ORIGINAL

Validation of a Pediatric Nutrition Screening Tool in Hospital Outpatients of Myanmar

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ABSTRACT *Background:* Nutrition screening is important in identifying children at risk of developing malnutrition. No pediatric nutrition screening tool is previously applied or validated in Myanmar. Objective*:* This study aimed to validate Screening of Risk for Nutritional Status and Growth (STRONGkids) tool and to analyze the association of nutrition status with the clinical characteristics of Myanmar pediatric outpatients. *Method:* The STRONGkids screening score was calculated and the nutrition risk from the tool was compared with the WHO growth standards determined by weight and height related z-scores. The nutrition status of the participants and its association with clinical factors were also investigated. *Results:* A total of 120 children (60 boys, 50%), aged between 1 and 12-year-old, were included. The screening tool identified 58.3% of children as nutritionally-at-risk. It had 90.9% sensitivity and 45% specificity to detect thinness, and 81% sensitivity and 46.5% specificity for stunting. The nutrition risk from the screening was also significantly associated with the weight, height, and BMI-related WHO z-scores ($p < 0.05$). Overall, 26.6% of our study children had thinness and/or stunting, and > 5-year old children had significantly reduced weight status compared to the younger age group. *Conclusion:* This study suggested that the STRONGkids screening tool is a sensitive and valid tool that can be used for early detection of malnutrition in Myanmar pediatric outpatients. The effectiveness of nutrition intervention following screening should be further investigated.

Keywords: Malnutrition; Pediatric; Nutrition Screening Tool; Myanmar; Anthropometry

INTRODUCTION

Childhood malnutrition is considered as a global health concern since it is associated with poor growth and development, as well as reduced educational outcomes of children and can have negative impacts on their adulthood (1). The 2018 global malnutrition report estimated that the prevalence of under-five malnutrition in the form of wasting was around 49 million, and stunting was around 149 million (2). Undernutrition is not only a consequence of prolonged starvation or food insecurity but also diseases, injuries or illness. Children with chronic diseases and hospitalized children have a greater risk of malnutrition since they have increased energy demand from the diseases, and reduced nutrient intakes and absorption from underlying conditions, medications and, or, inadequate nutritional support during the treatment (3). On the other hand, malnourished children have an increased risk of infections, poor healing and disease-associated complications, which can increase their morbidity and mortality (3, 4). Therefore, early identification of nutritional risk in children is essential in order to prevent from severe malnutrition and its complications (5, 6). International organizations such as the American Society for Parenteral and Enteral Nutrition (ASPEN) and the European Society of Pediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN), thus, recommend the early detection of malnutrition risk by screening (7). Several nutrition screening and assessment tools have recently been developed, but the agreement regarding the best screening tool has not reached yet (3, 8). Although nutritional screening tools are developed with pre-specified nutritional intervention plan, the successful implementation of this plan during hospitalization is limited for some patients due to decreased length of hospital stays. In contrast, if a screening tool can be applicable to the outpatient setting, followed by detailed nutritional assessment, the optimal benefit from timely nutrition intervention can be achieved. Almost all of the previous screening tools were developed for hospitalized children and the applicability of these tools in outpatient population is still needed to be investigated.

In the outpatient setting of Myanmar hospitals, although physicians could recognize the children who are already malnourished, the lack of a validated screening tool makes it difficult to diagnose the children who are at risk of malnutrition. In addition, a detailed nutritional assessment cannot be performed in every pediatric outpatient since it is a time-consuming process which required skills and knowledge in

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nutrition. Therefore, there is a probability of missing children who were at-risk to be malnourished and did not receive timely nutritional treatment. The application of nutritional screening tool in outpatient clinic can detect the children at risk at an early point, and can prevent from consequences of malnutrition. For the practical application in outpatient clinical practice, a malnutrition screening tool should be quick, simple, reliable and easy to understand. Therefore, our study aimed to validate the Screening of Risk for Nutritional Status and Growth (STRONGkids) tool which has been reported as an easy-to-use and rapid screening tool (6, 9), and furthermore, to evaluate the factors associated with nutrition status in Myanmar pediatric outpatients.

METHODS

This cross-sectional study was conducted during February to April 2019 in pediatric outpatient department of Parami General Hospital, which is a private medical center located in Yangon, and providing health care services especially for the children. The study was approved by Mahidol University Central Institutional Review Board (MU-CIRB 2019/029.1102).

