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Hospital-Acquired Malnutrition in the Pediatric Population: A Cross-Sectional Study

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Abstract

Malnutrition is a global problem, from which hospitalized patients are not exempt. Hospital-acquired malnutrition (HaM) is associated with adverse outcomes in pediatric patients. Therefore, health professionals need to understand the factors related to the issue in such patients. This study aims to identify the factors associated with the prevalence of HaM in pediatric patients. It employed a cross-sectional design involving children from one month to 18 years old who had been hospitalized for at least 72 hours. HaM was determined by a weight loss of more than 2% by the fourth day of hospitalization. The final sample was 373, from which it was indicated that the prevalence of HaM was 7%. There were statistically significant correlations between HaM and predictor factors, including age (p = 0.001), type of disease (p = 0.017), weight on admission (p = 0.001), nutritional therapy (p = 0.012), and class of ward (p = 0.001). However, the correlation between HaM and length of stay was not statistically significant. HaM occurred in younger patients in relation to infectious diseases, low admission weight, enteral nutrition therapy, longer hospital stays, and lower ward class. Nurses are expected to monitor pediatric patients' condition, including regular anthropometric measurement, to identify the initial signs of HaM.

Keywords: child, hospitalization, malnutrition, weight-loss

Abstrak

Malnutrisi Didapat di Rumah Sakit Pada Pasien Anak di Indonesia: Studi Potong Lintang. *Malnutrisi masih menjadi masalah global, termasuk pada pasien di rumah sakit. Malnutrisi didapat di rumah sakit (MDdRS) berkaitan dengan hasil yang buruk terhadap pasien anak sehingga tenaga kesehatan perlu mengetahui faktor yang berkaitan dengan MDdRS pada pasien anak. Penelitian ini bertujuan untuk mengidentifikasi faktor yang berhubungan dengan kejadian MDdRS pada pasien anak. Penelitian menggunakan desain potong lintang pada pasien anak usia 1 bulan hingga 18 tahun dan dirawat minimal 72 jam. MDdRS ditentukan berdasarkan penurunan berat badan lebih dari 2% pada hari rawat keempat. Sampel yang digunakan sebanyak 373 dengan hasil penelitian menunjukkan prevalensi MDdRS sebesar 7%. Faktor yang berpengaruh secara statistik pada kejadian malnutrisi di rumah sakit adalah usia(p = 0,001), jenis penyakit (p = 0,017), berat badan pada awal masuk rumah sakit (p = 0,001), terapi nutrisi (p = 0.012), dan kelas perawatan (p = 0,001). Lama rawat memiliki hubungan yang tidak bermakna secara statistik dengan kejadian MDdRS. Kejadian MDdRS terjadi pada usia yang lebih muda, jenis penyakit infeksi, berat badan awal masuk yang lebih rendah, terapi nutrisi enteral, lama rawat yang lebih tinggi, dan kelas perawatan yang lebih rendah. Perawat diharapkan dapat memantau kondisi pasien anak, termasuk mengukur antropometri secara berkala untuk mengidentifikasi tanda awal MDdRS.*

Kata Kunci: *anak, kehilangan berat badan, malnutrisi, rumah sakit*

Introduction

Malnutrition, including its incidence in the hospital setting, remains a global issue. Pacheco-Acosta et al. (2014) found that 50% of patients in their study suffered from the condition. It may occur when patients are first admitted to hospital and worsens during their stay. In Canada, 39.6% of one month to 19 year old patients who were admitted to hospital were malnourished (Baxter et al., 2014). In Africa, approximately two-thirds of patients are at risk

of malnutrition on admission, and become more malnourished during hospitalization, leading to increased morbidity and mortality (Chimera-Khombe et al., 2022). Such a condition causes deterioration of nutritional status whilst hospitalized. Hospital-acquired malnutrition (HaM) is caused by complex physiological and metabolic changes associated with iatrogenic factors, absorption barriers, and acute inflammatory responses that impair metabolism (Cass & Charlton, 2022). It indicates nutritional inadequacy during the hospital stay. Weight loss could be an indicator of malnutrition in hospitals (Juliaty, 2013). Campanozzi et al. (2009) define HaM as the deterioration of nutritional status after a hospital stay of 72 hours, while Pacheco-Acosta et al. (2014) used two indicators: weight loss of more than 2% and a decline in BMI of up to 0.25 SD. There is still no ideal method to define HaM, especially in children, since the indicator is determined with as based on the expert's judgment.

