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Assessment of Nutritional Status of Hospitalized Children:A Comparison of STRONGkids and Anthropometry

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Abstract

Introduction Malnutrition is defined as an imbalance between requirements and intake of energy and/or nutrients that affect the growth—physical and cognitive functions. It is a major public health problem worldwide especially in children under five years. It includes under-nutrition either stunting, wasting, or micronutrient deficiencies and overweight or obesity. Several nutritional screening tools had been designed to detect nutritional risk of hospitalized children at an early stage. There are six tools, however, there is no consensus on which is the best tool to be used. In clinical practice, the most frequently used screening tools are: Screening of Risk for Nutritional Status and Growth (STRONGkids) and the Subjective Global Assessment of Nutritional Status (SGA). The study aimed to assess the nutritional status of hospitalized children at the time of admission and to evaluate the usefulness of STRONGkids.

Patients and Methods A cross sectional study was conducted in Benghazi Medical Center (BMC), from July 2020 to November 2020. A total of 116 under five children admitted to the hospital were included in the study.

Result and Discussion The study showed that 53.45% of children were males and 46.55% were females and showed that by using STRONGkids score, 42.2% of children were at low risk of malnutrition, 50.0% at medium risk, and 7.8% at high risk. There was an accordance between result of STRONGkids and weight for age, $p = 0.000$, similarly for height for age and weight for height.

conclusion The STRONGkids screening tool could be used as an initial screening tool for children on admission to provide the right intervention at the right time.

Keywords
- STRONGKids
- malnutrition
- stunting
- wasting
- under-five
- anthropometry

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Introduction

Malnutrition is a major public health problem worldwide especially in developing countries with a great impact on children under five.[1]

World Health Organization (WHO) define malnutrition as an imbalance between requirements and intake of energy and/or nutrients that affect the growth—physical and cognitive functions. Malnutrition includes under-nutrition, either stunting (low height for age [HFA]) or wasting (low weight for height [WFH]), micronutrient deficiencies and overweight or obesity.[1,2] Globally, pediatric under-nutrition contributes to 45% of all children's deaths [3] with an estimated 159 million of under-five children stunted and 50 million wasted worldwide.[1]

In hospitalized children under-nutrition is linked to a prolonged hospitalization, delayed recovery, unfavorable clinical outcome and in general it is associated with increase in morbidity and mortality, thus affecting patients with a great financial burden on the health care system.[4] Despite that, malnutrition is common in hospitalized children. It is frequently unrecognized by pediatric hospitals' staff who are focusing on the primary disease and paying less attention to the nutritional status. Most of the patients were admitted and discharged from the hospital without any assessment of nutritional status. Therefore it is important to identify and detect children with nutritional risk early to allow pediatricians to intervene early and to prevent further deterioration of nutritional condition.

In the current practice Anthropometric measurements and interpretation enable the hospital staff to identify patients with malnutrition at admission. Recently several screening and nutritional assessment tools had been designed to detect nutritional risk of hospitalized children at an early stage. Currently, for hospitalized children and adolescents there are six tools, however, there is no consensus on which is the best tool to be used.[5–7] In clinical practice, the most frequently used screening tools are: Screening of Risk for Nutritional Status and Growth (STRONGkids) and the Subjective Global Assessment of Nutritional Status (SGA).[5,7]

We have therefore conducted this study to assess the nutritional status of hospitalized children at the time of admission and to evaluate the usefulness of STRONGkids in the setting of Benghazi, Libya.

Patients and Methods

A cross sectional study was conducted in Benghazi Medical Center (BMC), which is a referral and tertiary teaching hospital in Benghazi, Libya. The period of study was from July 2020 to November 2020. All children admitted to the general pediatric ward were enrolled in the study.

All children admitted older than 1 month and younger than 60 months (5 years) of age were included in the study. Children younger than 1 month and older than 60 months and patients admitted to intensive care unit were excluded from the study. Syndromic children and children with neurological disability whose WHO software is not applicable and precise height measure couldn't be obtained, were also excluded.

Demographic data such as sex, age (date of birth), and diagnosis at admission were collected from the hospital records and screening tool STRONGkids was applied for all enrolled patients. The anthropometric data including body weight, body length/ height, weight for length/height, and mid-arm circumference were taken of all children upon admission.

STRONGKids Tool

The STRONGkids is considered to be a fast, practical, and easy to apply for nutritional risk screening tool of hospitalized children, developed according to the European Society for Parenteral and Enteral Nutrition (ESPEN) guidelines.

