Proportion of malnourished ambulatory hospitalized patients based on international criteria at Cipto Mangunkusumo Hospital, Indonesia

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Abstract
Objective: Malnutrition is quite prevalent in hospitalized patients, and its diagnosis is particularly important for doctors in order to treat it accordingly. This study aims in finding the frequency of malnutrition in ambulatory hospitalized patients based on three international criteria.

Methods: The subjects of this study were hospitalized patients at Cipto Mangunkusumo Hospital, Jakarta, Indonesia. The subjects were investigated for malnutrition using World Health Organization (WHO), American Society for Parenteral and Enteral Nutrition (ASPEN), and the European Society for Clinical Nutrition and Metabolism (ESPEN) criteria for malnutrition. Two hundred and twenty-nine ambulatory hospitalized patients were subject to accurate anthropometry measurements. They were analyzed for their height using Seca-360 and their weight using Seca-869, from which their body mass index could be measured. They were also examined for their handgrip strength using Jamar® Handgrip Dynamometer. The rest of the criteria were fulfilled through subjective history taking.

Results: The proportion of malnutrition at Cipto Mangunkusumo hospital was 20.1% when assessed using WHO malnutrition criteria. Meanwhile, about 48.5% of the subjects had malnutrition when assessed using ASPEN criteria. About 42.8% of subjects were categorized as malnutrition according to ESPEN criteria.

Conclusion: The highest proportion of hospital malnutrition is based on ASPEN, followed by ESPEN, and the latter is WHO. ESPEN is more likely to capture malnutrition in chronic conditions, whereas ASPEN is more suitable in acute conditions rather than in chronic ones. ESPEN data would be more accurate when done appropriately according to its guidelines (with the use of a validated instrument).

Keywords: Malnutrition, World Health Organization, Hospitals, Nutrition Assessment, Ambulatory.

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Introduction
Malnutrition is often an unrecognized problem in hospitalized patients, occurring in hospital between 20-50%. A study in Australia showed that malnutrition in a tertiary hospital was approximately 23% as assessed by Subjective Global Assessment (SGA), and was related to 4.5 times longer hospital stay than well-nourished patients. One study in Denmark revealed that as many as 40% of hospitalized patients had a risk of malnutrition as assessed by Nutrition Risk Screening (NRS)-2002, where 8% were malnourished. A malnutrition study in the digestive ward of Cipto Mangunkusumo Hospital in Jakarta, Indonesia, found that 37.1% of patients had a malnourished nutritional status.

Malnutrition on hospital admission is associated with poor clinical outcomes, increased risk of infection, impaired wound healing, prolonged length of stay in the hospital, increased hospital costs, as well as increased morbidity and mortality. Therefore, assessment of nutritional status to detect any risk of malnutrition for admitted patients is needed to prevent hospital malnutrition and to determine nutritional therapy.

There are various tools to assess malnutrition, including World Health Organization (WHO), American Society for Parenteral and Enteral Nutrition (ASPEN), and European Society for Clinical Nutrition and Metabolism (ESPEN) criteria. The purpose of this research was to determine the proportion of malnutrition in ambulatory hospitalized patients based on these three tools.

Patients and methods
This is a descriptive and cross-sectional study, and the participants were hospitalized patients at Building A of Cipto Mangunkusumo Hospital, Jakarta, Indonesia, who met inclusion criteria and were willing to participate in this study from October until December 2018.

Inclusion criteria were new patients admitted to building A in the last 24 hours based on Electronic Health Records (EHR), ≥18 years old, had stable haemodynamic status,
could stand, and was willing to sign an informed consent. We excluded patients who had been hospitalized for more than 3 days, who were not in their respective rooms when the data was about to be collected, and who were not suitable for Bioelectrical Impedance Analysis (BIA) examination using Seca medical Body Composition Analyzer (mBCA) 525 (Seca, Hamburg, Germany) due to conditions such as: cramps, tremor, connected to electronic medical devices (electrocardiogram; ECG, infusions pumps), had an electronic implant (pacemaker), had orthopaedic prosthesis, cardiac arrhythmias, was pregnant, or had open wound or skin infections. The final subjects chosen were 109 males and 120 females. This research was approved by the Institutional Review Board (IRB) of Faculty of Medicine Universitas Indonesia, with the number 0668/UN2.F1/ETIK/2018.