Malnutrition in hospitals could occur due to certain risk factors, such as being aged less than 24 months, suffering from fever or abdominal pain, or hospital stays of more than 5 days (Campanozzi et al., 2009). A younger age increases children's vulnerability to malnutrition due to their immature immunity; fever is a condition of heat loss that causes risk of malnourished to increase. Abdominal pain at night could hinder children from having enough rest, which therefore disrupts their activity, including eating. Patients who are treated for a long time have been associated with a decreased appetite, meaning their nutritional intake is reduced when they should be receiving adequate to recover.

Malnutrition also occurs in hospitalized pediatric patients in Indonesia; Juliaty (2013) found that its incidence was 11.7%. It often goes undiagnosed and patients do not receive treatment until they are discharged from hospital (Budiputri et al., 2020). Several factors influence the occurrence of malnutrition in pediatric patients in hospitals. By undertstanding these, prevention can be made by providing effective nutritionnal management during treatment and handling nutritional interventions as soon as possible (Villares et al., 2016). Therefore, this study aims to measure the prevalence of HaM and identify the contributing factors to it in pediatric patients in Indonesia.

Methods

The study employed a cross-sectional design. The sample was medical records of patients aged from one month to 18 years old who had been hospitalized for at least 72 hours, selected using the consecutive sampling method. Data from the medical records of patients on pediatric wards were collected over a period of one year at a national referral hospital which fulfilled the inclusion criteria. Patients with tumors and organomegaly, fluid retention, and dehydration were excluded. The study was conducted at a top referral hospital, with the patients coming from various provinces in Indonesia. Five wards, namely the neonatology ward, pediatric surgical ward, pediatric intensive care unit, pediatric emergency unit, and general pediatric ward, were included. The study was approved by Ethics Committee of the Faculty of Medicine, Universitas Indonesia.

First, the patient's ID number was identified. The medical record officer then located and provided the available medical records. In this case, a consent form was not necessary. 373 medical records were analyzed; the data obtained included patients' identity (initials); class of ward; date of admission, and discharge from hospital, from which the length of stay was calculated; date of birth; medical diagnosis; nutritional therapy; and weight on admission. Hospital-acquired malnutrition was assessed through weight loss of at least 2% by the fourth day.

Univariate analysis was conducted on the independent variable in the study to identify the characteristics of the pediatric patients. Age, admission weight and length of stay were collected as numerical data and presented as me-

dian and minimum-maximum scores. In addition, other characteristics, namely type of disease, nutritional route and class of ward, were categorical data, which were analyzed using a proportion test to measure the frequency and percentage of each category. Bivariate analysis was also conducted using the Mann-Whitney test for numerical data and Pearson x^2 for categoric data. Such analysis was performed to measure the correlation between the prevalence of HaM and all the predictive factors.

Results

373 pediatric patient records were examined. Predictive factors considered as having an influence on the incidence of HaM included age, admission weight, length of stay, type of disease, nutritional therapy, and type of ward. These are presented in Tables 1 and 2. The respondents' age ranged from nine months to 18. Their median weight was 15 kilograms and length of stay ranged between 4 and 70 days. The majority of respondents were suffering from non-infectious diseases, were receiving nutrition through the oral route, and were hospitalized in the third-class hospital ward.

Table 3 shows that the prevalence of HaM was 7%. This figure was derived by comparing the number of pediatric patients who had experienced weight loss of > 2% by the fourth day of hospitalization to the number of all pediatric patients.

Bivariate data analysis was conducted to identify the correlation between HaM and all the predictive factors. The correlation between HaM prevalence and age, admission weight, and length of stay was analyzed using a Mann-Whitney test.

Table 1. Age, Admission Weight and Length of Stay of the Respondents (n = 373)

Variable	Median	Min – Max
Age (years)	4.13	0.09 – 18
Admission weight (kg)	15	2.33 – 120
Length of stay (days)	9	4 – 70

Table 2. Type of Disease, Nutritional Therapy and Class of Ward of the Respondents (n = 373)

Variable	n	%
Type of Disease		
Infectious	94	25.2
Non-infectious	213	57.1
Surgery	66	17.7
Nutritional Therapy		
Oral	231	61.9
Enteral	74	19.8
Parenteral	68	18.2
Class of Ward		
Third class	346	92.8
Non-third class	18	4.8
Intensive Care	9	2.4

Table 3. HaM Prevalence (n = 373)

Variable	n	%
HaM		
Yes	26	7
No	347	93

Table 4 shows that the mean rank of age and admission weight in the pediatric patients who experienced HaM was lower than those without HaM. This indicates that increased age was associated with a low prevalence of HaM. As well as admission weight was also associated with lower HaM prevalence. The correlation between HaM and length of stay was positive, which indicated that the longer the stay, the more likelihood of HaM occurring. Moreover, the p-value showed that the prevalence of HaM had a significant correlation with age and admission, but not with length of stay. Bivariate analysis was also applied to the type of disease, nutritional therapy and type of ward variables. The test used was Pearson x^2.

