RESEARCH ARTICLE

The risk of under-nutrition in hospitalised Malaysian children: Use of 3-minute nutrition screening-paediatrics (Paediatric 3-MinNS)

Pei Sien Yeo[1], Hazreen Abdul Majid[2,3]

Abstract

Objective: To evaluate the under-nutrition risk of children admitted to hospitals using a validated tool.

Methods: The cross-sectional study was conducted from September 2017 to June 2018 in the paediatrics wards of a tertiary referral paediatric government hospital, a tertiary teaching hospital and a government district hospital in Malaysia. The sample comprised paediatric patients aged 2-12 years within 24-72 hours of hospital admission. Data was collected using the 3-Minute Nutrition Screening-Paediatrics tool. Data was analysed using SPSS 20.

Results: Of the 341 patients screened, 284(83.3%) were included; 170(59.9%) boys and 114(40.1%) girls. The overall median age was 4.85 years (interquartile range: 4.33 years). The median length of hospital stay was 3 days (interquartile range: 3 days). There were 72(25.4%) participants at high under-nutrition risk, with the highest proportion being at the district government hospital 31(33%). Among those with high risk, 5.4% subjects had severe acute malnutrition, 9.7% had severe chronic malnutrition, and 11.1% had severe thinness.

Conclusion: The 3-Minute Nutrition Screening-Paediatrics scale was found to be effective as a nutrition screening tool for hospitalised children in Malaysia.

Keywords: Hospitalised children, Nutrition, Screening tool. (JPMA 74: 1074; 2024)

DOI: https://doi.org/10.47391/JPMA.9616

Introduction

Under-nutrition in childhood has been associated with stunted growth, reduced educational and social achievements, and possible health implications in adulthood.[1] Hospitalised children have an increased risk of under-nutrition, especially children with underlying medical conditions.[2,3] The reported prevalence of under-nutrition in children admitted to hospitals from different countries ranges 6.1-60%.[4,5] Poorer nutritional and clinical characteristics contribute to adverse clinical outcomes, delayed growth, cognitive development effects, prolonged length of hospital stay (LOS) and increased costs of care.[6] Early identification of hospitalised children at risk of under-nutrition and timely provision of treatment improves health outcomes and reduces healthcare costs.[7,8] Therefore, such children would most likely benefit from early screening and monitoring of their nutritional status upon acute hospital admission. Several nutrition screening tools have been developed over the years to facilitate early identification of children at risk of under-nutrition. The 3-Minute Nutrition Screening-Paediatric (Paediatric 3-MinNS) is a nutrition screening tool developed from the 3-Minute Nutrition Screening Tool for adult inpatients in Singapore.[9] The tool is used by ward nurses at admission, and the nutrition indicators score is translated into the need for a referral to a dietitian. In Malaysia, using nutrition screening tools to screen hospitalised children for under-nutrition risk was not a routine paediatric clinical practice. There was also limited data on under-nutrition proportion among hospitalised children in Malaysia. The current study was planned to fill the gap in knowledge by evaluating the under-nutrition risk of children admitted to hospitals, a tertiary teaching hospital, and a district government hospital using a validated tool.

Patients and Methods

The cross-sectional study was conducted from September 2017 to June 2018 at 3 hospitals in Malaysia: the Kuala Lumpur Hospital Paediatrics Institute (KLHPI), which is a tertiary referral paediatric government hospital, the University Malaya Medical Centre (UMMC), which is a tertiary teaching hospital, and the Hospital Sultanah Nora Ismail (HSNI), which is a government district hospital.

After approval from the ethics review committees of the Ministry of Health, Malaysia, and UMMC, the sample size was calculated using a sample size calculator for prevalence studies based on reported under-nutrition rate for hospitalised Malaysian adults with 95% confidence level of and 0.05 precision.[10] A 20% dropout rate was also factored

[1]Department of Social and Preventive Medicine, University of Malaya, Kuala Lumpur, Malaysia; [2]School of Health and Rehabilitation Sciences, AECC University College, Bournemouth, United Kingdom; [3]Centre for Population Health, Department of Social and Preventive Medicine, University of Malaya, Kuala Lumpur Malaysia

Correspondence: Hazreen Abdul Majid. e-mail: hazreen@ummc.edu.my

ORCID ID. 0000-0002-2718-8424

Submission complete: 17-04-2023 **Review began:** 05-06-2023

Acceptance: 02-03-2024 **Review end:** 11-11-2023

in.