Height was measured by Seca 360 (Seca, Hamburg, Germany), which measured the distance from heels to vertex. In this measurement, there were a number of requirements, such as using only minimum light clothing and removal of shoes and socks. The subjects being measured must look straight ahead (Frankfurt plane), arms placed by the side, and shoulders, buttocks, and heels should be touching the wall. During height measurement, the subject was asked to take a breath in order to straighten the spine. The movable part of the equipment was lowered to touch the tip of the head. Height measurement was carried out in a state of sitting and lying down. In sitting position, the subject could produce maximum handgrip strength. HGS measurement was done as part of the ASPEN criteria in determining malnutrition. It was done with the subject sitting and lying down. The hand used in this examination was non-dominant hand.10

WHO criteria for malnutrition is Body Mass Index (BMI) <18.5 kg/m2.11 Two alternative ways to diagnose malnutrition based on ESPEN criteria are 1. BMI <18.5 kg/m2.2 Unintentional weight loss (>10% indefinite of time, or >5% in the last three months) with either BMI <20 kg/m2 in <70 years of age, or <22 kg/m2 in ≥70 years of age) or FFMI (<17 kg/m2 and <15 kg/m2 in men and women, respectively).12 Diagnosis of malnutrition based on ASPEN is carried out with several physical examinations based on the guide.13

Descriptive analysis was performed for categorical variables using frequency distributions. The analysis was performed using "IBM SPSS Statistics 20" (IBM Corporation, SPSS, INC., Chicago, IL, USA).

Results

There were 350 subjects recruited, but only 229 subjects were selected because they were ambulatory. Two hundred and twenty-nine subjects (109 males; 47.6% and 120 females; 52.4%) were analyzed to compute for Fat Mass (FFM) in kg with height in meters squared (kg/m2). FFM was obtained from Seca mBCA 525 (Seca, Hamburg, Germany).

Handgrip Strength (HGS) was measured by Jamar® Handgrip Dynamometer (Sammons Preston, Bolingbrook, IL, USA), using the second handle position since it is considered the most consistent position and could produce maximum handgrip strength. HGS measurement was done as part of the ASPEN criteria in determining malnutrition. It was done with the subject sitting and lying down. In sitting position, the subject was instructed to sit with shoulder adducted, and elbow flexed at 90°. Meanwhile, in supine position, upper extremity remained in the same pose, except that the subject was lying down. The hand used in this examination was non-dominant hand.10

Table-1: Clinical characteristics of participants (n=229).

<table>
<thead>
<tr>
<th>Clinical Characteristic</th>
<th>n</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ward</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal Medicine</td>
<td>100</td>
<td>43.7</td>
</tr>
<tr>
<td>Surgery</td>
<td>78</td>
<td>34.0</td>
</tr>
<tr>
<td>Others</td>
<td>51</td>
<td>22.4</td>
</tr>
<tr>
<td>Malnutrition Screening Tool (MST)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>84</td>
<td>36.7</td>
</tr>
<tr>
<td>1</td>
<td>36</td>
<td>15.7</td>
</tr>
<tr>
<td>2</td>
<td>45</td>
<td>19.7</td>
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<tr>
<td>3</td>
<td>37</td>
<td>16.2</td>
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<tr>
<td>4</td>
<td>13</td>
<td>5.7</td>
</tr>
<tr>
<td>5</td>
<td>14</td>
<td>6.1</td>
</tr>
<tr>
<td>Albumin*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤2.49</td>
<td>5</td>
<td>5.8</td>
</tr>
<tr>
<td>2.5-2.9</td>
<td>7</td>
<td>8.1</td>
</tr>
<tr>
<td>≥3.0</td>
<td>74</td>
<td>86.0</td>
</tr>
<tr>
<td>Karnofsky Performance Status (KPS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤60</td>
<td>21</td>
<td>9.2</td>
</tr>
<tr>
<td>&gt;60</td>
<td>208</td>
<td>90.8</td>
</tr>
</tbody>
</table>

ENT: Ear, Nose, Throat, KPS: Karnofsky Performance Status, MST: Malnutrition Screening Tool.

*Total sample that had albumin examination was 86 subjects.
187 subjects, consisting of 91 males and 96 females. The wards where some of the subjects were collected (51 subjects; 22.4%) consisted of obstetrics and gynaecology (11.4%) patients; neurology (4.4%) patients; ear, nose, and throat (ENT) (5.7%) patients, and dermatology (0.9%) patients. The baseline clinical characteristics of the sample are shown in Table-1.

