International Journal Dental and Medical Sciences Research
Volume 6, Issue 1, Jan-Feb- 2024 pp 358-365 www.ijdmsrjournal.com ISSN: 2582-6018

Nutritional Screening in Children Hospitalized in a Tertiary Hospital

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Date of Submission: 25-01-2024 Date of Acceptance: 03-02-2024

ABSTRACT

Background: Children are particularly more susceptible to malnutrition compared to adults, as they have lower calorie reserves and higher calorie needs due to growth and development. For this reason, it is essential to identify nutritional risk as early as hospital admission, using nutritional screening tools.

Objective: This study aimed to perform a nutritional screening in children assisted by a pediatric service to determine the prevalence of high nutritional risk.

Methods: It was an observational, descriptive, cross-sectional cohort study carried out in a pediatric service of a tertiary hospital, with children aged from one month to 13 years 11 months, and 30 days, that were hospitalized for at least 24 hours. The analyzed variables were: gender, age, Body Mass Index (BMI), and STRONGKids Score.

Results: sample of 100 participants was obtained, with 52 (52%) being male and 48 (48%) female, age ranged from one month to 160 months (average: 61.8 months) and the length of stay ranged from one to 69 days (average: 8.16 days). There were 43 (43%) participants classified as Low Risk, 49 (49%) as Moderate Risk and eight (8%) as High Risk. The nutritional risk was correlated with subjective assessment of malnutrition, chronic disease, nutritional intake, weight loss, or poor weight gain ($p< 0.05$).

Conclusions: It is important to pay close attention to those children who present clinical signs of malnutrition, weight loss, or poor weight gain and also those who have a chronic disease before admission because they have a high risk of malnutrition during hospitalization.

KEY WORDS: Child; Malnutrition; Screening; Hospitalized; Nutritional.

I.INTRODUCTION

The World Health Organization (WHO) defines malnutrition as an imbalance between the body's supply and demand for nutrients and energy to ensure growth, maintenance, and specific functions[1]. Although malnutrition does not have the same proportions as in the past in Brazil[2], it is still a public health problem with a high prevalence, especially in children, and is more common in hospitalized children[3], resulting in longer hospital stays, higher complication rates, reduced quality of life[4,5], increased interventions and readmissions, susceptibility to infections,morbidity and mortality. Nutritional risk is defined by the current nutritional status and the risk of deterioration of this status due to the metabolic stress generated by the clinical condition[5]. For this reason, national and international societies recommend that nutritional risk should be identified as early as possible during hospitalization so that intervention can be made in those patients with increased nutritional risk[2,4,5,6].

Nutritional screening tools are commonly used to determine nutritional risk. Currently, the most widely used are: The Pediatric Nutritional Risk Score (PNRS), Screening Tool for the Assessment of Malnutrition in Pediatrics (STAMP), Pediatric Yorkhill Malnutrition Screening (PYMS), The Pediatric Digital Scaled Malnutrition Risk Screening Tool (PeDiSMART), Pediatric Malnutrition Screening Tool (PMST) and Screening Tool for Risk on Nutritional status and Growth (STRONGkids).

Of the instruments mentioned, STRONGkids considers the subjective clinical

assessment of malnutrition, high-risk disease, intake or losses in recent days, and insufficient weight loss or gain [2,7]. It is a tool that is easy to apply and understand and takes little time to apply, which is because it is recommended by the Brazilian Society of Pediatrics[2] and was chosen for this research.

This study aimed to screen for nutritional risk in children admitted to a pediatric ward using the STRONGKids questionnaire, determining the prevalence of children at high nutritional risk.

II.METHODS

This research was characterized as an observational, cross-sectional, descriptive study, carried out in a pediatric service of a tertiary hospital in the west of the state of Paraná, Brazil, from May 2022 to May 2023. The sample included subjects aged between 1 month and 13 years 11 months and 30 days, of both sexes, who were admitted to the emergency department and had been hospitalized for at least 24 hours.

Anthropometric assessment was carried out using weight, with subjects under two years of age naked and those over two years of age wearing only light clothing and barefoot, using Caumaq® anthropometric scales (2012, Porto Alegre-RS, Brazil) or Welmy® pediatric scales (2013, Santa Bárbara d'Oeste-SP, Brazil), and height, with children up to 24 months having their height measured in the supine position using an Avanutri® stadiometer (2021, Três Rios-RJ, Brazil) and those over 24 months having their height measured in the orthostatic position using an Avanutri® vertical stadiometer (2021, Três Rios-RJ, Brazil). Based on these data, the Body Mass Index (BMI) was calculated using the weight divided for height squared. BMI was classified into a Z score according to the BMI-for-age curves of the Brazilian Society of Pediatrics (2021)[8], according to gender, and separated into two groups: those under five years old and those over five years old. For statistical purposes, the age of the participants was documented in months.

