World Nutrition Journal |eISSN 2580-7013

ORIGINAL ARTICLE

Validity test of the Global Leadership Initiative on Malnutrition (GLIM) diagnostic criteria compared with the American Society for Parenteral and Enteral Nutrition (ASPEN) criteria in inpatients at Dr. Cipto Mangunkusumo hospital: A cross-sectional study

Received 11 June 2024
Accepted 28 August 2024
Published 30 August 2024

Link to DOI:
10.25220/WNJ.V08.i1.0008

Citation: Oentiono O Y, Manikam N R M. Malnutrition (GLIM) diagnostic criteria compared with the American Society for Parenteral and Enteral Nutrition (ASPEN) criteria in inpatients at Dr. Cipto Mangunkusumo hospital: A cross-sectional study. World Nutrition Journal.2024 August 30,8(i1): 54-61.

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Abstract

Background: Malnutrition experienced by numerous inpatients is linked to various complications. The Global Leadership Initiative on Malnutrition (GLIM), which established the latest malnutrition criteria, recommends a two-step methodology for diagnosing malnutrition in adult inpatients. This study aims to evaluate the validity of the GLIM criteria for the diagnosis of malnutrition in hospitalized patients at Cipto Mangunkusomo Hospital Jakarta by comparing them with the ASPEN criteria.

Methods: This cross-sectional study was conducted at Cipto Mangunkusomo Hospital, Jakarta. Secondary data was taken from 100 inpatients from October 2021 to February 2022 selected by consecutive sampling technique. The diagnosis of malnutrition in the patients applied the ASPEN and GLIM criteria. Furthermore, data were analyzed using Cohen's Kappa and chi-square tests.

Results: Of 100 inpatients, 63% were diagnosed with malnutrition according to the GLIM diagnostic criteria. Meanwhile, 48% of them were found to be malnourished according to the ASPEN criteria. The GLIM criteria have a specificity of 69.2%, a sensitivity of 97.9%, a PPV of 74.6%, and an NPV of 97.3%.

Conclusion: The GLIM diagnostic criteria are valid as an instrument for diagnosing malnutrition but require further research to assess the severity of malnutrition.

Keywords: Malnutrition, inpatient, diagnostic criteria of malnutrition, ASPEN, GLIM

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Introduction

According to WHO, malnutrition is a condition characterized by inadequate or excessive nutrient intake, an imbalance of critical nutrients, or poor nutrient use. The prevalence of malnutrition abroad ranges from 33-54% and between 33-70% in Indonesia.[1] Meanwhile, the prevalence of malnutrition in patients at Cipto Mangunkusomo Hospital (*Rumah Sakit Cipto Mangunkusumo*/RSCM) is 20.1% based on the WHO criteria, 42.8% based on the European Society for Clinical Nutrition and Metabolism (ESPEN) criteria, and 48.5% based on the American Society for Parenteral and Enteral Nutrition (ASPEN) criteria.[2]

The fundamental physiopathology of malnutrition involves a reduction in nutrient intake caused by anorexia (often seen in inflammatory conditions) and/or an inability to eat, although there may also be poor nutrient absorption. Inflammation is a recognized factor that leads to higher energy and protein needs. When coupled by reduced food intake, it results in an unfavorable nutritional balance and subsequent loss of fat-free mass, which is a key indicator of malnutrition. Adult malnutrition associated inpatient hospital has been linked to a higher likelihood of death, infection, hospital readmission, and various other consequences that have a financial impact on healthcare systems.[3]

Since there has been no widely approved method for diagnosing malnutrition in adults, differences in definitions of malnutrition diagnosis, patient demographics, and nutrition assessment methodologies result in substantial heterogeneity in the prevalence of malnutrition among the results of previous studies.[2–6] Currently, the diagnosis of malnutrition commonly employ criteria from ASPEN, ESPEN, and other organizations. In Indonesia itself, the National Guidelines for Malnutrition Health Services implemented though the Decree of the Minister of Health of the Republic of Indonesia adopted ASPEN's six diagnostic criteria derived from anamnesis, anthropometric assessment, and clinical examination. To diagnose malnutrition, at least two of the six criteria must be present.[3]