The sample was raised using convenience sampling technique. Those included were paediatric patients of either gender aged 2-12 years within 24-72 hours of hospital admission. Those excluded were critically ill patients, patients with enteral or parenteral nutrition support, and hospital admission <24 hours or unobtainable weight and height measurements. Data was collected after taking informed consent from all parents/guardians.

The Paediatric 3-MinNS tool was used to screen the under-nutrition risk of all paediatric patients admitted to the participating wards of the 3 participating health centres as a routine nursing admission process. Paediatric 3-MinNS consists of four nutrition indicators: diagnosis, unintentional weight loss, food intake, and the ability to retain food. The screening tool was validated in Malaysia, and a score of 4 or higher has been defined as an indicator of high under-nutrition risk.[11] The tool was administered by trained ward nursing staff. All the relevant staff at the 3 centres were given training by a dietitian on using Paediatric 3-MinNS.

Anthropometric data such as weight and height was taken by the ward nursing staff within 24-72 hours of admission. Weight and height were measured by calibrated scales available at the respective wards at KLHPI [KLHPI – a digital column scale with height rod (Seca 769, Germany), UMMC – a digital scale (Detecto PD300, USA), HSNI – a mechanical column scale with waist level beam and height rod (Seca 700, USA)]. Weight and height percentiles were referred to and evaluated using the World Health Organisation (WHO) growth charts.[12,13] Referring to the WHO classification of malnutrition, acute malnutrition was defined as severe when weight-for-height (WFH) z-score was below -3 standard deviation (SD), while severe chronic malnutrition was defined when height-for-age (HFA) z-score was below -3 SD.[14] Severe thinness was defined as a body mass index (BMI)-for-age z-score was below -3 SD.[15] LOS was determined from the date of admission until discharge.

Data was analysed using SPSS 20. Descriptive statistics were used to describe the characteristics of the participants. Chi-square test was used for comparison between nutritional risk and categorical variables. The WHO Anthro software version 3.2.2, and the WHO Anthro Plus software version 1.0.4 were used to determine Z-scores for which the sample was grouped as those waged 2-5 years and those aged 5-12 years. P<0.05 was considered significant.

Results

Of the 341 patients screened, were included in the study; 170(59.9%) boys and 114(40.1%) girls. The overall median age was 4.85 years (interquartile range [IQR]: 4.33 years). There were 229(80.6%) patients in medical wards. Malay was the predominant race 213(75%), followed by Chinese 37(13%), Indian 28(9.9%) and others 6(2.1%). The median LOS was 3 days (IQR: 3 days).

Overall, there were 72(25.4%) participants at high undernutrition risk, while severe malnutrition based on the WFH and HFA were 11(8.5%) and 19(6.7%). The highest proportion of participants who had high undernutrition risk was detected at HSNI 31(33%), followed by KLHPI 29(26.4%) and UMMC 12(15%). The nutritional characteristics of the participants at each hospital were noted separately (Table 1).

There were 2(18.2%) participants who had high undernutrition risk defined as severe acute malnutrition, 7(36.8%) were severe chronic malnutrition, and 8(27.6%) had severe thinness. More participants aged 5-12 years were in the high undernutrition risk group than those aged

Table-1: Nutritional characteristics of participants at the study hospitals.

Nutrition Assessment	KLHPI n (%)	UMMC n (%)	HSNI n (%)	*p*-value
Paediatric 3-MinNS				
High under-nutrition risk	29 (26.4)	12 (15)	31 (33)	*<0.001
Low under-nutrition risk	81 (73.6)	68 (85)	63 (67)	
[a]**Weight-for-height**				
Severe acute malnutrition	1 (1.8)	3 (9.7)	7 (15.9)	*<0.001
Moderate/ Well nutrition	54 (98.2)	28 (90.3)	37 (84.1)	
Height-for-age				
Severe chronic malnutrition	7 (6.4)	3 (3.8)	9 (9.6)	*<0.001
Moderate/ Well nutrition	103 (93.6)	77 (96.2)	85 (90.4)	
BMI-for-age				
Severe thinness	7 (6.5)	10 (12.5)	12 (12.9)	*<0.001
Thinness/ Well nutrition	100 (93.5)	70 (87.5)	81 (87.1)	

*Significant difference between groups, $p<0.001$; [a] n= 130: the weight-for-height is used for children from 2 to 5 years; KLHPI: Kuala Lumpur Hospital Paediatrics Institute, UMMC: University Malaya Medical Centre, HSNI: Hospital Sultanah Nora Ismail, Paediatric 3-MinNS: 3-minute nutrition screening-paediatrics, BMI: Body mass index.

