the 304 cases between three and 48 months, the calculation of upper arm and head circumferences showed malnutrition in 135 of the cases (44.6%) (Table 6). When cases were evaluated according to the given diagnosis, the largest group was that of acute or chronic lung disease in 83 of the cases (15.7%). Chronic kidney insufficiency, genetic diseases, immune insufficiency, cerebral palsy and cystic fibrosis were among the most frequent groups of diseases deriving from nutritional disturbances (Table 7).

Table 5. Nutritional status according to body mass index

Malnutrition degree	Number of cases	%
Mild malnutrition	202	38.3
Moderate malnutrition	27	5.1
Severe malnutrition	12	2.3
Normal	287	54.4

Table 6. Nutritional status of the cases between three and 48 months (according to circumference of the upper arm / circumference of the head rates)

Nutritional status	Number of cases	%
Severe malnutrition	17	5.7
Moderate malnutrition	29	9.6
Mild malnutrition	89	29.3
Normal	123	40.5
Overweight or obese	45	14.9
Total	304	100

Table 7. Nutritional status of cases according to diagnosis (according to WAZ)

Disease	Number of cases	%*
Kidney insufficiency	25	64
Genetic diseases	21	52.4
Immune insufficiency	15	46.7
Cystic fibrosis	22	45.5
Organic brain	7	42.9
Malabsorption	9	33.3
Metabolic diseases	20	30
Congenital heart diseases	14	28.6

*Weight for age Z score <-2 , WAZ: Weight for age Z score

DISCUSSION

Acute or chronic malnutrition reduces the number and function of T cells and phagocytic cells and secretory immunoglobulin-A antibody response (2). Subsequently, with the increase in malnutrition rates of hospitalized children, the number of patients who have died has increased as well (5). Particularly in cases when the loss of weight is more than 30%, there is no possibility for recovery. In similar situations, high susceptibility for infection, late wound recovery, muscle weakness, and impossibility to cope with stress occur. This situation, together with the increase in the expenses of the hospital and society, leads to a patient's longer stay in the hospital (10, 11). According to one study, during the time of hospitalization, death ratio of the cases with WAZ above -2 standard deviations was 7.2%, whereas it increased to 22.7% in cases with WAZ below -4 standard deviations (6). Another study reported that the hospitalization period of patients with WAZ -2.7 at the time of hospitalization is between 28 and 77 days, whereas hospitalization period for patients with WAZ -1.24 is between 10 and 13 days (8). The differences in the nutritional status of the hospitalized patients could change as a result of the hospital's services, as well as according to their diagnoses (3, 8, 12-16). Sometimes these differences could relate to the doctor taking care of the patient in the clinic or to the method used for anthropometric measurement, or they could stem from economic and technical problems (Table 8) (17). There is an inverse proportion between the number of the patients with malnutrition – both adult and children - and the level of development of the country (5, 17-18). Two researches on the nutritional status of children before school in Nigeria and South Korea reported acute malnutrition rates of 7.4% and 16.5%, and chronic malnutrition rates of 60.7% and 38.2%, respectively (19, 20). In our country, the study of Tunçbilek et al. (21) covering 3, 152 children in the pre-school period showed that 21% of the children were stunted, 3% wasted and 10% underweight. Since in the evaluation of nutritional status sometimes only one value of the anthropometric measurement could be enough, more than one anthropometric measurement and nutritional risk scores have been developed (22, 23). The use of volume of consumed food and biochemical variables together with the anthropometric measurement methods in most of these nutritional risk scores, and their use in the evaluation of stress factors, very often restrict the use of the risk scores. That is why at the moment of hospitalization at least weight and height value for each patient should be recorded (9). While W/A and W/H are worthy for the cases with acute malnutrition, the H/A and HAZ scores are sound indicators for chronic malnutrition (1, 8). In our study, given the two types of malnutrition – acute and chronic - and according to the various nutrition indicators for the different age groups, we used more than one anthropometric measurement value. Insufficient intake of food, increased losses, or increased requirements in the case of sick children leads to an increase in malnutrition rates (1). Despite the restricted information regarding the malnutrition status of the hospitalized patients in developing countries, the proportion varies between 21% and 80% in accordance with the level of development of the countries (17). In their study Hulst et al. (24) found that from all hospitalized patients, 15% had acute and 20% chronic type malnutrition. In a similar study, Tienboon et al. (5) showed that 55% of patients between the ages of one and 15 suffered from acute malnutrition. Ferreira et al. (9), when evaluating W/A of the patients, reported that 71.2% suffered from malnutrition at the moment of their hospitalization. A research done in Mexico purports that in 72.2% of 450 hospitalized patients, a varying degree of malnutrition was found (3). According to two studies done in different areas of our country, malnutrition rates in Turkey vary between 55.1-56.6% (25, 26). According to the H/A, our study established chronic malnutrition in 27% of the cases. According to W/A and W/H results, acute malnutrition was shown in 52.4% and 40.9% of the cases, respectively. These rates, apparently high when related to the children among the population of our country, have shown similarities to another study done among hospita-