It consists of the scores of four items: 1—presence of a disease with high risk of malnutrition; 2—subjective clinical evaluation; 3—reduced food intake and presence of vomiting or diarrhea during the last 1 to 3 days and 4—recent weight loss. Depending on the total score obtained, the nutritional risk of malnutrition is classified to: i—low nutritional risk, (the score is zero), ii—moderate nutritional risk (the score is 1 to 3), iii—high nutritional risk (the score is 4 to 5).[8–10]

Anthropometric Measurements

All anthropometric measurements were taken by main investigators. Height was measured to nearest 0.1 cm with a stadiometer (Seca700 mechanical column scales with eye-level beam) with a fixed vertical backboard and an adjustable headboard with children standing bare foot while, recumbent length was measured for all children aged less than 24 months by a portable foldable infantometer (Seca 417) with a fixed head piece, horizontal backboard, and an adjustable foot piece.

Patients who weighed less than 10 kg, were measured by digital scale (Digital baby scale Seca 334) in a supine position, while, patients who weighed more than 10 kg were measured by scales (Seca 700 mechanical scale) in a standing position with the patients wearing clean diaper or light cloths, respectively.[11]

Nutritional Status Assessment

According to WHO, Global Database on Child Growth and Malnutrition which uses a *Z*-score cutoff point for all anthropometric measurements [weight for age [WFA], height/length for age, and WFH/length for age]. Children were classified into normal nutritional status when *Z*-score was between (−2 and 2) standard deviation (SD), moderate malnourished with *Z*-score less than −2 SD, or severe with *Z*-score less than −3 SD.[12] *Z*-score of WFH, HFA, WFA. According to WHO classification of malnutrition; children were classified as;

1. Wasting or acute malnutrition if they had low weight-for-height/length.

2. Stunting or chronic malnutrition if they had low height/length-for-age.
3. Underweight or wasting and stunting combined if they had a low weight-for-age.[12–14]

Statistical Analysis

Statistical package for social science was used for data entry and analysis. Continuous variables were transformed to categorical variables. Descriptive statistics in the form of percentage was applied and analytical statistics was used for comparison between age, gender, and weight, WFH and STRONGkids categories. Chi-square was applied and result was considered statistically significant if p-value <0.05.

Results

►**Fig. 1A**, demonstrates that children aged between 13 and 48 months of age were mostly male (31.90%). Male children aged more than 48 months represent 7.76% and female represent 10.34%.

Male children with normal weight represent the highest proportion (41.38%) and females with 35.34%. Regarding children who are underweight, females have higher proportion compared with males (10.34 vs. 8.62%) as shown in ►**Fig. 1B**.

►**Table 1** illustrates that 83.6% of cases were normal stature, 8.6% with severe stunting, and 6.9% were with moderate stunting. Regarding WFH, 78.5% of children were well nourished, 10.3% had moderate wasting, and 6.9% had severe wasting. Concerning STRONGkids categories, half of the cases have medium risk of malnutrition, 7.8% of cases have high risk of malnutrition, and 42.2% of cases have low risk of malnutrition.

►**Table 2**, shows that there is a relationship between scores of STRONGkids and WFA. All children diagnosed as high risk according to STRONGkids and similarly are classified as underweight. Therefore, there is an agreement between result of STRONGkids and WFA, $p=0.000$.

Table 1 Distribution of children according to height, weight for height, and STRONGkids categories

Categories of height No = 116	Frequency (%)
Normal stature	978 (3.6)
Sever stunting	10 (8.6)
Moderate stunting	8 (6.9)
Tall stature	1(0.9)
Categories of weight for height	
Well nourished	90 (77.6)
Moderate wasting	12 (10.3
Sever wasting	8 (6.9)
Over weight	6 (5.2)
Categories of STRONGkids	
Low risk	49 (42.2)
Medium risk	58 (50.0)
High risk	9 (7.8)

Regarding the relationship between STRONGkids and height for age, children with moderate and severe stunting were diagnosed as high risk of malnutrition (33.3 and 44.4%, respectively). This difference was statistically significant at $p=0.000$ (►**Table 3**).

►**Table 4** illustrates that 33.3 and 55.6% of children were diagnosed as moderate and sever wasting, respectively and have high risk of malnutrition according to STRONGkids .This result was statistically significant at $p=0.000$.

Discussion

In our study, the STONGkids score showed significant association with the anthropometric parameter analyzed (WFA, height/length for age, and WFH).