Based on table 5, 94 patients were suffering from infectious diseases, of whom 12.8% suffered HaM. Of the patients with non-infectious diseases, 6.1% suffered from HaM, while 1.5% of the patients with diseases that required surgery experienced the condition. The percentage of pediatric patients who suffered from HaM in the oral, enteral and parenteral nutritional therapy categories was 3.9%, 12.2% and 11.8%. respectively. Of all the patients in third class 5.8% suffered from HaM, while three out of 18 the non-third class patients did. Amongst the PICU pediatric patients, 33.3% suffered from HaM. The p-value in the correlational analysis between the prevalence of HaM and type of disease, nutritional therapy and class of ward was $p < 0.05$, meaning that it could be concluded that the correlation between HaM and these factors was statistically significant.

Table 4. Correlational between HaM and Age, Admission Weight and Length of Stay (n = 373)

Variable	HaM		p
	Yes Median (Min – Max)	No Median (Min – Max)	
Age (years)	1.31 (0.12 – 12.12)	4.47 (0.09 – 18)	0.001
Admission weight (kg)	7.85 (3.8 – 38)	15 (2.33 – 120)	0.001
Length of stay (days)	11 (6 – 36)	8 (4 – 70)	0.075

Age: Mean rank HaM 121.79; No HaM 191.89.
Admission weight: Mean rank HaM 118.48; No HaM 192.13.
Length of stay: Mean rank HaM 223.15; No HaM 184.29.

Table 5. Correlational Analysis between HaM and Type of Disease, Nutritional Therapy and Class of Ward (n = 373)

Variable	HaM				p
	Yes		No		
	n	%	n	%	
Type of Disease					
Infectious	12	12.8	82	87.2	0.017
Non-infectious	13	6.1	200	93.9	
Surgery	1	1.5	65	98.5	
Nutritional Therapy					
Oral	9	3.9	222	96.1	0.012
Enteral	9	12.2	65	87.8	
Parenteral	8	11.8	60	88.2	
Class of Ward					
Third class	20	5.8	326	94.2	0.001
Non-third class	3	16.7	15	83.3	
PICU	3	33.3	6	66.7	

Discussion

Hospital-acquired Malnutrition. The prevalence of HaM in the pediatric patients was 7%. More than 16% of the patients were suffering from weight loss on the fourth day of their hospitalization; however, 36 of them did not reach the HaM indicator determined by the researcher.

These findings are supported by several previous studies. Maryani et al. (2016) found that the prevalence of HaM reached 27%. Their research was conducted at RSUP Dr Sardjito Yogyakarta and involved patients aged 1 month – 18 years using the Walker and Hendricks indicator (percentage of weight loss based on length of stay). Other research conducted in Makassar found that the prevalence of HaM was 8.9% (Juliaty, 2013). Outside Indonesia, a study of hospital malnutrition was also conducted in Brazil, which found that its prevalence was 48.1%, based on the Subjective Global Assessment (SGA) instrument of Waitzberg et al. (2001).

Age. The median age of pediatric patients suffering from HaM in this study was lower than those who were not. Such a finding is in line with the research conducted by Hecht et al. (2015), who demonstrated that age was inversely proportional to the risk of malnutrition. Campanozzi et al. (2009) also proved that an age of less than 2 years was a risk factor for HaM. In Indonesia, Juliaty (2013) demonstrated that the age group of 25 – 36 months was that which suffered most frequently from malnutrition during hospitalization. Children of a younger age are easily exposed to microorganisms, therefore are more likely to suffer from malnutrition. However, Pacheco-Acosta et al. (2014) found that there were no significant differences in the prevalence of HaM at various ages. It can be concluded that children aged less than 1 or 2 years old are more susceptive to suffering from respiratory tract infections that could cause malnutrition.

Type of Diseases. HaM and the type of disease being treated had a significant correlation. Waitzberg et al. (2001) specifically researched the correlation between infection and HaM, and found that infection increased the risk of HaM by 2.6 times. Infection could cause a loss of protein, energy, mineral and vitamins (Rodriguez et al., 2011). During the mounting of immune response, the body needs considerable energy. If the condition is not balanced by adequate nutrition intake, this could cause malnutrition.

