Original Article

Simplified malnutrition tool for Thai patients

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Malnutrition in hospitals often goes unrecognized. At present, no nutrition screening tool provides satisfactory results in identifying nutritional risk. Most tools depend on weight and height as criteria for diagnosing malnutrition. Weight is not recorded in many patients and some tools are time-consuming. An inclusive nutrition screening form (Nutrition Alert Form, NAF) was developed and validated. NAF was modified from the original version of Subjective Global Assessment (SGA) by adding in two standard laboratory tests. The severity of the symptom and laboratory changes were scored. NAF was validated in 210 hospitalized Thai patients at Ramathibodi hospital by an experienced clinical nutritionist (physician) at Ramathibodi hospital. Cross validation was carried out between the dietitian and nurse in another 90 patients. Most of the time nurses could complete the nutrition screening in a patient within 5 minutes. One out of four patients could not be weighed on admission. The scores of 5 and 11 were selected as the cut-off scores of different malnutrition levels due to their high sensitivity, specificity and accuracy and scores of 6 to 10 were defined as moderate malnutrition. The diagnostic agreement between the dietitian and nurse for "normal to mild malnutrition", "moderate malnutrition", and "severe malnutrition" were 85%, 70% and 72%, respectively. NAF for screening of malnutrition in hospitalized Thai patients is easy to use, concise, does not require nutrition expertise and can be used whether or not body weight is taken.

Key Words: nutrition screening tool, malnutrition, nutritional assessment, prevalence, malnutrition risk

INTRODUCTION

Malnutrition occurs in 20% to 50% of hospitalized patients.[1-7] In Asia, the prevalence of undernutrition among hospitalized patients in Beijing, China was found to be 9.2%[8] but in Thailand, it was 40%-70% depending on the parameters used.[9-10] However, malnutrition often goes unrecognized by healthcare providers resulting in increased complications, length of stay and mortality as well as creating an adverse economic impact.[1-7] Early nutrition intervention reverses these impacts.[11-13] Hence, early diagnosis of malnutrition risk is essential as indicated by recent recommendations from the American Society for Parenteral and Enteral Nutrition (ASPEN) in 2011.[14]

The European Society for Parenteral and Enteral Nutrition (ESPEN) stated that the screening tool must also have a high degree of content validity, high reliability and must also be simple, quick and intuitively purposeful.[15] At present, no nutrition screening tool provides satisfactory results in identifying nutritional risk. Most nutrition screening tools depend on weight and height as indicators for the diagnosis of malnutrition. However, weight is not taken in many sick patients and some tools are time-consuming to complete.[16] In addition, BMI categories are often inappropriate for Southeast Asia population with a smaller body type.[17] Though food intake can be affected by abdominal discomfort, changes of gastrointestinal symptoms and food consistency have not been clinically considered. The original version of Subjective Global Assessment (SGA) developed by Detsky[18] does not include the score in classifying the patient to A (well-nourished), B (moderately malnourished) or C (severely malnourished) status. A patient whose nutrition status is classified as B might be close to either A or C and the original SGA does not differentiate these facts. Serum albumin has been a frequent indicator of protein nutritional status and inflammation, lower levels are associated with multiple nutrient deficiencies[19] and also in-hospital mortality[20,21] as well as mortality in patients with hemodialysis.[22] Serum albumin can help identify patients who are likely to become malnourished even if they seem to be adequately nourished.[20] Our original data revealed the prevalence of low albumin level was similar to low arm muscle circumference.[10] Though its half-life is 14-20 days, when properly evaluated, serum albumin level less than 2.8-3.5 g/dL assist the clinician to identify patients who are seriously ill and those at risk of serious nutrition-

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al deficits and probably requires closely monitored medical nutrition therapy.[20,23]

Although lymphocyte count is affected by various factors such as septic conditions and immune reactions, the lymphocyte count in peripheral blood is reduced in malnutrition. Values between 900 and 1500 cells per mm^3 indicate patients who are moderately undernourished and those with values less than $900/mm^3$ denotes patients who are severely undernourished. Both groups have a significantly greater risk of mortality and has been clearly shown in patients suffered from hip fracture.[24] The aims of this study were to develop a nutrition screening form (Nutrition Alert Form, NAF) which is easy, concise, not requiring nutrition expertise and can be used whether or not the body weight is measured by adding in the effects of serum albumin and total lymphocyte count and to validate the Nutrition Alert Form.