Validation of nutrition screening tool

In order to validate a screening tool, the nutrition status based on WHO anthropometric indicators: weight-for-age (WFA), weight-for-height (WFH), height-for-age (HFA) and BMI- for-age were chosen as a trusted criterion standard. Malnutrition as defined by World Health Organization is the presence of either wasting (WFH z-score <-2SD or BMI-for-age z-score < -2 SD), stunting (HFA z-score < -2 SD) or underweight (WFA z-score < -2 SD) (10). The patients with each of these anthropometric z-score of < -2SD were considered as malnourished, and ≥-2 SD were considered as well-nourished.

Subject selection and data collection

The pediatric outpatients who aged 1 years or older and whose parents agreed to participated in the study were included in the study. Critically ill children, and the children with inability to perform anthropometric measurements were excluded. All of the subjects were recruited by convenient sampling, and data collection was initiated after getting the informed consent from the parents. The application of screening tool and anthropometric assessment were performed on the same day by two different researchers.

Anthropometry

The weight measurement was done with the children on light clothes and recorded to the nearest 10 g, on the electronic scale accurate to at least 100g (11). Height was recorded to the nearest 0.1 cm, and supine length was measured for children under 2years of age. Mid-upper Arm Circumference (MUAC) was measured in children younger than 5 years old, by using the measuring tape in the left upper arm of the child, at the mid-point between olecranon process and acromion. The anthropometric measurements were classified as z-scores corresponding to age and sex according to WHO growth reference, and these were calculated by using the WHO Anthro version 3.2.2 and WHO Anthro Plus software (12).

Nutrition Screening

The caregivers or older children in the study were interviewed with the questions in the STRONGkids nutrition screening tool (9) which includes 1) the presence of illness with nutrition risk or plan for surgery, 2) physical appearance by subjective clinical assessment, 3) indicators of reduced intake such as gastrointestinal symptoms, pain, reduced food intake, nutritional intervention and presence of pain, and 4) weight history. The scoring of 1 point was given to any positive answer the questions except the presence of underlying disease and given with the weighted score of 2 points. Therefore, the total score for all positive response is 5 points and the children were categorized into three groups; high risk (total score ≥ 4), moderate risk (total score = 1 to 3), and low risk (total score = 0).

Dietary evaluation

A single 24-hour dietary recall of the children during their illness was taken from the caregivers or older children to estimate the approximate energy intake. The energy intake of the children was compared with the age-specific recommended dietary allowance per day for Southeast Asia (13), in order to decide whether they had an adequate caloric intake (≥ 75% of RDA) or inadequate caloric intake (< 75% of RDA) during illness (14).

Statistical analysis

Descriptive statistics were used for presenting patient characteristics, anthropometric data and other categorical variables. Based on the weight and height related z-scores and the cut-off point of -2 SD for malnutrition, the sensitivity, specificity, positive predictive value and negative predictive value of the nutrition screening tool was determined. In the contingency table, medium and high-risk categories from the tool were combined as ″at-risk″ category, and the low-risk was considered as ″not-at risk″ category in order to calculate these diagnostic values of the tool. The chi-square method, or exact Fisher′s test when appropriate, was applied to determine the presence of a significant association between dichotomous variables such as nutritional risk (at-risk and not-at-risk), age (< 5 years and ≥ 5 years), gender (male, female) and caloric intake (adequate, inadequate) and disease status (acute and chronic) with the nutritional status by WHO z-scores (well-nourished and malnourished). The agreement of the screening tool with anthropometry was decided by calculating Cohen κ statistics, with 95% confidence intervals, and interpreted using value scores by Landis and Koch (15). The sample size for the validation was calculated by expecting the Cohen′s kappa coefficient κ value would be at least 0.4, which was considered to be appropriate based on previous report (15). With the significance level of 5%, power of 90% with two tails, the minimum sample of 62 is required for kappa at 2×2 category, according to sample size calculation guideline using Cohen′s kappa value by Bujang et. al (16). However, in order to avoid the possibility of incomplete data, we accounted a doubled sample size (16). All the statistical calculations were done by using computer software, IBM SPSS Statistics version 22.0 (IBM Corp. Armonk, NY, USA). The p value <0.05 was considered statistically significant.