The prevalence of malnutrition in patients with non-infectious diseases and ones requiring surgery was 17.9% and 7.7% respectively. Waitzberg et al. (2001) categorized these diseases as body system disorders and showed that the causes of HaM were autoimmune diseases and hematological disorders. A study conducted by Merhi and Aquino (2014) demonstrated that neoplasm was associated with the level of the prevalence of malnutrition in hospitals. Pediatric patients with cancer had a 3.7 times higher possibility of suffering from malnutrition compared to non-oncology one (Waitzberg et al., 2001). Cancer patients have been associated with appetite loss, changes in sensory perception (smell and taste), weight loss, and gastrointestinal disorders (Teixeira et al., 2016).

Weight at Admission. Body weight is one of the nutritional status parameters that is measured when patients are admitted to the hospital. Initial nutritional status on admission could influence subsequent status during hospitalization and after discharge. A previous study by Juliaty (2013) showed that initial nutritional status correlated to HaM. Juliaty (2013) reported that there was a relationship between the initial nutritional status and nutritional intake during treatment with the patient's status when returning home. Admission weight is one of the factors that needs to be considered in managing pediatric patients.

Nutritional Therapy. Malnutrition correlates to the nutritional intervention received by patients. Enteral feeding correlates to the low level of malnutrition in hospitals (Waitzberg et al., 2001). However, the high percentage of

HaM in the enteral and parenteral therapy groups in this study was related to the severity of the disease experienced by the patients, who therefore needed nutritional support. A study conducted by Villares et al. (2017) identified patients who had a high risk of malnutrition based on nutrition feeding type; i.e., oral 33.4%, enteral 83.8%, and parenteral 87.5%. This indicates that various feeding routes could be considered as an intervention for pediatric patients suffering from malnutrition or at high risk of it.

Length of Stay. The correlation between the prevalence of HaM and the length of stay was positive. Statistically, neither was significantly correlated. A study conducted by Teixeira et al. (2016) in Brazil also showed that the length of stay between malnourished and well-nourished patients was not statistically different. However, the length of stay is directly proportional to the malnutrition risk in hospitals. Being hospitalized for more than 5 days could be a risk factor in malnutrition in hospitals (Campanozzi et al., 2009). In Indonesia, Maryani et al. (2016) found that disease status was the factor that influenced the length of stay. A third-class pediatric patient (malignancy, severe sepsis, major surgery, and depression) had a 2.56 times greater risk of suffering from malnutrition. The increase in the length of hospitalization is caused by nutritional deterioration, that can lead to infection, gastrointestinal complications and organ dysfunction, and can also be influenced by hospital policy (Hecht et al., 2015). Thomas et al. (2016) researched elective surgery patients aged 14 – 91 and concluded that the length of stay was influenced by malnutrition, age, malignant tumors, and disease complications. Such conditions show the correlation between length of stay and malnutrition.

Class of Ward. In this study, the correlation between HaM and the class of the ward was statistically significant. It was noted that third class ward was the highest contributor to HaM compared to the other types of ward. The selected class of ward could represent the family's economic status, which also determines the quality and quantity of food consumed (Pravana et al., 2017). The nutritional status of children in a poor family can lead to the risk of malnutrition during hospital care (Tette et al., 2015).

Conclusion

The prevalence of HaM in this study was 7%. The characteristics of pediatric patients that were predictive factors of HaM were age, type of disease, admission weight, nutritional therapy, length of stay and class of ward. Apart from the length of stay, these factors statistically influence the prevalence of malnutrition in hospitals. HaM mostly occurs at younger ages, in those with infectious diseases, low admission weight, enteral nutritional therapy, longer hospital stays, and lower classes of ward.

After conducting the study on the factors contributing to the prevalence of HaM, the researcher recommends that all nursing staff make an overall initial assessment of pediatric patients and control control their condition regularly, especially in terms of nutrition. It is also recommended that nursing staff complete clear documentation related to the patients' progress during their hospitalization.

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References

Baxter, J.-A.B., Al-Madhak, F.I., & Zlotkin, S.H. (2014). Prevalence of malnutrition at the time of admission among patients admitted to a Canadian tertiary-care paediatric hospital. *Paediatrics & Child Health*, *19* (8), 413–417. doi: 10.1093/pch/19.8.413.

Budiputri, G.L., Suryawan, I.W.B., & Dewi, M.R.

(2020). Analisis faktor–faktor yang mempengaruhi kejadian Malnutrisi Rumah Sakit (MRS) pada pasien anak di Bangsal Kaswari, RSUD Wangaya, Bali, Indonesia. *Intisari Sains Medis*, *11* (2), 680–685. doi: 10.15562/ism.v11i2.647.

