International Journal of Research and Review
Vol. 10; Issue: 5; May 2023
Website: www.ijrrjournal.com
Original Research Article *E-ISSN: 2349-9788; P-ISSN: 2454-2237*

Diagnostic Test Using Subjective Global Nutrition Assessment in Determining Nutritional Status in Patients with Cerebral Palsy in M Djamil Hospital Padang

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DOI: https://doi.org/10.52403/ijrr.20230526

ABSTRACT

Background: Malnutrition often occurs in children with cerebral palsy, and anthropometric measurement becomes a challenge due to spastic posture. Subjective Global Nutrition Assessment (SGNA) is a helpful non-invasive screening tool to determine the nutritional status of its simplicity, ease to use, comprehensive, and affordable.
Objective: This study aimed to determine the sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of SGNA in determining nutritional status in children with cerebral palsy
Methods: A diagnostic test study was performed on 40 children with cerebral palsy who came to the outpatient clinic of M. Djamil Hospital from July to September 2022 where the caregiver signed the informed consent. Patients with a congenital anomalies and obesity were excluded. Measurements were carried out and nutritional status was determined by plotting weight and height data to WHO 2006/CDC 2000 anthropometric curve and caregivers were asked to fill in the questionnaire. Data analysis was performed with a 2x2 table using a computer program. Main outcome measures: sensitivity, specificity, positive predictive value, and negative predictive value of SGNA.
Result: Data from 40 samples were collected to compare the sensitivity, specificity, positive predictive value, and negative predictive value of SGNA in determining nutritional status to anthropometric as a gold standard. The results were 91.3%, 88.2%, 91.3%, and 88.2 %, respectively.
Conclusion: SGNA is recommended for screening nutritional status in children with cerebral palsy.

Keywords: SGNA, nutritional status, cerebral palsy

INTRODUCTION

Every child has the right to grow and develop optimally. Indicators for knowing growth are height, weight, and head circumference. Malnutrition is frequently reported in children with disabilities, including cerebral palsy. Cerebral palsy is a disorder of neuromotor development that often occurs in children, the prevalence in Indonesia is 1-5 per 1000 live births, where 1000-25000 births with a diagnosis of cerebral palsy every 5 million live births in Indonesia per year.[1]

Cerebral palsy (CP) is a disorder or damage to the brain that is non-progressive in nature that occurs during the growth and development process. These abnormalities or damage can occur while in the womb (prenatal), during the birth process (perinatal), or after the birth process

(postnatal). Cerebral palsy can cause disturbances in posture (body posture), movement control, and impaired muscle strength including oromotor which is usually accompanied by neurological disorders in the form of paralysis, spasticity, disorders of the basal ganglia, cerebellum, and mental disorders.[1]

Children with CP generally have difficulty swallowing (dysphagia) so children with CP have a high risk of aspiration and generally have low nutritional status.[2] The prevalence of low nutritional status ranges from 46% - 90%. Research in Kenya found that 70.3% of cerebral palsy children who went to the polyclinic suffered from malnutrition, in Uganda and Botswana 52% and 43% of CP children suffered from malnutrition.[3,4] Almuneef, et al (2019) found a prevalence of malnutrition in CP children of 56.4 %.[5] In Indonesia, Nur FT (2019), Iroth (2017), Gunawan (2018), and Salfi (2019) found the prevalence of undernutrition and malnutrition in CP children was 78%, 63%, 68%, and 60 respectively %.[4,6,7,8] This is due to a neurological condition that can affect the muscles and movements of chewing, swallowing, and independent eating. Children with CP can also have gastrointestinal problems which will affect the types of food that can be given and how these nutrients are absorbed.[9],[10]

Several nutritional status screening tools have been used widely in the world including screening tools for risk on nutritional status and growth (STRONG-kids), screening tools for the assessment of malnutrition in pediatrics (STAMP), subjective global nutrition assessment (SGNA), but not some are universally accepted as screening tools.[11]

Subjective global assessment (SGA) is a nutritional assessment method based on clinical assessment, which has been widely used to assess the nutritional status of adults for both clinical and research purposes. Secker and Jeejeebhoy from Canada then introduced a subjective global nutrition assessment (SGNA) to assess children's nutritional status. SGNA, taking into account findings regarding child nutrition and disease severity, in the absence of biomarker data. SGNA can assess malnutrition status and has been used worldwide in various disease conditions.[12]

Research by Ong, et al (2018), compared SGNA with STAMP with anthropometry to assess malnutrition in hospitalized children. The specificity value of SGNA was higher (70.45%) compared to STAMP (18.18%). Research by Xavier, et al (2022), comparing SGNA and STRONG-kids with anthropometric measurement tools, found that the sensitivity value of SGNA was higher (92%) than STRONG-kids (84%).[13,14]

The use of SGNA has been widely used to screen nutritional status in children, but its use in the cerebral palsy population is still limited. Therefore, researchers are interested in assessing the nutritional status of children with CP subjectively by using the SGNA and compared with anthropometric measurements which are objective measurements.