MATERIALS AND METHODS

The Nutrition Alert Form was modified from the original version of SGA, developed by Detsky,[18] by stratifying and scoring the symptoms affecting food intake. NAF contains eight sections: height, weight and body mass index, body build, weight change, dietary intake change, gastrointestinal symptoms, functional capacity and patient's disease. We also added two routine standard laboratory tests, including albumin level and total lymphocyte count for patient whose weight was not/could not be taken. NAF excluded physical examination such as muscle wasting, edema, ascites because these judgments require further training and experience. The detail of NAF is attached.

The validation of NAF was carried out and divided into two phases in 210 hospitalized Thai patients at Ramathibodi hospital. The first phase was validation to find the cut-off scores of malnutrition levels by an experienced clinical nutritionist (physician) who confirmed the nutrition diagnosis with standard methods as previously published[10] and an experienced dietitian in 120 hospitalized patients. The second phase was the cross-validation to examine the performance of the NAF by the dietitian and nurse in 90 additional hospitalized patients. Patients were randomly selected from the hospital admission registered in the internal medicine department, Surgery department and Orthopedics department. The exclusion criteria were 1-day admission and age under 18 years. Patients gave their signed consent for participation in the study, which was approved by the Ethics Committee of Ramathibodi hospital. The cut-off scores of malnutrition levels were selected from the 50^{th} and 85^{th} percentile and area under the receiver operating characteristics (ROC) curves. ROC curve analysis was used to examine cut-off scores of malnutrition levels with high sensitivity and specificity. Data were analyzed with the Statistical Package for Social Science, SPSS (SPSS Inc, Chicago, IL, USA) version 13 for Windows. The Kappa (κ) statistic was calculated to measure the diagnostic agreement between the dietitian and nurse.[25]

RESULTS

The NAF was validated in 210 hospitalized Thai patients in the Medicine department (130 patients), the Surgery department (40 patients) and Orthopedics department (40 patients) at Ramathibodi hospital (89 women, 121 men), with a mean age of 59 years (18-97 years). The range of body mass index was from 13.2 to 48.8 kg/m^2, with a mean of 23.2 kg/m^2. The majority of admitted diseases were diabetes, followed by chronic kidney disease (CKD) to end stage renal disease (ESRD), solid cancers, tumor/cancer surgery, chronic heart failure, knee osteoarthritis (OA), severe pneumonia, and gastrointestinal (GI) surgery (Table 1).

Table 1. The distribution of diseases

Disease	%
Chronic heart failure	4.5
CKD-ESRD	15.0
CLD/cirrhosis/hepatic encephalopathy	2.5
COPD	3.5
DM	29.5
Malignant hematologic disease	3.5
Septicemia	3.0
Severe pneumonia	4.0
Solid cancer	12.5
Stroke/CVA	2.5
GI surgery	4.0
Tumor/cancer surgery	6.5
OA knee	4.5
Hip fracture	0.5
Arm/Leg fracture	1.5
Bone tumor/cancer	2.5

Table 2. Percentage of malnutrition in different departments

Department	Normal-mild malnutrition	Moderate malnutrition	Severe malnutrition
Medicine	24%	22%	16%
Surgery	17%	2%	0%
Orthopedics	18%	1%	0%

The prevalence of malnutrition, NAF grade B and C, on admission was 40.5% (85 of 210 patients, moderately malnutrition (NAF grade B) = 24.8% and severe malnutrition (NAF grade C) = 15.7%) and higher prevalence was found in the Medicine department (38%) (Table 2). One fourth of the patients could not be weighed or were not being weighed on admission (25.24%).

Data from the 50^{th} and 85^{th} percentile and area under the ROC curves, revealed the scores of 5 and 11 as high sensitivity, high specificity and high accuracy (Tables 3 and 4). Therefore, the scores of 5 and 11 were selected as the cut-off scores of malnutrition levels. The scores of 0 to 5 were defined as "normal to mild malnutrition" (NAF=A), 6 to 10 were defined as "moderate malnutrition" (NAF=B) and 11 and higher were defined as "severe malnutrition" (NAF=C). Additionally, the scores of 6 as the cut-off score for moderate malnutrition was confirmed by area under the ROC curve and revealed high sensitivity, high specificity and high accuracy (Table 4).