In 2016, the most recent criteria for the diagnosis of malnutrition on a global scale were established by representatives of major clinical nutrition groups in the world namely the Global Leadership Initiative on Malnutrition (GLIM) criteria. GLIM proposed a two-step model covering an initial screening with validated instruments for broad identification and diagnostic assessment of the patient at risk. GLIM employed a consensus method to establish operational criteria for the diagnosis of various types of malnutrition with inpatient subjects, i.e., imbalances in energy, protein, and other nutrients, based on at least one phenotypic criterion and one etiologic criterion.[7]

The GLIM diagnostic criteria are shorter and easier to classify than the ASPEN criteria, thus accelerating the diagnosis of malnutrition. Despite being the most modern diagnostic criteria established by numerous international clinical nutrition societies including ASPEN, the GLIM diagnostic criteria have not been widely used in Indonesia and GLIM-based statistics on the prevalence of malnutrition in this country are currently not available. Therefore, this study aims to examine the validity of the GLIM criteria for the diagnosis of malnutrition in adult inpatients at RSCM by comparing them with the ASPEN criteria.

Methods

Study design and population

This cross-sectional study was conducted at RSCM Jakarta, with a population of all adult inpatients at the Integrated Inpatient Service Installation, Building A, RSCM for the period of October 2021 to February 2022. The samples of this study were 100 participants who met the inclusion and exclusion criteria and were selected using a sequential sampling technique.

The inclusion criteria were aged between 18 and 60 years, treated at the Integrated Inpatient Service Installation, Building A, RSCM during the study period, and willing to participate in this study by signing an informed consent. Meanwhile, the exclusion criteria were suffering from skin diseases of the upper and lower extremities, having metal

implants or pacemakers, being in a psychiatric inpatient unit, intensive care unit or high care unit (ICU or HCU), or inpatient obstetrics and gynecology unit, experiencing burns, or being uncooperative during examination. This study has obtained research permit from Research Ethics Committee at the Faculty of Medicine, Universitas Indonesia with a research protocol KET-933/UN2.F1/ETIK/PPM.00.021/2021.

GLIM Validity Test Procedure

1) Two clinicians diagnosed malnutrition in the patients by adopting the GLIM criteria in the first diagnosis and the ASPEN criteria in the second, with an interval of one to two hours between the two diagnoses. Both clinicians did the same method for each patient.
2) Result of agreement has been trained well before the study began. The findings from both assessments were recorded, then the amount of agreement between the two evaluators was determined using Cohen's Kappa test.
3) The results of malnutrition diagnosis based on the GLIM criteria were compared with those of the ASPEN criteria in terms of sensitivity, specificity, PPV, and NPV.

Statistical analysis

The statistical analyses utilized SPSS for Windows (20th version). This study employed univariate chi-square test to evaluate patient characteristics and the k = 0 and k = 1 interpretations of Cohen's Kappa test to measure the independent variables. Data on subject parameters with normal distribution, such as sex, albumin level, and total lymphocytes, are presented as mean and standard deviation, whereas those with a distorted distribution are presented as median (minimum and maximum values). The validity of the GLIM diagnostic criteria of malnutrition was expressed in k values, and their sensitivity, specificity, positive predictive value, and negative predictive value were examined and reported as percentages in a 2 x 2 table.

Results

Among the 112 respondents who consented to having their data collected, 12 were excluded because the BIA tool did not provide access to their body composition information. Thus, 100 individuals participated in this study, 47 of whom were male and 53 were female. The age of the participants ranged from 20 to 59 years, with a median age of 44.5 years. Most of the patients (n=29, or 29%) were diagnosed with gastrointestinal, hepatobiliary, or pancreatic diseases. The characteristics of the patients and the prevalence of malnutrition are displayed in **Table 1** and **Table 2**, respectively.

Table 1. Characteristics of patients

Variable	Value
Age, median (min-max)	44.5 (20-59)
Sex	
- Female, n (%)	53 (53%)
- Male, n (%)	47 (47%)
Diagnosis, n (%)	
- Gastrointestinal tract, Hepatobiliary, Pancreas	29 (29%)
- Malignancy	21 (21%)
- Neuromuscular	15 (15%)
- ENT	14 (14%)
- Kidneys and urogenital tract	7 (7%)
- Immune and allergies	6 (6%)
- Endocrine metabolism	3 (3%)
- Cardiovascular	3 (3%)
- Teeth and mouth	2 (2%)

In this study, 48% of the total sample suffered from malnutrition based on the ASPEN diagnostic criteria, with 22 patients (45.8%) suffering from moderate malnutrition and 26 patients (54.2%) suffering from severe malnutrition. Meanwhile, 63% of the patients were severely malnourished based on the GLIM diagnostic criteria.