METHODS

A diagnostic test study was performed on 40 children with cerebral palsy who came to the outpatient clinic of M. Djamil Hospital from July to September 2022 where the caregiver signed the informed consent. Samples were selected by consecutive sampling. In this way, the researcher will take all subjects who match the inclusion and exclusion criteria until the number of samples is met. Patients with a congenital anomalies and obesity were excluded. Subjects who meet the inclusion criteria are subjected to anamnesis and physical examination, check BB, PB/knee height. Weight: weighed using a digital scale with the SECA brand that has been stamped, children who cannot stand are weighed by caregivers/parents. Body height/length: done using a tape measure/stadiometer, if the child's posture cannot be straight then knee height is used to measure body height/length, use the formula: S= (2.68 x KH) + 24.2

The measured results were plotted onto the WHO 2006/CDC 2000 growth curve based on weight/weight according to age. The group obtained based on the growth curve (BB/PB) will again be grouped into 2 categories of diagnostic test research, namely good nutrition and malnutrition (undernutrition plus malnutrition). The researcher filled out the SGNA questionnaire. The groups obtained will be grouped into 2 categories of diagnostic test research, namely good nutrition and malnutrition (undernutrition plus malnutrition). All data obtained is recorded in a special sheet, processed by computerization, and presented in the form of a 2x2 table and ROC curve. Analysis was carried out to obtain the sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of the diagnostic test as depicted on the ROC curve.

RESULTS

This research assessed the subjective global nutrition assessment (SGNA) diagnostic test in determining the nutritional status of children with cerebral palsy in 40 samples of cerebral palsy children who went to the Polyclinic of RSUP Dr.M Djamil Padang from July to September 2022. The characteristics of the study subjects consisted of age, sex, degree of GMFCS, use of feeding tube, and use of anti-spastic. Subject characteristics can be seen in the following table:

Table 1. Characteristics of research subjects

Characteristic	**f (%)**	**Median (min-max)**
Age, (years)		3,5 (1-18)
< 5	23 (57,5%)	
≥ 5	17 (43,5%)	
Gender, f(%)		
Male	24 (60%)	
Female	16 (40%)	
***Gross Motor Function Classification System* (GMFCS),** f(%)		
Level 1	0	
Level II	2 (5%)	
Level III	12 (30%)	
Level IV	16 (40%)	
Level V	10 (25%)	
Penyakit penyerta, f(%)		
Brain Atrophy	1 (2,5%)	
Epilepsy	25 (62,5%)	
Hydrocephaly	2 (5%)	
Hypothyroid	4 (10%)	
Meningitis	1 (2,5%)	
Microcephaly	7 (17,5%)	
***Feeding tube* (NGT)**, f(%)		
Yes	5 (12,5%)	
No	35 (87,5%)	
Use of anti-spastic drugs, f(%)		
Yes	12 (30%)	
No	28 (70%)	

Table 1 shows that most patients were children in the age group <5 years (57.5%). The number of patient boys (60%) was found to have a greater proportion than girls (40%). Most of the children were in GMFCS level IV (40%), did not use tube feeding (87.5%), and did not take anti-spastic drugs (70%). Most children have epilepsy as a co-morbidity (62.5%).

Table 2. Grouping of nutritional status for diagnostic tests

		Grafik Z-score/CDC		
		Malnutrition	**Well nourished**	**Total**
SGNA	Malnutrition	21 (52,5%)	2 (5%)	23 (57,5%)
	Well nourished	2 (5%)	15 (37,5%)	17 (42,5%)
	Total	23 (57,5%)	17 (42,5%)	40 (100%)

Table 2 shows that 57.5% of children with malnutrition status and 42.5% of children with good nutrition on examination using a gold-standard instrument. The same results in the assessment using the SGNA showed that there were 57.5% of children with malnourished status and 42.5% of children with good nutrition.

Before carrying out a diagnostic test, true positive, true negative, false positive, and false negative values are needed to facilitate the calculation of sensitivity, specificity, positive predictive value, and negative predictive value. The table shows that from the measurement results, the number of true positives was 21, the number of true negatives was 15, the number of false negatives was 2, and the number of false positives was 2.

Table 3. Statistical indicators of SGNA

Statistic indicators	Formula	SGNA
Sensitivity (%)	$\frac{TP}{TP+FN}$	91,3%
Specificity (%)	$\frac{TN}{TN+FP}$	88,2%
Positive predictive value (%)	$\frac{TP}{TP+FP}$	91,3%
Negative predictive value (%)	$\frac{TN}{TN+FN}$	88,2%

TP=true positive; FP=false positive; FN=false negative; TN=true negative

Determining the value of the area under curve (AUC) in a diagnostic test aims to assess how well an instrument is used in detecting nutritional status. Analysis of the SGNA AUC value can be seen in Table 3.