RESULTS

Among the families approached in the outpatient department during the study period, there were 120 eligible pediatric outpatients (50% males) who completed both anthropometric assessment and nutrition screening tool. The median age of the patients was 3.3 years (range between 1 to 10 years). There were 85 children (70.8%) who aged below 5 years old, and 35 children (29.2%) aged 5 years or older. Majority of the children (84.2%) were presented with acute illness including seasonal flu and viral or bacterial infections of respiratory tract, urinary tract or skin, gastroenteritis and others. Only 15.8% of the patients had chronic disease conditions such as congenital heart disease, tuberculosis and chronic respiratory diseases. According to the 24-hr dietary recall of the children, we found that there were 26 children who had inadequate caloric intake (< 75% of the recommended daily allowance) during their illness (Table 1). Moreover, it was also observed that more than half (55%) of this outpatient population were currently taking multivitamin supplements.

Prevalence of undernutrition among study participants

Among the 120 patients studied, the WFH z-score was determined in 86 children who were 5 years old or younger. There were 6 children who had wasting (WFH z-score < -2 SD) with one of them being severely wasted (WFH z-score <-3 SD). The same age group was examined for MUAC z-score and no children in this group had their MUAC z-score less than or equal to -2 SD. The WFA z-scores was calculated in children younger than 10 years (n=118) and there were 14 children who were underweighted and the remaining 88.1% had normal weight. BMI-for- age z-score was also calculated for children of all age groups and 9.1% of them (n=11) had thinness. It was also found that 21 children in our study had stunting (HFA z-score < -2 SD) or chronic malnutrition. Overall, acute malnutrition was found in 9.1% and chronic malnutrition was diagnosed in 17.5 % of our sample (Table 2).

Table 1. General characteristics of study children

Characteristics		No. (n=120)	%
Age (yr)	<2	28	23.3
	≥2 to <5	57	47.5
	≥5	35	29.2
Gender	Male	60	50
	Female	60	50
Disease	Acute	101	84.2
	Chronic	19	15.8
Diagnosis	Infection/fever	44	36.7
	Respiratory	43	35.8
	Gastrointestinal	21	17.5
	Cardiac	1	0.8
	Others	11	9.2
Caloric intake*	Adequate	94	78.3
	Inadequate (<75% of RDA)	26	21.7

**Caloric intake calculated from 24-hr food recall (intake during illness)*
RDA, recommended daily allowance

Table 2. Anthropometric characteristics of the study children

Anthropometric indicator	Number of children, n (%)		
	≥-2SD	< -2SD to -3SD	<-3SD
WFH z-score(n=86)	80(93)	5(5.8)	1(1.2)
HFA z-score(n=120)	99(82.5)	19(15.8)	2(1.7)
WFA z-score(n=118)	104(88.1)	10(8.5)	4(3.4)
BMI for age z-score(n=120)	109(90.8)	7(5.8)	4(3.3)
MUAC z-score (n=86)	86(100)	0(0.0)	0(0.0)

WFH, weight-for-height; HFA, height-for-age; WFA, weight-for-age; BMI, body mass index; MUAC, mid-upper arm circumference

Validity of STRONGkid nutrition screening tool in hospital outpatient setting

According to nutrition screening by STRONGkids tool, 58.3% of our study population (n=70) had moderate nutrition risk and the remaining children had low or no risk of malnutrition. None of the participants from our study had high risk of malnutrition. When the nutrition risk was compared to WHO anthropometric indicators, it has 100% sensitivity and 47.5% specificity in identifying wasting, and 81% sensitivity ad 46.5% specificity in identifying stunting. Overall, the tool has an

excellent sensitivity (>90%) except the comparison with HFA z-score (81%), and fair specificity (>45%) in detecting malnutrition. When compared to WHO standards of weight for height, weight for age, BMI-for-age and height for age, it was found that the screening questionnaire had significant association with wasting, underweight and stunting with p-value < 0.05. However, the kappa agreement between anthropometry and nutrition risk was still weak (□= 0.105 to 0.143) (Table 3).

Characteristic of 120 pediatric outpatients in relation to their nutritional status

Among the under-five years old children (n=85), 7.1% had wasting, 7.1% had underweight and 20% had stunting according to WHO standards. In the children who aged 5 years or older, 24.2% had underweight, 20% had thinness and 11.4% had stunting. Between these two age groups, the WFH and HFA z-scores were not significantly different. However, the older age group had significantly lower WFA and BMI-for-age z-scores ($p < 0.05$) than the younger ones. According to our data, different forms of acute malnutrition such as wasting, underweight and thinness were more common in boys compared to girls, 7.7%, 15% and 11.7% respectively. The percentage of chronic malnutrition or stunting in girls was more than boys (18.3% compared to 16.7%). However, there was no statistically significant difference in characteristics of the patients such as sex, and acute or chronic disease status in both well-nourished and malnourished groups, except the inadequate caloric intake calculated from 24-hour dietary recall, which had a statistical association with stunting (p=0.02) (Table 4).