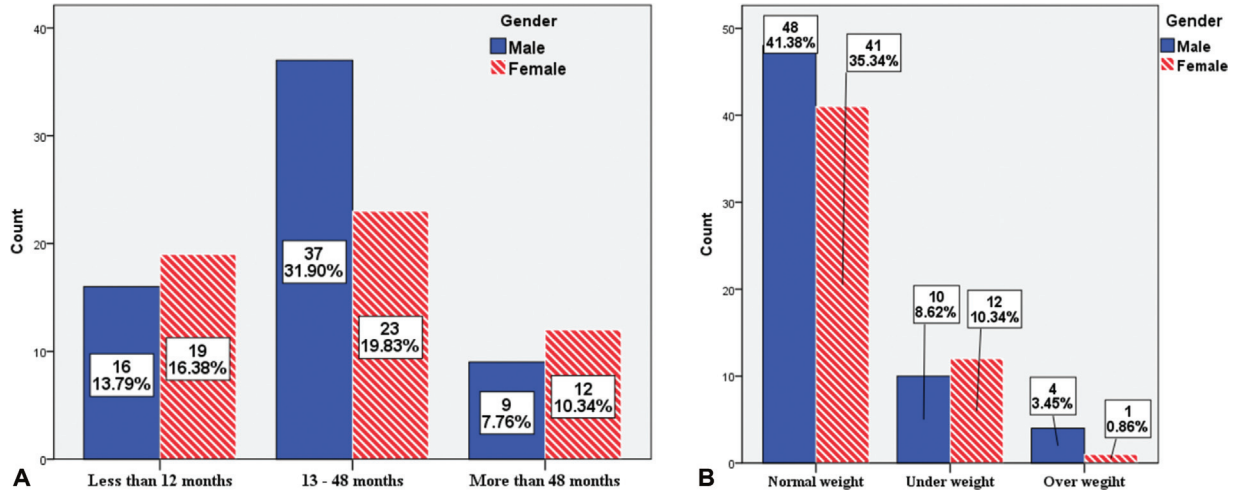

Fig. 1 (**A**) *Relationship between age and sex of studied children.* A comparison of STRONGkids and anthropometry. (**B**) *Relationship between weight and sex of studied children.*

Table 2 Relationship between weight for age and STRONGkids scores

Weight for age categories	Categories of STRONGkids					
	Low risk		Medium risk		High risk	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Normal weight	46	93.9	43	74.1	0	0%
Under weight	1	2.0	12	20.7	9	100.0
Over weight	2	4.1	3	5.2	0	0
Total	49	100.0	58	100.0	9	100.0

Note: $p = 0.000$.

Table 3 Relationship between height for age and STRONGkids scores

Height for age categories	Categories of STRONGkids					
	Low risk		Medium risk		High risk	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Normal height	48	98.0	47	81	2	22.3
Moderated stunted	1	2	4	6.9	3	33.3
Sever stunted	0	0	6	10.3	4	44.4
Tall stature	0	0	1	1.7	0	0
Total	49	100.0	58	100.0	9	100.0

Note: $p = 0.000$.

Table 4 Relationship between weight for height and STRONGkids scores

Weight for height category	Categories of STRONGkids					
	Low risk		Medium risk		High risk	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Well nourished	43	87.8	46	79.3	1	11.1
Moderate wasting	3	6.1	6	10.3	3	33.3
Severe wasting	0	0	3	5.2	5	55.6
Over weight	3	6.1	3	5.2	0	0
Total	49	100.0	58	100.0	9	100.0

Note: $p = 0.000$.

The present study showed that by using STRONGkids score, it was observer that 42.2% of the patients had low risk of malnutrition, 50.0% had medium risk, and 7.8% had high risk of malnutrition. Similarly Ling et al[10] studied a group 43 children admitted to the Children's Hospital, Oxford to screen for malnutrition. Screening Tool for the Assessment of Malnutrition in Pediatrics (STAMP) and STRONGkids scores were applied for all patients. The authors reported that 49% of the studied patients had medium risk of malnutrition and there was a correlation between STRONGkids and all anthropometric measures.

In agreement with our results, Spagnuolo et al[15] performed a prospective observational multicenter study in 12 hospitals in Italy, 2012 including 144 Italian children aged from 1 to 18 years of age. The study showed that 53% of the studied children had moderate risk of malnutrition. Additionally there was a significant but weak correlation existed between STRONGkids and anthropometric measurments.[15]

Huysentruyt et al studied 368 children (105 hospitalized in a tertiary and 263 in three secondary hospitals). Their age ranged between 0.08 and 16.95 years. The SRONGkids tool was applied and it was revealed that 47.3% were scored at low risk, 45.1% at the moderate risk, and 7.6% of children were at high nutritional risk. There was a good correlation with weight-for-height *Z*-score, but not with the height- for-age *Z*-score.[16]

Matak et al performed a study among 124 children admitted to a University Hospital in Zagreb to estimate the nutritional status and risk of malnutrition by using STRONGkids score and anthropometric measurements. They found out that children with low risk score represented 24.2%, 64.5% at moderate risk, and 11.3% children were at high nutritional risk. They concluded that there was no

correlation between HFA *Z*-scores and STRONGkids risk categories were present.[17]

Although de Oliveira et al reported in their study which included 71 children aged 1 month to 17 years that 5.6% of the studied children had high nutritional risk, 63.4% had moderate nutritional risk, and 31.0% had low nutritional risk, there was no significant association between this tool and anthropometric data.[18]

The limitation of the study is the small sample size and according to our aim we included children less than 5 years as malnutrition is more prevalent in this age group. AS other studies included elder age group, we planned to extend our study to include older age group as well.