After the parents or guardians signed the Free and Informed Consent form during hospitalization, and the Free and Informed Assent form was signed by children and adolescents over seven years of age, the STRONGKids questionnaire was applied. This tool was validated in 2009 in the Netherlands[6] and translated into Brazilian-Portuguese in 2013[9] and consists of four items with a maximum score of five points:

1. Subjective clinical assessment: whether the patient appears a poor nutritional status, with reduced subcutaneous fat and/or muscle mass and/or thin face - 1 point;
2. High-risk disease: anorexia nervosa, bronchopulmonary dysplasia, celiac disease, cystic fibrosis, prematurity (corrected age up to six months), chronic disease (cardiac, renal or hepatic), burns, cancer, HIV/AIDS, inflammatory bowel disease, trauma, pancreatitis, short bowel syndrome, cerebral palsy or neurological disease, muscular disease, metabolic disease, pre- or post-surgery of major surgery or others (classified by the doctor) - 2 points;
3. Nutritional intake or losses in recent days: the presence of diarrhea, vomiting, difficulty eating due to pain, previous nutritional intervention, or decreased food intake - 1 point;
4. Weight loss or insufficient gain in recent weeks or months - 1 point.

Questions answered with yes are scored, allowing the patient to be classified as High Risk (4 to 5 points), Medium Risk (1 to 3 points), and Low Risk (0 points)[2,6].

The data collected was then inserted into a Microsoft Excel table. The software Stata/SE v.14.1 StataCorp LP®, USA, 2021 was used for statistical analysis. The description of the quantitative variables considered the statistics of mean, median, minimum, and maximum values and standard deviation. The qualitative variables were summarized using frequencies and percentages. To assess the association between age and nutritional risk, the Analysis of Variance model with one source of variation was used. The non-parametric Kruskal-Wallis test was used to assess the association between length of stay and nutritional risk. The association between qualitative variables was assessed using Fisher's exact test. The Jarque-Béra test was used to assess the normality of the variables. A p-value of less than 0.05 indicated statistical significance. Due to the low number of subjects (n), for statistical purposes, nutritional risk, concerning the other variables, was grouped into low, medium, and high risk. Due to the large number of BMI classifications and the low number of subjects (n), when correlated with nutritional risk, the results were presented only descriptively and it was not possible to carry out statistical correlations.

Participants who required care in the Pediatric Intensive Care Unit during hospitalization, were transferred to other hospitals, were hospitalized for an elective surgical procedure, or refused to participate in the study were excluded from the study.

International Journal Dental and Medical Sciences Research
Volume 6, Issue 1, Jan-Feb- 2024 pp 358-365 www.ijdmsrjournal.com ISSN: 2582-6018

This study was approved by the Research Ethics Committee from Western Paraná State University under protocol number 5.325.460/2022.

III.RESULTS

A total of 123 questionnaires were administered, of which 23 were excluded, one due to death and the others because they met some of the exclusion criteria. The total sample was 100 participants, 52 (52%) male and 48 (48%) female. Age was assessed in months, ranging from one month to 160 months (average: 61.8 months). Because the BMI classification was different for those aged over and under five years old, the sample was divided into two groups: those aged under five accounted for 59 (59%) of the total, and those aged over five 41 (41%) of the total. The length of stay ranged from one to 69 days (average: 8.16 days). Regarding nutritional risk, 43 (43%) of the sample was classified as Low Risk, 49 (49%) as Moderate Risk, and eight (8%) as High Risk.

Table 1 shows the correlation between nutritional risk and the variables gender, subjective assessment of malnutrition, previous chronic illness, nutritional intake or losses in recent days, and weight loss, according to age (under five years old and over five). Table 2 also shows the correlation between nutritional risk and the variables studied but in the general population of the study.

Table 1 – Correlation between nutritional risk and analyzed variables (under 5 years old and older 5 years old).

	Under 5 years old				
Nutritional Risk	**Gender**				**p value**
	Male		**Female**		
	n	**%**	**n**	**%**	
Low or Moderate	24	85.7%	29	93.5%	
High	4	14.3%	2	6.5%	0.409
Total	28	100.0%	31	100.0%	
Nutritional Risk	**Subjective Assessment of Malnutrition**				
	No		**Yes**		
	n	**%**	**n**	**%**	
Low or Moderate	53	96.4%	0	0.0%	
High	2	3.6%	4	100.0%	< 0.001
Total	55	100.0%	4	100.0%	
Nutritional Risk	**Chronic Disease**				
	No		**Yes**		
	n	**%**	**n**	**%**	
Low or Moderate	48	100.0%	5	45.5%	
High	0	0.0%	6	54.5%	< 0.001
Total	48	100.0%	11	100.0%	
Nutritional Risk	**Nutritional Intake or Losses**				
	No		**Yes**		
	n	**%**	**n**	**%**	
Low or Moderate	32	94.1%	21	84.0%	
High	2	5.9%	4	16.0%	0.386
Total	34	100.0%	25	100.0%	
Nutritional Risk	**Weight Loss or Poor Weight Gain**				
	No		**Yes**		
	n	**%**	**n**	**%**	
Low or Moderate	49	100.0%	4	40.0%	
High	0	0.0%	6	60.0%	< 0.001
Total	49	100.0%	10	100.0%	
	Older 5 years old				
Nutritional Risk	**Gender**				
	Male		**Female**		
	n	**%**	**n**	**%**	