Table-2: Nutritional characteristics of participants at the study hospitals.

Characteristics	Low under-nutrition risk (<4) n (%)	High under-nutrition risk (≥4) n (%)	*p*-value
Gender			0.559
Male	129 (45.4)	41 (14.4)	
Female	83 (29.2)	31 (11)	
Age (year)			0.197
2 - 4	95 (33.5)	26 (9.2)	
5 - 12	117 (41.2)	46 (16.1)	
Weight-for-height (<-3SD)	9 (81.8)	2 (18.2)	0.728
Height-for-age (<-3SD)	12 (63.2)	7 (36.8)	0.274
BMI-for-age (<-3SD)	21 (72.4)	8 (27.6)	0.808

*Significant difference between groups, $p< 0.05$; SD: Standard deviation, BMI: Body mass index.

Table-3: Nutrition-associated indicators.

	n	KLHPI n (%)	UMMC n (%)	HSNI n (%)	*p*-value
Disease with nutrition risk	284				*<0.001
Yes		21 (19.1)	4 (5.0)	4 (4.3)	
Possible		22 (20.0)	17 (21.2)	16 (17.0)	
No		96 (58.2)	59 (73.8)	74 (78.7)	
Unintentional weight loss					*<0.001
2-5 years:	168				
>2kg		Nil	1 (1.1)	4 (4.3)	
≤2kg/ Yes, unsure		12 (10.9)	17 (14.9)	17 (14.9)	
Don't know/ No weight gain		26 (23.6)	11 (11.7)	11 (11.7)	
Normal weight gain		30 (27.3)	30 (31.9)	30 (31.90)	
6-12 years	116				
>3kg		3 (2.7)	Nil	Nil	
2-3kg/ Yes, unsure		7 (6.4)	3 (3.8)	2 (2.1)	
1-2kg/ Don't know		16 14.5)	6 (7.5)	7 (7.4)	
<1kg/ No		16 (14.5)	30 (37.5)	26 (27.7)	
Food intake	284				*<0.001
Refused/ < ¼ of usual diet		4 (3.7)	3 (3.8)	15 (16.0)	
¼ - ≤ ½ of usual diet		11 (10.0)	5 (6.2)	8 (8.5)	
½ - ≤ ¾ of usual diet		27 (24.5)	12 (15.0)	11 (11.7)	
¾ - 1 share of usual diet		68 (61.8)	60 (75.0)	60 (63.8)	
Ability to retain food	284				*<0.001
Vomiting/ watery stool >3x/day		7 (6.4)	3 (3.8)	12 (12.7)	
Vomiting/ watery stool 2-3x/day		7 (6.4)	2 (2.5)	8 (8.5)	
Vomiting/ watery stool 1-2x/day		15 (13.6)	14 (17.5)	12 (12.8)	
No vomiting/ watery stool		81 (73.6)	61 (76.2)	62 (66.0)	

*Significant difference between groups, $p < 0.001$; [a] 6-12 years: >6 to 12 years; [b] unintentional weight loss >2kg (2-6 years) or >3kg (6-12 years); KLHPI: Kuala Lumpur Hospital Paediatrics Institute, UMMC: University Malaya Medical Centre, HSNI: Hospital Sultanah Nora Ismail.

2-4 years (Table 2).

All nutrition-associated indicators, including disease with nutrition risk, unintentional weight loss, food intake for the preceding week, and ability to retain food were significantly ($p<0.001$) associated with the risk of undernutrition (Table 3). The highest proportion of participants who had nutrition risk was at KLHPI 21(19.1%). Only 8 (4.8%) participants overall had unintentional weight loss for both age groups. The highest proportion of participants who refused or took less than a quarter of the usual diet and who had vomiting or watery stool more than three times per day were reported at HSNI, with 15(16%) and 12(12.7%) participants, respectively. The distributions of nutritional characteristics among the 3 hospitals were significantly different ($p<0.05$).