Conclusions

The present study illustrated that half of the studied children had moderate risk of malnutrition, 42.2% had low risk, and 7.8% had severe risk of malnutrition. Thus the STRONGkids screening tool could be used as an initial screening tool for children on admission to the hospital to find out children at risk of malnutrition and to provide them the right intervention at the right time.

Authors' Contribution

All the authors contributed substantially to the planning and conduct of the study and to the drafting and finalization of the manuscript.

Compliance with Ethical Principles

None.

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None.

Conflict of interest

None declared.

Reference

1 World health organization (WHO). Malnutrition; 2019. Accessed December 2020 at: https://www.who.int/news-room/q-a-detail/malnutrition
2 Shashi X, Bishroj I. Weight measurement of primary school rural community of Faizabad. In Pract 1990;109(06):461
3 World Health Organization. 10 facts on child health. Children: reducing mortality. Fact sheet No. 178. Updated September 2013. Accessed November 2020 at: http://www.who.int/mediacentre/factsheets/fs178/en/
4 McCarthy A, Delvin E, Marcil V, et al. Prevalence of malnutrition in pediatric hospitals in developed and in-transition countries: the impact of hospital practices. Nutrients 2019;11(02):236
5 Hulst JM, Zwart H, Hop WC, Joosten KF. Dutch national survey to test the STRONGkids nutritional risk screening tool in hospitalized children. Clin Nutr 2010;29(01):106–111
6 Moeeni V, Walls T, Day AS. The STRONGkids nutritional risk screening tool can be used by paediatric nurses to identify hospitalised children at risk. Acta Paediatr 2014;103(12): e528–e531
7 Joosten KF, Hulst JM. Nutritional screening tools for hospitalized children: methodological considerations. Clin Nutr 2014;33(01): 1–5
8 Moeeni V, Day AS. Nutritional risk screening tools in hospitalised children. Int J Child Health Nutr 2012;1:39–43
9 Kondrup J, Allison SP, Elia M, Vellas B, Plauth MEducational and Clinical Practice Committee, European Society of Parenteral and Enteral Nutrition (ESPEN) ESPEN guidelines for nutrition screening 2002. Clin Nutr 2003;22(04):415–421
10 Ling RE, Hedges V, Sullivan PB. Nutritional risk in hospitalised children: Na assessment of two instruments. E Spen Eur E J Clin Nutr Metab 2011;6(03):153–157
11 Centers of Disease Control and Prevention. Accessed August 2014 at: http://www.cdc.gov/nchs/datanhanes_09_10/bodymeasures_09.pdf
12 WHO Multicentre Growth Reference Study Group. WHO Child Growth Standards based on length/height, weight and age. Acta Paediatr Suppl 2006;450:76–85
13 de Onis M, Blössner M. The world health organization global database on child growth and malnutrition: methodology and applications. Int J Epidemiol 2003;32(04):518–526
14 Physical status: the use and interpretation of anthropometry. Report of a WHO Expert Committee. WHO Technical Report Series No. 854. Geneva: World Health Organization; 1995. Accessed January 09, 2019 at: https://www.who.int/childgrowth/publications/physical_status/en/
15 Spagnuolo MI, Liguoro I, Chiatto F, Mambretti D, Guarino A. Application of a score system to evaluate the risk of malnutrition in a multiple hospital setting. Ital J Pediatr 2013;39:81
16 Huysentruyt K, Alliet P, Muyshont L, et al. The STRONG(kids) nutritional screening tool in hospitalized children: a validation study. Nutrition 2013;29(11-12):1356–1361
17 Matak Z, Tjesic-Drinkovic D, Omerza L, Senecic-Cala I, Vukovic J, Tjesic-Drinkovic D. Detecting undernutrition on hospital admission - screening tool versus WHO criteria. Clin Med Res 2017;6 (03):74–79
18 Oliveira TC, Albuquerque IZ, Stringhini MLF, Mortoza AS, Morais BA. The nutritional status of hospitalized children and adolescents: a comparison between two nutritional assessment tools with anthropometric parameters. Rev Paul Pediatr 2017;35(03): 273–280