International Journal Dental and Medical Sciences Research
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Low or Moderate	22	91.7%	17	100.0%	
High	2	8.3%	0	0.0%	0.502
Total	24	100.0%	17	100.0%	
Nutritional Risk	**Subjective Assessment of Malnutrition**				
	No		**Yes**		
	n	**%**	**n**	**%**	
Low or Moderate	39	97.5%	0	0.0%	
High	1	2.5%	1	100.0%	0.049
Total	40	100.0%	1	100.0%	
Nutritional Risk	**Chronic Disease**				
	No		**Yes**		
	n	**%**	**n**	**%**	
Low or Moderate	31	100.0%	8	80.0%	
High	0	0.0%	2	20.0%	0.055
Total	31	100.0%	10	100.0%	
Nutritional Risk	**Nutritional Intake or Losses**				
	No		**Yes**		
	n	**%**	**n**	**%**	
Low or Moderate	18	100.0%	21	91.3%	
High	0	0.0%	2	8.7%	0.495
Total	18	100.0%	23	100.0%	
Nutritional Risk	**Weight Loss or Poor Weight Gain**				
	No		**Yes**		
	n	**%**	**n**	**%**	
Low or Moderate	38	100.0%	1	33.3%	
High	0	0.0%	2	66.7%	0.004
Total	38	100.0%	3	100.0%	

Table 2 – Correlation between nutritional risk and researched variables in general population.

Nutritional Risk	**Gender**				**p value**
	Male		**Female**		
	n	**%**	**n**	**%**	
Low or Moderate	46	88.5%	46	95.8%	
High	6	11.5%	2	4.2%	0.272
Total	52	100.0%	48	100.0%	
Nutritional Risk	**Subjective Assessment of Malnutrition**				
	No		**Yes**		
	n	**%**	**n**	**%**	
Low or Moderate	92	96.8%	0	0.0%	
High	3	3.2%	5	100.0%	< 0.001
Total	95	100.0%	5	100.0%	
Nutritional Risk	**Chronic Disease**				
	No		**Yes**		
	n	**%**	**n**	**%**	

International Journal Dental and Medical Sciences Research
Volume 6, Issue 1, Jan-Feb- 2024 pp 358-365 www.ijdmsrjournal.com ISSN: 2582-6018

Low or Moderate	79	100.0%	13	61.9%	
High	0	0.0%	8	38.1%	< 0.001
Total	79	100.0%	21	100.0%	
Nutritional Risk	**Nutritional Intake or Losses**				
	No		**Yes**		
	n	**%**	**n**	**%**	
Low or Moderate	50	96.2%	42	87.5%	
High	2	3.8%	6	12.5%	0.149
Total	52	100.0%	48	100.0%	
Nutritional Risk	**Weight Loss or Poor Weight Gain**				
	No		**Yes**		
	n	**%**	**n**	**%**	
Low or Moderate	87	100.0%	5	38.5%	
High	0	0.0%	8	61.5%	< 0.001
Total	87	100.0%	13	100.0%	

Nutritional risk was also correlated with the age of the population studied. Among those classified as Low Risk, the minimum age was one month and the maximum 156 months (average: 55.7 months, median: 50). Among those classified as Medium Risk, the minimum age was two months and the maximum 160 months (average: 71.2 months, median: 64 months). Finally, among those classified as High Nutritional Risk, the minimum age was one month and the maximum 104 months (average: 40.1 months, median: 33.5 months). The p-value was 0.121 and there was no significance between nutritional risk and age.

Table 3 shows the BMI Z-score classification associated with nutritional risk according to age. Concerning high-risk diseases, 22 (22%) participants had them previously and may have had more than one. There was a higher prevalence of metabolic disease, in six (27.3%) subjects, followed by five (22.7%) with chronic disease (heart, kidney, or liver) and five (22.7%) with cerebral palsy or metabolic disease. There were also two (9.1%) participants in the sample who were premature, two (9.1%) with pancreatitis, and one (4.5%) child with cancer. Three (13.6%) participants had another high-risk disease classified by the evaluator.