The proportion of malnutrition at the Cipto Mangunkusumo hospital was 20.1% assessed using WHO criteria, about 43.6% and 27.1%, presenting quite a high difference between ASPEN and ESPEN criteria. A decrease in body weight seen in subjects assessed by ESPEN criteria showed that there was a significant decrease in food intake, loss of appetite, and imbalance between nutrient requirements and intake. This is defined in ESPEN criteria where malnutrition is also defined as a decrease in 5% body weight within 3 months for acute conditions, and >10% in unlimited time for chronic conditions. Term weight loss would encompass significant reductions in food intake, appetite loss, and any imbalance between nutrient requirements and intake. Criteria of weight loss should be combined with either reduced BMI or reduced free fat mass. Meanwhile, criteria of reduced BMI or reduced free fat mass might not be seen in surgery cases associated with acute conditions.

The proportion of malnutrition at the Cipto Mangunkusumo hospital was 20.1% assessed using WHO criteria, about 48.5% of the subjects were malnourished according to ASPEN criteria, and about 42.8% of subjects were malnutrition according to ESPEN criteria, which was then divided according to the levels of malnutrition as shown in Table-2. Based on these three malnutrition diagnostic tools, the malnutrition proportion in each ward could be seen in Figure-1.

**Discussion**

The diagnosis of malnutrition by ESPEN emphasized disease-related malnutrition or malnutrition due to inadequate intake of nutrients. Therefore, the main objective of determining criteria for malnutrition based on ESPEN is to recognize the presence of energy and protein depletion as a result of illness. The BMI criteria are <18.5 kg/m², similar to the recommendations of WHO. Malnutrition criteria by ESPEN also recognize that malnutrition might be different for geriatric patients (malnutrition BMI criteria of 20 kg/m² for <70 years old and 22 kg/m² for ≥70 years old) since it could be associated with weight loss, underlying chronic disease, or changes in nutritional status.

Our subjects who entered internal medicine ward with malnutrition were 54.0% and 51.1% based on ASPEN and ESPEN criteria respectively. Unlike the subjects who were admitted to surgery ward, malnutrition incidence was 43.6% and 27.1%, presenting quite a high difference between ASPEN and ESPEN criteria. A decrease in body weight seen in subjects assessed by ESPEN criteria showed that there was a significant decrease in food intake, loss of appetite, and imbalance between nutrient requirements and intake. This is defined in ESPEN criteria where malnutrition is also defined as a decrease in 5% body weight within 3 months for acute conditions, and >10% in unlimited time for chronic conditions. Term weight loss would encompass significant reductions in food intake, appetite loss, and any imbalance between nutrient requirements and intake. Criteria of weight loss should be combined with either reduced BMI or reduced free fat mass. Meanwhile, criteria of reduced BMI or reduced free fat mass might not be seen in surgery cases associated with acute conditions.

The proportion of malnutrition based on ESPEN in this study is quite high. This could be because most subjects (43.7%) allocated from internal medicine department, which presented most patients suffering from chronic diseases. In addition, the hospital used in this study is the highest referral hospital in Jakarta.

The research conducted by Fink et al, showed that using ESPEN criteria alone to determine the risk of malnutrition might not be as accurate compared to the use of...
combination of malnutrition criteria and other nutrition screening tools. Malnutrition identified based on ESPEN criteria could predict the risk of infection, primarily when used together with Malnutrition Screening Tools (MST) or when used with Nutrition Risk Screening (NRS-2002), which could also predict mortality. The prevalence of malnutrition in patients assessed using ESPEN criteria alone (step 2) compared to those assessed using a combination with NRS-2002 and MST was 20.5%, 29.3%, and 37.1%, respectively. However, Fink's study did not include FFMI in assessing the risk of malnutrition because it had used secondary data. Research conducted by Guerra et al, showed that as many as 72% of subjects screened using NRS-2002 had a risk of malnutrition, then from these results, as many as 57.1% and 12.1% of subjects had malnutrition based on Patient-Generated criteria of Subjective Global Assessment (PG-SGA) and ESPEN criteria. This data proved that ESPEN might be effective in assessing malnutrition, but it will be more accurate when done appropriately with the use of MST or NRS-2002.