Table 4. Area under curve (AUC)

AUC	95% CI	p-value
0,898	0,786 – 1,010	0,00

The results of the analysis showed that the AUC value was 0.898 (> 0.7, p-value <0.05).

DISCUSSION

This study is a diagnostic test study that aims to determine the sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of SGNA in determining the nutritional status of children with cerebral palsy who seek treatment at the Dr.M.Djamil Children's Polyclinic Padang compared to anthropometric measurements as the gold standard. Samples were collected by consecutive sampling for 3 months from July to September 2022. A similar study was conducted by Bell, et al in 2020 in Australia which compared the assessment of nutritional status in cerebral palsy children using the subjective global nutrition assessment (SGNA) method with anthropometric assessments.

A total of 48 research samples were obtained, but 8 samples were excluded because the results of anthropometric measurements and the WHO 2006/CDC 2000 curve based on body weight/body length, nutritional status and obesity were obtained. This study examined 40 subjects of children with cerebral palsy who went to the Pediatric Polyclinic at Dr.M.Djamil Hospital, Padang. All subjects were measured for body weight and length and filled out a questionnaire conducted by the researcher. Measurement of knee height length to determine body length is done if the subject has a stiff body posture. From the results of the study, there were more subjects under 5 years old, male patients (56.5%) were found to have a greater proportion than women (47.5%). Most of the children were in GMFCS grade IV (40%), had epilepsy (62.5%) as comorbidity, did not use feeding tubes (87.5%), and did not take anti-spastic drugs (70%). Almost the same as Salfi's study (2019), where the proportion of boys was greater than girls. [8] Most of the children were in GMFCS degrees III-V, namely 38 children (95%), almost the same as the study conducted by Jahan et al. (2021), obtained from 130 children with cerebral palsy in Sumba, 83.3% were categorized as GMFCS III-V. 40 Most of the comorbidities in this study sample were epilepsy (62.5%) who had received anti-epileptic drug therapy, and 30% of samples received anti-spastic drugs.[15,16]

From a total of 40 research samples, 23 children (57.5%) were found to be malnourished from objective measurements (anthropometrics), the same from the results of the SGNA assessment, 23 children

(57.5%) were also malnourished. Of the 23 samples of malnutrition measured anthropometrically, SGNA found 21 malnourished (91.3%). Research by Minocha et al. found 76.67% of malnourished children using the SGNA method compared to objective measurements (anthropometrics).[15] Research by Bell et al. also found that the SGNA identified 29% more potentially malnourished children compared to anthropometric measurements, including 12% -of children classified as malnourished on the SGNA but well nourished on BMI measurements.[17]

The sensitivity value of SGNA in this study in determining nutritional status when compared with anthropometric examination was 91.3%, with a specificity of 88.2%. Almost the same as a study conducted by Xavier, et al (2022), which obtained a sensitivity and specificity of SGNA of 92.3% and 84.6%.[14] This study obtained a higher sensitivity than the results of a study by Ong, et al (2019), which obtained a sensitivity of SGNA 63.15%, and a specificity of 70.45%.[13] From the results of Xavier's research, et al stated that SGNA can be applied to patients not only to identify nutritional risks early on, but can also be used effectively as a nutritional status assessment method.[14]

The positive predictive value (PPV) of SGNA in determining nutritional status in this study was 91.3% and the negative predictive value (NPV) was 88.2%. Nutrition screening in pediatrics, the aim is to identify individuals who are at nutritional risk so that any intervention can be carried out. Therefore, higher scores for sensitivity and PPV indicate a higher probability that patients classified as malnourished do carry this risk. The specificity value was also high in this study, leading to a lower probability of false positive results. So that SGNA can be expected to be a screening tool because it shows a high sensitivity value and can also be used as a tool to determine nutritional status so that nutritional intervention can be carried out early.

The results of the analysis show that the value of the area under the curve is 0.898 (> 0.7, p-value <0.05), so that it can be concluded that the accuracy of the SGNA in determining high nutritional status.

CONCLUSION

SGNA is recommended for screening nutritional status in children with cerebral palsy.

Declaration by Authors

Ethical Approval: Approved
Acknowledgement: None
Source of Funding: None
Conflict of Interest: The authors declare no conflict of interest.

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How to cite this article: Utari Gustiany G, Nice Rachmawati, Rahmi Lestari. Diagnostic test using subjective global nutrition assessment in determining nutritional status in patients with cerebral palsy in M Djamil Hospital Padang. *International Journal of Research and Review*. 2023; 10(5): 216-221.
DOI: *https://doi.org/10.52403/ijrr.20230526*

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