Table 3 – Number and Percentage of subjects according of age, nutritional risk and BMI.

	Under 5 years old						
Z Score	**Nutritional Risk**						**Total**
	Low		**Moderate**		**High**		
	n	**%**	**n**	**%**	**n**	**%**	
Severely Wasted	1	20.0%	0	0.0%	4	80.0%	5
Wasted	3	100.0%	0	0.0%	0	0.0%	3
Normal	19	57.6%	12	36.4%	2	6.1%	33
Overweight Risk	5	62.5%	3	37.5%	0	0.0%	8
Overweight	1	11.1%	8	88.9%	0	0.0%	9
Obesity	0	0.0%	1	100.0%	0	0.0%	1
	Over 5 years old						
Z Score	**Nutritional Risk**						**Total**
	Low		**Moderate**		**High**		
	n	**%**	**n**	**%**	**n**	**%**	

International Journal Dental and Medical Sciences Research
Volume 6, Issue 1, Jan-Feb- 2024 pp 358-365 www.ijdmsrjournal.com ISSN: 2582-6018

Severely Wasted	0	0.0%	1	100.0%	0	0.0%	1
Wasted	1	25.0%	3	75.0%	0	0.0%	4
Normal	9	45.0%	10	50.0%	1	5.0%	20
Overweight	2	28.6%	5	71.4%	0	0.0%	7
Obesity	1	16.7%	4	66.7%	1	16.7%	6
Severely Obesity	1	33.3%	2	66.7%	0	0.0%	3

When correlating length of stay and nutritional risk for the 43 (43%) participants classified as Low Risk, it was found that the minimum length of stay was one day and the maximum was 35 days (average: 6.86 days, median: six days). Among the 49 (49%) children classified as Medium Risk, the minimum length of stay was one day and the maximum 69 days (average: 8.9 days, median: seven days). In the eight (8%) children classified as High Risk, the minimum length of stay was three days and the maximum was 35 days (average: 10.63 days, median: 6.5 days). The p-value was 0.538, and there was no statistical significance between length of stay and nutritional risk.

IV.DISCUSSION

Malnutrition is associated with longer hospital stays, multiple interventions, readmission, increased susceptibility to infections, and morbidity and mortality[5]. Children are particularly more susceptible to malnutrition compared to adults, as they have lower calorie reserves and higher calorie needs due to growth and development[7]. For this reason, it is essential to identify nutritional risk as early as hospital admission[6], using nutritional screening tools.

In this study, most of the patients admitted were at moderate or high nutritional risk, as found in other national and foreign studies[4,10,11]. In addition, the child's nutritional status on admission to a hospital unit is also related to nutritional risk, since patients with previous signs of acute or chronic malnutrition are at greater nutritional risk[5]. In this case, loss of muscle mass, when evidenced in the patient's initial assessment, is correlated with a higher risk of malnutrition[3]. In a hospital in Korea, for example, the malnutrition rate on admission varied between 17.3% and 20.2%[11]. In this study, the subjective assessment of malnutrition was correlated with nutritional risk, both in children under and over 5 years of age; however, the percentage of the population assessed as malnourished was lower than in previous studies[6].

Another factor related to higher nutritional risk is the presence of a chronic disease before hospitalization. In a hospital in Thailand, three-quarters of the children admitted had a previous chronic illness, which had a higher proportion classified as medium and high nutritional risk, as found in this study and another Brazilian study [11,13].

Weight loss or insufficient weight gain before and during hospitalization is also assessed by the tool used in this study. In the population investigated, the result was similar to that found in a Dutch hospital[6] and another in Korea[12], but lower than that identified in a Brazilian study of children with congenital heart disease admitted for surgical repair[14].

Finally, studies carried out in Brazil[11,15], Thailand[13], Iran[16], Turkey[17], and Egypt[18] showed that malnourished patients or those at high nutritional risk had a longer hospital stay, but in the population studied in this study, this relationship was not found.

This study had some limitations: the research period lasted only 12 months, which may have contributed to the reduced number of participants; some hospitalized subjects did not want to participate in the research; some children were transferred to other sectors or hospitals, which hindered their follow-up; and, finally, some subjects had conditions that made it impossible to perform their measurements.

V.CONCLUSION

The Screening Tool for Risk on Nutritional Status and Growth (STRONGkids) is a simple and easy-to-apply tool, making it an efficient strategy for identifying children at high nutritional risk and, consequently, for early intervention. There was a relationship between the subjective assessment of malnutrition, chronic illness, weight loss, and nutritional risk, showing that it is essential to pay close attention, especially to those children who, on admission, show clinical signs of malnutrition, weight loss, or insufficient gain, as well as having a pre-existing chronic illness.

Disclosure Statement: the authors declare no conflicts of interest.
Funding: The authors declare no funding source to this research.

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