Table 2. Prevalence of malnutrition based on ASPEN, GLIM, Albumin, and TLC

Malnutrition criteria	Prevalence
ASPEN criteria, n (%)	
- Good nutrition	52 (52%)
- Malnutrition	48 (48%)
○ Moderate malnutrition	22 (45.8%)
○ Severe malnutrition	26 (54.2%)
GLIM criteria, n (%)	
- Good nutrition	37 (37%)
- Malnutrition	63 (63%)
○ Severe malnutrition	63 (100%)
Albumin, n (%)	
- Mild malnutrition	14 (14%)
- Moderate malnutrition	11 (11%)
- Severe malnutrition	10 (10%)
TLC, n (%)	
- Mild malnutrition	18 (18%)
- Moderate malnutrition	9 (9%)
- Severe malnutrition	2 (2%)

Note: ASPEN = American Society for Parenteral and Enteral Nutrition; GLIM = Global Leadership Initiative on Malnutrition; TLC = Total Lymphocyte Count

Table 3. Prevalence of malnutrition by diagnosis

Diagnosis	Number of malnourished patients	Percentage (%)
GI tract, Hepatobiliary, pancreas	20	69
ENT	7	50
Teeth and mouth	1	50
Malignancy	10	47
Kidneys and urogenital tract	3	43
Endocrine metabolism	1	33
Cardiovascular	1	33
Immune and allergies	2	33
Neuromuscular	3	20
Total	**48**	**48**

Gastrointestinal, hepatobiliary, and pancreatic diseases were shown to be the most common in malnourished patients among the nine diagnoses examined in this study. As seen in **Table 3**, 20 patients (69%) of the 29 patients diagnosed with gastrointestinal, hepatobiliary, and pancreatic diseases also suffered from malnutrition.

Table 4. Degree of malnutrition based on GLIM component criteria

GLIM Criteria	n (%)
Weight loss	
- Moderate malnutrition	17 (27)
- Severe malnutrition	19 (30.2)
BMI	
- Moderate malnutrition	8 (12.7)
- Severe malnutrition	12 (19)
ALMI	
- Severe malnutrition	63 (100)

Note: GLIM = Global Leadership Initiative on Malnutrition; BMI = Body Mass Index; ALMI = Appendicular Lean Mass Index

Table 5. Cross-tabulation of ASPEN and GLIM diagnostic criteria of malnutrition

		ASPEN	
		Malnutrition	Good nutrition
GLIM	Malnutrition	47	16
	Good nutrition	1	36

Note: ASPEN = American Society for Parenteral and Enteral Nutrition; GLIM = Global Leadership Initiative on Malnutrition

According the GLIM criteria, weight loss, BMI, and ALMI determine the severity of malnutrition. **Table 4** describes the severity of malnutrition in the observed inpatients based on weight loss, BMI, and ALMI.

The GLIM diagnostic criteria have a sensitivity of 97.9%, a specificity of 69.2%, a PPV of 74.6%, and an NPV of 97.3% in detecting malnutrition, as shown in **Table 5**.

Discussion

In Southeast and East Asian countries, malnutrition is extremely common in adult inpatients [8] The elderly and those with chronic diseases such as cancer are more susceptible to malnutrition.[9] A prior study conducted in Vietnam revealed that most of the malnourished individuals in the study were women (58%) and the average age was 80.2 years (±10.2).[9] However, although female individuals are at risk for malnutrition, another previous study has found that only males were substantially associated with a greater prevalence of malnutrition (OR 10.06, CI 95%, p = 0.008).[10] Another study at Mexico shows malnourished patient vary from age 56-83 years old and has higher prevalence at post operative population. The GLIM criteria for malnutrition exhibit a link with bad short-term (in-hospital) outcomes that is dependent on both the dosage and duration of exposure. The findings were noted in individuals who had elevated levels of inflammation and reduced muscular mass.[11]