Table 8. Factors and difficulties affecting the evaluation of the nutritional status of hospitalized patients (17)

1. Physicians' lack of awareness of malnutrition
2. Inadequate equipment for evaluating nutritional status
3. Current sophisticated nutritional support techniques
4. Lack of nutritional devices, e.g. enteral pump and feeding tube
5. High cost of nutrition support and hospitalization
6. Poverty of admitted patient
7. Lack of nutrition support team
8. Need to develop inexpensive enteral and parenteral nutrition formulas
9. Different disease states of hospitalized patients
10. Inadequate skills and knowledge of nutrition therapy
11. Complications associated with enteral and parenteral nutrition
12. Inadequate management strategies
13. Lack of research activities

lized children. In addition, lower height was established in 14.4% and weakness in 35.3% of the acute malnutrition cases, and lower height in 33% and weakness in 57.3% of the chronic malnutrition cases. The changes in the nutritional status of the hospitalized patients may vary in accordance with the given diagnosis as well (6). In their study, Cruz et al. (14) established malnutrition among patients hospitalized with bronchopneumonia according to the following measurements: according to W/A in 27.8% of the patients, W/A in 25.9% and W/H in 12.4% of the patients. Dewan et al. (15) emphasized that among patients hospitalized with diarrhea, 26% were severely underweight, 27% were severely wasted and 19% severely stunted. The manifestation of the above-mentioned facts is stronger in the cases of diarrhea caused by bacteria. In the most recently published yearly report of the North American Cystic Fibrosis Association, it was stated that among patients suffering from cystic fibrosis, 26% had weight loss and 29% lower height (12). McWhirter et al. (16) in their study established malnutrition in 30% of the patients hospitalized in the surgery unit at the moment of their hospitalization. In our study, according to HAZ, malnutrition was found in 64% of the patients suffering from kidney insufficiency, in 52.4% of patients with genetic diseases, in 46.7% of patients with immune insufficiency, and in 45.5% of patients with cystic fibrosis diseases.

In conclusion, malnutrition among hospitalized children, especially in the cases of chronic disease, is worth attention. The evaluation and support of nutrition are elements of the diagnostic and treatment process. In particular, closer observation and nutritional support are required in the cases of patients diagnosed with chronic kidney insufficiency, immune insufficiency, neurological diseases, and cystic fibrosis.