Most of the time nurses could complete the nutrition screening of a patient within 5 minutes. In examining the

Table 3. Percentile ranking of scores determining malnutrition

Percentile	Scores
5th	0
10th	1
25th	2
50th	5
75th	9
85th	11
90th	12
95th	15

performance of the NAF, the nurse's and experienced dietitian's diagnosis scores were compared. The diagnostic agreement between dietitian and nurse for "normal to mild malnutrition", "moderate malnutrition", and "severe malnutrition" were 85%, 70% and 72%, respectively (κ statistic = 0.57). Moreover, the reliability test had been done in the 8-item questionnaire prior to the study (reliability = 0.561).

DISCUSSION

The prevalence of malnutrition in our study was 40.5% similar to the previous study in hospitalized Thai patients at Ramathibodi hospital.[9] Our results revealed 24.8% as moderately malnourished and 15.7% as severely malnourished, which are consistent with the high prevalence of malnutrition found in other studies.[1-3] Vidal *et al* found no difference in the prevalence of malnutrition in medical and surgical wards;[26] however, our findings (Table 2) agree with those of Velasco *et al*[27] showing higher prevalence of malnutrition in the medical patients than surgical patients. This suggests that most surgical conditions are progressive and hospitalization is inevitable; therefore, requiring medical attention earlier than most medical conditions. The other explanation is the patients' concern about their own health.

Usual nutrition screening tools such as the Malnutrition Universal Screening Tool (MUST), Nutritional Risk Screening 2002 (NRS 2002), Mini Nutritional Assessment® (MNA) and Malnutrition Screening Tool (MST)[16] rely mainly on body weight or BMI. This hinders the applicability of the assessment tools. In England, about one sixth of the patients (256 out of 1611 patients in four hospitals) could not be weighed for screening.[1] Our findings demonstrated that one forth of the patients could not be weighed on admission. Moreover, weight at hospital admission was obtained in only 26.5% of patients in Latin America (from 9348 patients).[3] The failure to record the weight at any time during the episodes of patient care does suggest that nutritional status was not assessed in these people.[28] These lead to underestimation of the malnutrition prevalence. To correct these drawbacks NAF included serum albumin and total lymphocyte count which are two standard laboratory tests done in most inpatients. Though serum albumin level is not a sensitive test for assessing nutrition change, it can help to identify patients at risk of serious nutritional deficits requiring nutritional intervention.[20] These two parameters are affected by various insults, these insults are part of the disease and disease process affecting the body's nutrition status. This is similar to the condition when we assess a patient, we are assessing the cumulative result of multiple affronts. Furthermore, almost all patients had either one these laboratory data done within one admission day and not being used in the nutritional evaluation. NAF puts these forgotten facts back to work. By using NAF, the nutrition status of patient whose weight could not be taken can still be evaluated, and this can be done without further training. Moreover, albumin was combined with C-reactive protein into the Glasgow Prognostic Score (GPS) which reflects cachexia and has been used as a predictor of cancer survival.[29] Also the risk of mortality increased with total lymphocyte count less than 1500 cells per mm^3.[24] O'Daly *et al* studied survival in hip fracture patients and concluded that serum albumin and total lymphocyte count were accurate and inexpensive clinical markers of protein-energy malnutrition.[30]

While the Kappa value (κ) of the interobserver agreement on SGA between two clinicians from one previous study was 0.784,[18] the κ value on MNA between two geriatric clinicians from another study was 0.51.[31] The κ value of diagnostic agreement between dietitian and nurse using NAF in our study was 0.57 ($p<0.01$) in spite of the fact that our observers were from different healthcare specialties. We believe that the discrepancy is easily lessened with practice. NAF also stratified the symptoms which interrupt the patient from obtaining adequate intakes. Hence, the changing of score with follow up monitoring will be useful for care providers to see the progress of their interventions.

Some nutrition screening tools includes physical examination which required practical experience such as the diagnosis of pedal edema and ascites, whereas many nutrition screening tools often require experienced clinicians and dietitians to collect data, which therefore become too specialized and time-consuming for implementation on a hospital-wide basis. The MNA requires more than 10 minutes to finish and is only suitable for elderly.[27] In many instances, determination of the body weight requires a special weighing machine and more than one man power to carry out the work. NAF provides content validity, simplicity and accurate results. We found that NAF was also very convenient for nurses since it is also a small part of their routine work. Therefore, the NAF for screening of malnutrition in hospitalized Thai patients is easy to use, concise, does not require nutrition expertise and can be used whether or not the body weight is taken.