The proportion of malnutrition according to ASPEN in this study was higher compared to ESPEN proportion since ASPEN criteria consider the characteristics that reflect nutritional status or inflammatory response associated with underlying disease. The study by Hudson et al, showed that 66.88% of subjects had malnutrition based on ASPEN criteria. Malnourished subjects were associated with 30-day readmissions, with Odd Ratio (OR) 2.13 and mortality with OR 1.76.

The criteria by ASPEN considered more subjective than objective means in grading malnutrition. Rodriguez et al, showed that ASPEN criteria had high sensitivity but low specificity. It means that ASPEN would be more useful to identify early stages of malnutrition or nutrition-related syndromes. Early stages of malnutrition usually occur in acute conditions. Acute conditions are defined as the presence of an underlying disease, which lasts for 3 months. Acute diseases could cause malnutrition due to hypermetabolism and reduced intake. An increase in metabolism leads to depletion of fat mass and muscle mass, resulting in a decrease in body weight and, consequently, malnutrition.

The ASPEN criteria included all of those listed in ESPEN, except for BMI. ASPEN criteria are much more practical since it only needs two criteria to make a definitive malnutrition diagnosis, yet ESPEN criteria require two stages. The first step is to identify the risk of malnutrition, and the second is to determine diagnosis of malnutrition. In ESPEN, malnutrition is associated with poorer functional capacity.

The proportion of malnutrition based on WHO is 20.1%. However, since WHO assesses malnutrition only using BMI, it would not represent the amount of fat mass (FM) and free fat mass (FFM). Therefore, BMI measurement could not determine the amount of adipose tissue in the body. This is crucial since adipose reserve might lead to co-morbidities such as fatty liver, insulin resistance, and malignancy.

When we combined BMI < 18.5 kg/m² and MST ≥2, the proportion of malnutrition increased to 30.6%. Hence, malnutrition is not considered only related to BMI <18.5 kg/m². Malnutrition parameters in ASPEN and ESPEN criteria indicated that physical and objective examination is related to malnutrition even though BMI >18.5 kg/m². ASPEN is more suitable for use in hospitals that do not own complete facilities because most of its nutritional assessment is by anamnesis and physical assessments. ESPEN is more suitable in hospitals that own complete facilities, due to many objective nutritional assessments.

Both ASPEN and ESPEN malnutrition criteria are associated with a longer length of stay in the hospital. Patients' length of stay in the hospital could be influenced by several factors, such as diagnosis, severity of illness, and nutritional status. Pichard et al, and Pirlich et al, showed that malnutrition had a longer hospital stay than who were not. Tsouasi, et al, showed that malnourished patients had a higher length of stay than those well-nourished patients (14.1 days compared to 3.7 days). Furthermore, Merhi et al, showed that complications were more common in those staying at the hospital for ≥7 days.

This study would be the first to compare the diagnosis of malnutrition with these three tools. We used top referral hospitals with various background diseases and we used a wide age range of subjects that helped the data retrieved more applicable.

Unfortunately, this study is limited by a couple of factors. The first being a high cost for the electrodes used during assessment using ESPEN criteria. This resulted in only 187 subjects to be examined, compared to 229 subjects assessed using WHO and ASPEN criteria. Therefore, a lower amount of malnutrition assessed using ESPEN criteria might be due to lack of subjects to be compared with. The second factor is the diversity of diseases present in subjects. The wide range of diseases found during this study complicated the analysis of how certain diseases could be related to the degree of malnutrition found in general population.
Conclusion
The highest proportion of hospital malnutrition in Cipto Mangunkusumo is based on ASPEN, followed by ESPEN, and the latter is WHO. The different criteria could be used according to patient’s condition, whether acute or chronic. ESPEN is more likely to capture malnutrition in chronic conditions, whereas ASPEN is more suitable in acute conditions rather than in chronic ones. Both ESPEN and ASPEN assess nutritional status using subjective and objective means, but ESPEN is more detailed due to the use of high cost facilities. ESPEN data would be more accurate when done appropriately according to its guidelines (with the use of a validated instrument). However, ASPEN criteria is more feasible when used in a low budget setting. ASPEN and ESPEN criteria are better used to determine malnutrition rather than WHO criteria since more factors are considered.

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Conflict of Interest: The authors declare no conflicts of interest.

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