REFERENCES

1. Baker S. Protein energy malnutrition in the hospitalized patient. In: Walker WA, Watkins JB, Duggan C, eds. Nutrition in Pediatrics. 3rd ed. London: BC Decker Inc Hamilton, 2003; 910-6.
2. Chandra RK. Nutrition and immunology: from the clinic to cellular biology and back again. Proc Nutr Soc 1999; 58: 681-7.
3. Cortes RV, Nava-Flores G, Perez CC. Frecuenci de la desnutricion en ninos de un hospital pediatrico de tercer nivel. Rev Mexicana Pediatr 1995; 62: 131-3.
4. Tienboon P. Incidence and spectrum of malnutrition in pediatric wards. Thai J Pediatr 1985; 24: 20-6.
5. Tienboon P. Nutritional status of pediatric patients: Maharaj Nakorn Chiang Mai Hospital. Thai J Paren Enter 1995; 6: 3-14.
6. Leite HP, Isatugo MK, Sawaki L, et al. Anthropometric nutritional assessment of critically ill hospitalized children. Rev Paul Med 1993; 111: 309-13.
7. Hankard R, Bloch J, Martin P, et al. Nutritional status and risk in hospitalized children. Arch Pediatr 2001; 11: 1203-8.
8. Man WD, Weber M, Palmer A, et al. Nutritional status of children admitted to hospital with different diseases and its relationship to outcome in Gambia, West Africa. Trop Med Int Health 1998; 3: 678-86.
9. Ferreira HS, França AOS. Evolution of nutritional status in hospitalized children. Journal de Pediatria 2002; 78: 491-6.
10. Stefee WP. Malnutrition in hospitalized patients. JAMA 1980; 244: 2630-5.
11. Orne JF, Clemmer TP. Nutrition in the critical care unit. Med Clin North Am 1983; 67: 1295-302.
12. Cystic Fibrosis Foundation. Cystic Fibrosis Foundation patient registry annual data report. Cystic Fibrosis Foundation, Bethesda, MD 2000; 1-27.
13. Waitzberg DL, Caiffa WT, Correia MITD. Hospital malnutrition: the Brazilian national survey (IBRANUTRI): a study of 4000 patients. Nutrition 2001; 17: 573-80.
14. Cruz JR, Sibrian R, Osorio V, et al. Nutritional status of Guatemalan preschool children hospitalized for acute respiratory infections. Arch Latinoam Nutr 1989; 39: 251-62.
15. Dewan N, Faruque AS, Fuchs GJ. Nutritional status and diarrhoeal pathogen in hospitalized children in Bangladesh. Acta Paediatr 1998; 87: 627-30.
16. McWhirter JP, Pennington CR. Incidence and recognition of malnutrition in hospital. BMJ 1994; 308: 945-8.
17. Souba WW. Nutritional support. Drug Ther 1997; 336: 41-8.
18. Tienboon P. Nutrition problems of hospitalized children in a developing country: Thailand. Asia Pacific J Clin Nutr 2002; 11: 258-62.
19. Adelekan DA, Fatusi AO, Fakunle JB, et al. Prevalence of malnutrition and vitamin A deficiency in Nigerian preschool children subsisting on high intakes of carotenes. Nutr Health 1997; 12: 17-24.
20. Katana-Apte J, Mokdad A. Malnutrition of children in the Democratic People's Republic of North Korea. J Nutr 1998; 128: 1315-9.
21. Tuncbilek E, Unalan T, Coskun T. Indicators of nutritional status in Turkish preschool children: results of Turkish Demographic and Health Survey 1993. J Trop Pediatr 1996; 42: 78-84.
22. Reilly HM, Martineau JK, Moran A, et al. Nutritional screening – evaluation and implementation of a simple nutrition risk score. Clin Nutr 1995; 14: 269-73.
23. Sermet-Gaudelus I, Poisson-Salomon AS, Colomb V, et al. Simple pediatric nutritional risk score to identify children at risk of malnutrition. Am J Clin Nutr 2000; 72: 64-70.
24. Hulst J, Joosten K, Zimmermann L, et al. Malnutrition in critically ill children: from admission to 6 months after discharge. Clin Nutr 2004; 23: 223-32.
25. Özer N, Urgancı N, Usta A, et al. Determination of malnutrition in hospitalized children. T Klin J Pediatr 2001; 10: 133-8.
26. Genel F, Alıhan F, Bak M, et al. Prevalence of anemia and malnutrition in hospitalized cases. T Klin J Pediatr 1997; 6: 173-7.