The highest prevalence of malnutrition in this study was in the gastrointestinal, hepatobiliary, and pancreatic disease group, with the highest incidence being in patients with gastrointestinal disease associated with aging. This is consistent with the age characteristic of the patients in this study (median > 40 years). In line with the results of a previous study carried out at the same hospital, acute gastrointestinal diseases, including hematemesis, melena, cholangitis, cholecystitis, and obstructive jaundice, remain the most inpatient diagnoses at RSCM during this study (48.3%).[12] Changes in the aging gastrointestinal tract are found in the mechanical disintegration of food, gastrointestinal motor functions, food transit, chemical digestion of food, and intestinal wall function. Meanwhile, the main age-related changes in the oral cavity are a decrease in bite force and the occurrence of mandibular reflexes. This is

caused by a decrease in the number of orosensory receptors which leads to increased sensory thresholds and decreased secretion of saliva, thus reducing the motor activity of the tongue and the masticatory muscles.[13]

The GLIM criteria have comparable evaluation points and parameters to those of the ASPEN criteria, but their cut-off values are different. In addition, the ASPEN criteria evaluate subcutaneous fat loss, presence or absence of fluid buildup, and functional condition of the patient, whereas the GLIM criteria do not. Therefore, the validity and reliability tests of the GLIM diagnostic criteria must be done in various sectors and sample groups.[5]

Comparatively, several previous studies have examined the validity of the GLIM criteria using different reference standards from this study. A systematic review and meta-analysis by Huo et al. indicated combined sensitivity of the GLIM criteria of 0.72 (95% CI, 0.64-0.78) and specificity of 0.82 (95% CI, 0.72-0.88).[15] Meanwhile, based on the results of the subgroup analysis (SGA), the GLIM criteria had higher diagnostic values (sensitivity of 0.81 and specificity of 0.80).[15] Another study by Balci et al. compared the GLIM criteria with SGA and NRS-2002 in the diagnosis of malnutrition and found that they had a sensitivity of 86.05% (95% CI 76.89–92.58), a specificity of 93.79% (95% CI 88.54–97.12), an PPV 89.16% (95% CI 81.28–93.96), and a NPV of 91.89% (95% CI 87–95.05).[16]

The GLIM approach for diagnosing malnutrition is more rapid than the ASPEN method as it uses fewer diagnostic criteria. In the process of establishing a diagnosis of malnutrition according to GLIM, there is a validated method for measuring muscle mass by using the Appendicular Lean Mass Index (ALMI) measured by dual-energy absorptiometry (DXA), bioelectrical impedance analysis (BIA), CT scan, or MRI.[7] Of the various reference values issued by malnutrition-related guidelines or associations to determine decreased muscle mass, the widely used ones are the normal values above 5.6 kg/m2 for women and 7.4 kg/m2 for men[17]. In this study, only 5 patients were found with ALMI values above 5 kg/m2, which were below normal values. This indicates that all samples in this study are malnourished.

The limitations of the current study include its observational design, being biased among examiner even though both examiners already trained before, conducted at a single facility, the absence of post-discharge follow-up, and the uncertainty regarding whether patients received nutritional support throughout their hospitalization. By considering all the criteria, clinicians can obtain a comprehensive understanding of malnutrition, including its causes and implications. Future studies should focus on investigating the relationship between malnutrition and nutritional interventions that take into account each criterion. This will help improve the clinical outcomes for every patient. These conclusions need to be confirmed through multicentric investigations with a larger sample size.

Conclusion

The GLIM criteria are valid for diagnosing malnutrition in patients compared to ASPEN criteria in hospital settings. Multicenter data and extrapolation analysis are needed to strengthen the validity of this study.

Limitation of study

This study is the first study ever conducted in Indonesia to compare the validity of the GLIM and ASPEN diagnostic criteria. The difficulty of blinding the evaluators limits this study to diagnosing malnutrition based on the GLIM or ASPEN criteria. Another limitation is the lack of an ALMI cut-off recommendation for the Indonesian population.

Conflict of interest

The authors declare that there is no conflict of interest.

Acknowledgements

The authors would like to express the sincerest gratitude to Cipto Mangunkusumo Hospital and the Faculty of Medicine, Universitas Indonesia.

Funding

This study received no specific grant from any funding agency.

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