Campanozzi, A., Russo, M., Catucci, A., Rutigliano, I., Canestrino, G., Giardino, I., Romondia, A., & Pettoello-Mantovani, M. (2009). Hospital-acquired malnutrition in children with mild clinical conditions. *Nutrition*, *25* (5), 540–547. doi: 10.1016/j.nut.2008.11.026.

Cass, A.R., & Charlton, K.E. (2022). Prevalence of hospital-acquired malnutrition and modifiable determinants of nutritional deterioration during inpatient admissions: A systematic review of the evidence. *Journal of Human Nutrition and Dietetics, 35* (6), 1043–1058. doi: 10.1111/jhn.13009.

Chimera-Khombe, B., Barcus, G., Schaffner, A., & Papathakis, P. (2022). High prevalence, low identification and screening tools of hospital malnutrition in critically-ill patients in Malawi. *European Journal of Clinical Nutrition*, *76*, 1158–1164. doi: 10.1038/s41430-022-01087-5.

Hecht, C., Weber, M., Grote, V., Daskalou, E., Dell'Era, L., Flynn, D., Gerasimidis, K., Gottrand, F., Hartman, C., Hulst, C. (2015). Disease associated malnutrition correlates with length of hospital stay in children. *Clinical Nutrition, 34* (1), 53–59. doi: 10.1016/j.clnu.2014.01.003

Juliaty, A. (2013). Malnutrisi rumah sakit pada bangsal anak Rumah Sakit Dr. Wahidin Sudirohusodo Makassar. *Sari Pediatri*, *15* (2), 65–68.

Maryani, E., Prawrirohartono, E.P., & Nugroho, S. (2016). Faktor prediktor malnutrisi rumah sakit pada anak. *Sari Pediatri*, *18* (4), 278–284.

Merhi, V.A.L., & de Aquino, J.L.B. (2014). Determinants of malnutrition and post-operative complications in hospitalized surgical patients. *Journal of Health Population and Nutriton, 32* (3), 400–410.

Pacheco-Acosta, J.C., Gomez-Correa, A.C., Florez, I.D., Cortés, J.E., Velez, D., Gomez, J., Munera, M., & Arboleda, S. (2014). Incidence of nutrition deterioration in non-seriously ill hospitalized children younger than 5 years. *Nutrition in Clinical Practice*, *29* (5), 692–697. doi: 10.1177/0884533614533122.

Pravana, N., Piryani, S., Chaurasiya, S., Kawan, R., Thapa, R., & Shrestha, S. (2017). Determinants of severe acute malnutrition among children under 5 years of age in Nepal: A community-based case–control study. *BMJ Open*, *7* (8), e017084. doi: 10.1136/ bmjopen-2017-01708.

Rodriguez, L., Cervantes, E., & Ortiz, R. (2011). Malnutrition and gastrointestinal and respiratory infections in children: A public health problem. *International Journal of Environmental Research and Public Health, 8* (4), 1174–1205. doi: 10.3390/ijerph8041174.

Teixeira, V.P., Miranda, R.C., & Baptista, D.R. (2016). Malnutrition on admission, length of hospital stay and mortality of hospitalized patients in a tertiary hospital, *Demetra: Food, Nutrition & Health*, *11* (1), 239–251. doi: 10.12957/demetra.2016.18457.

Tette, E.M.A., Sifah, E.K., & Nartey, E.T. (2015). Factors affecting malnutrition in children and the uptake of interventions to prevent the condition. *BMC Pediatrics*, *15*, 189. doi: 10.1186/s12887-015-0496-3.

Thomas, M.N., Kufeldt, J., Kisser, U., Hornung, H-M., Hoffmann, J., Andraschko, M., Werner, J., & Rittler, P. (2016). Effects of malnutrition on complication rates, length of hospital stay, and revenue in elective surgical patients in the G-DRG-system. *Nutrition, 32* (2), 249–254. doi: 10.1016/j.nut.2015.08.021.

Villares, J.M., Calderón, V.V., & García, C.B. (2016). Malnutrition in children admitted to hospital. Results of a national survey. *Anales de Pediatria, 86* (5), 270–276. doi: 10.1016/j.anpedi.2015.12.013.

Waitzberg, D.L., Caiaffa, W.T., & Correia, M.I.T.D. (2001). Hospital malnutrition: The Brazilian national survey (IBRANUTRI): A study of 4000 patients. *Nutrition*, *17* (7–8), 573–580. doi: 10.1016/S0899-9007(01)00573-1.