Table 3. Cross-classification of nutrition risk from screening and WHO anthropometric standards

Nutrition risk	WFH z-score (n=86)		WFA z-score (n=118)		BMI-for-age z-score (n=120)		HFA z-score(n=120)	
	<-2 SD	≥-2SD	<-2 SD	≥-2SD	<-2 SD	≥-2SD	<-2 SD	≥-2SD
Risk (n)	6	42	13	57	10	60	17	53
No risk (n)	0	38	1	47	1	49	4	46
p-value	0.032[b]		0.007[a]		0.025[b]		0.02[a]	
Kappa	0.112		0.139		0.105		0.143	
Sensitivity	100		92.9		90.9		81	
Specificity	47.5		45.2		45		46.5	
PPV	12.5		18.6		14.3		24.3	
NPV	100		97.9		98		92	

[a]chisquare; [b]fisher′s exact test

WFH, weight-for-height; WFA, weight-for-age; BMI, body mass index; HFA, height-for-age; PPV, positive predictive value, NPV; negative predictive value

Table 4. Association between clinical characteristics and nutrition status of children

	Wasting		Underweight		Thinness		Stunting	
	n (%)	p	n (%)	p	n (%)	p	n (%)	p
Age								
<5yr (n=85)	6(7.1)	1.00	6(7.1)	0.02*	4(4.7)	0.01*	17(20)	0.30
≥5yr (n=35)	0 (0)		8(24.2)		7(20)		4(11.4)	
Gender								
Male (n=60)	3(7.7)	1.00	9(15)	0.40	7(11.7)	0.53	10(16.7)	1.00
Female (n=60)	3(6.4)		5(8.6)		4(6.7)		11(18.3)	
Disease								
Acute (n=101)	6(8)	1.00	12(12)	1.00	10(9.9)	1.00	19(18.8)	0.52
Chronic(n=19)	0(0)		2(11.1)		1(5.3)		2(10.5)	
Caloric intake								
Adequate (n=94)	4(6.0)	0.61	8(8.7)	0.08	9(9.6)	1.00	12(12.8)	0.02*
Inadequate (n=26)	2(10.5)		6(23.1)		2(7.7)		9(34.6)	

p-value for association between categorical variables were derived from Fisher's exact test

DISCUSSION

In Myanmar, the applicability of nutrition screening tool has never been studied in hospitalized children, or, in children at the outpatient department. To the best of our knowledge, this is the first study to evaluate the efficiency of a nutrition screening tool in detecting risk of malnutrition among children in a hospital outpatient setting of Myanmar.

The STRONGkids nutrition screening tool has been validated and widely used in many developed and developing countries (17, 18). For the validation of this tool in Myanmar population, we chose the anthropometric measurements which have been used globally to assess the malnutrition, as a reference method (6) for comparison. The validation of the screening tool in our study demonstrated a good sensitivity and negative predictive value (> 90%) in detecting different forms of acute malnutrition of the children (Table 3). This value was higher than the validation of STRONGkids tool in Belgium which presented 71.9% sensitivity for identifying acutely malnourished pediatric inpatients (9). Alternatively, when comparing to WFH z-score, our screening tool has slightly lower specificity (47.5%) than the study by Huysentruyt et al which has 49.1% specificity (9). According to ASPEN, the purpose of the screening in a clinical setting is to filter out the children with no risk of undernutrition, and to find the children who may be benefitted from full nutritional assessment and intervention (19). Therefore, the higher false positive rates will only increase the number of patients who undergo full nutritional assessment and, for the purpose of screening, sensitivity is more important than the specificity (9).

Previously, few studies had been conducted to investigate the value of nutritional screening in pediatric outpatients, although most of the tool have applied and validated for hospitalized children in developed and developing countries. The STRONGkids screening tool was studied in special schools by Joosten et al with the aim of finding association between subjective health status and nutrition risk, and it was reported that children with nutrition risk had more difficulties in performing daily activity and increased tendency to have pain (20). Another tool, the Screening Tool for the Assessment of Malnutrition in Pediatrics (STAMP) was also applied in 1-6 years old children at an ambulatory setting, and, in contrast to our screening results which only had weak agreement (□~0.1) with the reference method, the STAMP tool had a moderate agreement with full dietitian assessment (□=0.47(95% CI 0.24-0.70)) (21). This can be explained by the use of different criterion standards for determining nutritional status in validation of screening tool.