Discussion

The current study reported that 25.4% hospitalised children had a high undernutrition risk on admission. A single-centre study in Malaysia, reported 57% risk using the Paediatric Nutrition Screening Tool (PNST).[16] Al-Waleedi et al. reported that 21% of sick children in Yemen had global acute malnutrition (GAM).[17] In Thailand, it was reported that 14.3% of hospitalised children had acute undernutrition, while 23.6% had chronic undernutrition on the basis of anthropometric measurements.[18] A study of 116 hospitalised children aged 1-15 years in Indonesia found the prevalence of malnutrition to be 28.4%.[19] A multi-centre study of 2,567 hospitalised children in 12 European countries reported that 23% of participants were at high risk of malnutrition, using various screening tools.[20] Baser et al., in a nationwide study involving 1513 inpatients at 37 hospitals in Turkey, reported that 3.4% to 40% children were at risk of undernutrition, using 2 different nutrition screening tools.[21]

In the current study, children with high undernutrition risk had a lower WFH, HFA and BMI z-scores, which was consistent with other reports.[22,23] The Malaysian National Health and Morbidity Survey (NHMS) 2019 reported that the prevalence of underweight (WFA <-2SD), stunting (HFA <-2SD) and wasting (BMI-for-age <-2SD) for children aged <5 years was 14.1%, 21.8% and 9.7%, respectively. For children aged 5-17 years, the corresponding values were 15.4%, 17.1% and 11.2%, respectively.[24] The current findings were consistent with the national data, and showed that Paediatric 3-MinNS was a quicker and simpler nutrition screening tool for identifying children at risk of undernutrition.

Wonoputri et al. reported that hospitalised children presenting with undernutrition were more among those with oncological, infectious and neurological disorders.[19] Hetch et al. found that >10% of the hospitalised children diagnosed with mental and behavioural disorders, gastrointestinal diseases and endocrine or metabolic diseases were wasted.[5] The current study included all hospitalised children from all wards to represent a broad range of non-selected population.

Unintentional weight loss prior to hospital admission, a weight of 20% under the reference body weight, underlying chronic diseases, diseases with nutrition risk, and nutritional intake changes are nutritional risk indicators, and should be given due attention.[25] The absence of weight gain is followed by weight loss and stunting over time. Siddiqui et al. reported that low BMI was related to unexpected re-admission and re-intervention after one year post-surgery for congenial heart disease.[26] Therefore, children's growth is important as a nutritional risk indicator.

White et al. indicated that decreased dietary intake was one of the major nutritional risk factors for hospitalised children.[27] J. Pérez Moreno et al. found that nearly 31% of the participants had a dietary intake <50% of their normal food intake by the third day of hospital admission.[28]

Factors, such as acute illness that increases energy requirements, disease-induced anorexia, more frequent episodes of fasting due to admission or investigation procedures, types of meals served in the hospital, and emotional stresses could contribute to the poor or low nutrition intakes of hospitalised children.

The WHO reported that diarrhoeal disease was the second biggest cause of death in children aged <5, especially those with malnutrition, which puts them at a higher risk of death from diarrhoea.[29] Hecht et al. found that a higher proportion of undernutrition children had diarrhoea (22% vs. 12%) and vomiting (26% vs. 14%) than the well-nourished children.[5] Vomiting and diarrhoea would worsen the imbalance between the nutrition requirements and intakes.[30] Hence, the finding that the ability to retain food was associated with undernutrition risk in the current study was consistent with literature.[5,29,30]

The strength of the current study is that it was conducted at a tertiary referral government hospital and a tertiary teaching hospital. Both were major referral centres for paediatric patients in Malaysia compared to a district government hospital that was also included. Participants were from a non-selected population, including low- and high-risk participants. Therefore, the findings can represent the nutritional characteristics and risk of hospitalised children in Malaysia. Another strength of the study is the use of Paediatric 3-MinNS, which considered the implication of underlying disease on nutrition risk. It was validated against clinical outcomes, like weight loss and LOS. However, the study did not include objective nutritional assessment as it aimed at evaluating the usefulness and reproducibility of the validated Paediatric 3-MinNS.

The current study also has its limitations. Weight changes during hospital admission were not available. The missing weight change data could have underestimated the nutritional status deterioration during hospitalisation. Furthermore, the scale administration was dependent on the assessors. Inconsistent or missing data, such as anthropometric measurements, might induce an error in the evaluation of undernutrition. Therefore, adequate training would be needed to maintain the optimal performance of the nutrition screening tool.

Conclusion

The Paediatric 3-MinNS scale was found to be effective as a nutrition screening tool for hospitalised children in Malaysia. It is suggested that all hospitals implement nutrition screening for paediatric patients on admission for early undernutrition risk identification and management of hospitalised patients at risk of undernutrition.

Disclaimer: The text was part of a poster presentation at the 41st European Society for Critical Nutrition and Metabolism (ESPEN) meeting held in Krakow, Poland, from August 31 to September 3, 2019.

Conflict of Interest: None.

Source of Funding: University of Malaya Postgraduate Research Fund (PG075-2015A).

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Author Contribution:
PSY: Design and conducted the research, analysed data, writing, final approval.
HAM: Design the research, revision, final approval.