In our study population, 7% of children had wasting, 9.1% had thinness and 17.5% were stunted according to WHO growth standards. The overall prevalence of malnutrition in our participants according to anthropometry was 26.6%. This percentage is less than our neighbor country, India by Gupta et al, where the prevalence of malnutrition in OPD children of under five years was reported as 66.4% (22). However, the data in Myanmar comparable to our study results is limited. Among the participants, 70% of children were younger than 5 years old, and wasting and stunting were identified in 7.1% and 20% of them respectively (Table 2). These prevalence rates were in accordance with the recent community malnutrition report by UNICEF/ WHO in which 6.6% and 29.4% of under 5 years children in Myanmar had wasting and stunting (2). Although the study was done in a private hospital, there was a recognizable prevalence of malnutrition in children with acute illness. Moreover, we also found that although the weight of the children was measured by the nurses as a routine procedure in outpatient department, the measurement of height and standard procedure of plotting anthropometric measurement on WHO growth charts was not performed routinely. Therefore, the application of a screening tool not only can help in detecting the children with nutrition risk, but also can improve the use of WHO growth chart.

It was also found that there was a statistically significant association ($p<0.05$) between age of the child with the malnutrition status according to WFA and BMI-for-age data (Table 4). Children who were older than 5 years had higher prevalence of underweight and thinness. Similar to our results, the general population prevalence of underweight in 5-19 years old children was also high in Myanmar, which was reported as 33.3% in females and 39.9% in males in 2015(2). No statistical association ($p>0.05$) was found between sex and malnutrition status in our study (Table 4). In contrast, a study performed in Iranian hospitalized children by Gholampour et al demonstrated that the male sex constituted the larger proportion of malnourished group (23).

The results of the current study indicated that 15.8% of the participants had chronic disease and 84.2% had acute illness. It was noticeable that in the group of children with acute fever or other non-specific infections, there was a relatively high rate of chronic malnutrition or stunting (Table 4). Rub et al also reported regarding high malnutrition prevalence which was found in apparently healthy children, and this is comparable with our results (21). The evaluation of 24-hour food intake of the children revealed that reduced caloric intake had statistically significant association with malnutrition risk (Table 4). This indicates that the patients with acute illness had tendency to be malnourished due to reduced oral intake. Moreover, we found that the reduced food intake of patients had statistical association with stunting (Table 4). However, the food intake was taken from a single day during illness, and it cannot be used to explain the high rate of stunting in our population.

There are some limitations in our study. Firstly, this is a single center study with relatively small sample size, and our participants may not represent the whole outpatient population in Myanmar, and the generalization of our results is not possible. The cross-sectional design of our study does not permit evaluating the outcome of nutrition intervention in children with high or moderate risk. Further research which evaluate the effect of presence or absence of nutrition intervention following screening in children at-risk is recommended.

In conclusion, our study is the first one to validate a simple pediatric nutrition screening tool for detecting malnutrition in Myanmar hospital-outpatient setting. The tool was very sensitive and it can detect >90% of the children with poor nutrition status. The specificity of the screening tool was around 50% and there was a significant association of nutrition risk calculated from screening tool with the nutrition status by WHO growth standards. Our results demonstrated a recognizable prevalence of malnutrition among the pediatric outpatients of Myanmar. Furthermore, the present study provided public health information regarding disease

and malnutrition status in a private hospital. Together, our results encouraged the use of nutrition screening tool in different hospital settings for early detection of malnutrition and to reduce the prevalence and consequences of malnutrition in Myanmar children.

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REFERENCES

1) Shrimpton R, Rokx C. The Double Burden of Malnutrition: A Review of Global Evidence: Health, Nutrition: and Population Discussion Paper. 2012.

2) Unicef. Levels and trends in child malnutrition: eSocialSciences. 2018.

3) Hartman C, Shamir R, Hecht C, Koletzko B. Malnutrition screening tools for hospitalized children. Curr Opin Clin Nutr Metab Care 15: 303-09. 2012.

4) Hecht C, Weber M, Grote V, Daskalou E, Dell'era L, Flynn D, Gerasimidis K, Gottrand F, Hartman C, Hulst J. Disease associated malnutrition correlates with length of hospital stay in children. Clin Nutr 34: 53-59. 2015.

5) Mehta N M, Corkins M R, Lyman B, Malone A, Goday P S, Carney L, Monczka J L, Plogsted S W, Schwenk W F, Parenteral A S F, Directors E N B O. Defining pediatric malnutrition: a paradigm shift toward etiology□related definitions. Journal of Parenteral and Enteral Nutrition 37: 460-81. 2013.

6) Hulst J M, Zwart H, Hop W C, Joosten K F. Dutch national survey to test the STRONGkids nutritional risk screening tool in hospitalized children. Clin Nutr 29: 106-11. 2010.

7) Agostoni C, Axelsson I, Colomb V, Goulet O, Koletzko B, Michaelsen K F, Puntis J W, Rigo J, Shamir R, Szajewska H. The need for nutrition support teams in pediatric units: a commentary by the ESPGHAN committee on nutrition. J Pediatr Gastroenterol Nutr 41: 8-11. 2005.

8) Kondrup J, Allison S P, Elia M, Vellas B, Plauth M. ESPEN guidelines for nutrition screening 2002. Clin Nutr 22: 415-21. 2003.

9) Huysentruyt K, Alliet P, Muyshont L, Rossignol R, Devreker T, Bontems P, Dejonckheere J, Vandenplas Y, De Schepper J. The STRONGkids nutritional screening tool in hospitalized children: a validation study. Nutrition 29: 1356-61. 2013.

10) Organization, W.H., WHO child growth standards: length/height for age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age, methods and development. 2006: World Health Organization.

11) Organization W H. Training course on child growth assessment. Geneva: WHO: p17-25. 2008.

12) Organization, W.H., WHO Anthro (version 3.2. 2, January 2011) and macros. Geneva: WHO. 2011.

13) Barba C V, Cabrera M I Z. Recommended dietary allowances harmonization in Southeast Asia. Asia Pac J Clin Nutr 17: 405-08. 2008.

14) Becker P, Carney L N, Corkins M R, Monczka J, Smith E, Smith S E, Spear B A, White J V, Nutrition A O, Dietetics, Parenteral A S F, Nutrition E. Consensus statement of the Academy of Nutrition and Dietetics/American Society for Parenteral and Enteral Nutrition: indicators recommended for the identification and documentation of pediatric malnutrition (undernutrition). Nutr Clin Pract 30: 147-61. 2015.

15) Landis J R, Koch G G. The measurement of observer agreement for categorical data. Biometrics: 159-74. 1977.

16) Bujang M, Baharum N. Guidelines of the minimum sample size requirements for Cohen's Kappa. Epidemiol Biostatistics Public Health 14: e12267-61. 2017.

17) Joosten K F, Hulst J M. Nutritional screening tools for hospitalized children: methodological considerations. Clin Nutr 33: 1-5. 2014.

18) Wonoputri N, Djais J T, Rosalina I. Validity of nutritional screening tools for hospitalized children. J Nutr Metab 15: 1-6. 2014.

19) Mueller C, Compher C, Ellen D M, Parenteral A S F, Directors E N B O. ASPEN clinical guidelines: nutrition screening, assessment, and intervention in adults. Journal of Parenteral and Enteral Nutrition 35: 16-24. 2011.

20) Joosten K, Van Der Velde K, Joosten P, Rutten H, Hulst J, Dulfer K. Association between nutritional status and subjective health status in chronically ill children attending special schools. Qual Life Res 25: 969-77. 2016.

21) Rub G, Marderfeld L, Poraz I, Hartman C, Amsel S, Rosenbaum I, Pergamentzev-Karpol S, Monsonego-Ornan E, Shamir R. Validation of a nutritional screening tool for ambulatory use in pediatrics. J Pediatr Gastroenterol Nutr 62: 771-75. 2016.

22) Gupta M, Jindal R. Assesment of Nutritional Status of Under Five Children Attending Outpatient Departement At a Tertiary Care Hospital: A Study from North India. International Journal of Scientific Research and education (IJSRE) 4: 5283-87. 2016.

23) Gholampour Z, Hosseininasab M, Khademi G, Sezavar M, Abdollahpour N, Imani B. Assessment of nutritional status based on STRONGkids tool in Iranian hospitalized children. Int J Child Health Nutr 4: 61-6. 2015.