Table 4. The scores of malnutrition risk and accuracy according to area under the ROC curves

Score	Sensitivity	Specificity	PPV*	NPV*	Accuracy
5	100	93	91.4	100	96
6	90	100	100	95.7	97
11	84	100	100	95.7	97

*PPV = Positive Predictive Value, NPV = Negative Predictive Value

Additionally, it helps the health professional team identify the undiagnosed malnourished patients.

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AUTHOR DISCLOSURES

No conflict of interest in this study.

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Appendix

Nutrition Alert Form
A simplified nutrition screening form for Nurse

Name ..... ☐ Male ☐ Female Age.....yr HN.....D/M/Y admitted ..... Time.....

Diagnosis ..... Data from ☐ Patient ☐ Pt.'s relative ☐ from.....

Mark ✓ in ☐ by choosing only one choice in each big topic and small topic (except topics 6 and 8 which more choices are allowed) and fill scores in the box — Scores

1. Height/Body's lenght/Arm span ☐ Height ..... cm

☐ Body's lenght..... cm ☐ Arm span ..... cm ☐ From Pt.'s relative ..... cm

2. Weight and Body mass index [Body mass index (BMI) = Weight (kg)/Height (m)^2]

2.1 Weight..... kg ☐ Lie down position *(1)* ☐ Stand position *(0)* ☐ Not feasible *(0)* ☐ From Pt.'s relative *(0)*

2.2 BMI.....kg/m^2 ☐ BMI < 17.0 kg/m^2 *(2)* ☐ BMI 17.0-18.0 kg/m^2 *(1)* ☐ BMI 18.1-29.9 kg/m^2 *(0)* ☐ BMI ≥ 30.0 kg/m^2 *(1)*

If weight is not available, use either Albumin or Total Lymphocyte Count (TLC) (TLC = Total WBC/mm^3 X % Lymphocyte/100)

2.1 Albumin ☐ ≤ 2.5 g/dl (< 25 g/l) *(3)* ☐ 2.6-2.9 g/dl (26-29 g/l) *(2)* ☐ 3.0-3.5 g/dl (30-35 g/l) *(1)* ☐ >3.5 g/dl (35 g/l) *(0)*

2.2 TLC ☐ ≤ 1,000 cells/mm^3 (3) ☐ 1,001-1,200 cells/mm^3 *(2)* ☐ 1,201-1,500 cells/mm^3 *(1)* ☐ >1,500 cells/mm^3 *(0)*

3. Body build ☐ Too thin *(2)* ☐ Thin *(1)* ☐ Obese *(1)* ☐ Normal-Overweight *(0)*

4. Weight change in the past 4 wk. ☐ Decreased *(2)* ☐ Increased *(1)* ☐ Not available *(0)* ☐ Stable *(0)*

5. Dietary intake in the past 2 wk.

5.1 Type ☐ Clear liquid diet *(2)* ☐ Full liquid diet/BD/Medical food *(2)* ☐ Soft diet *(1)* ☐ Regular diet *(0)*

5.2 Quantity ☐ Too little *(2)* ☐ Little *(1)* ☐ Too much *(0)* ☐ Adequate *(0)*

6. Persistent gastrointestinal symptoms in the past 2 wk. (more than one choice is allowed)

6.1 Chewing / Swallowing problems ☐ Aspiration *(2)* ☐ Chewing difficulty/Dysphagia/Tube feeding *(2)* ☐ No *(0)*

6.2 Gastrointestinal problems ☐ Diarrhea *(2)* ☐ Abdominal pain (2) ☐ No *(0)*

6.3 Problems during intake ☐ Vomiting *(2)* ☐ Nausea *(2)* ☐ No *(0)*

7. Functional capacity ☐ Bed ridden *(2)* ☐ Needs assistance occasionally *(1)* ☐ Self dependence *(0)* ☐ Normal *(0)*

8. Pt.'s disease, please inform dietitian/nutritionist (more than one choice is allowed)

☐ DM *(3)* ☐ CKD-ESRD *(3)* ☐ CLD/Cirrhosis/Hepatic encephalopathy *(3)*

☐ Solid cancer *(3)* ☐ Chronic heart failure *(3)* ☐ Severe head injury *(3)*

☐ Hip fracture *(3)* ☐ COPD *(3)* ☐ ≥ 2° of burn *(3)*

☐ Stroke/CVA *(6)* ☐ Septicemia *(3)* ☐ Severe pneumonia *(6)*

☐ Multiple fracture *(6)* ☐ Malignant hematologic disease/ Bone marrow transplant *(6)* ☐ Critically ill *(6)*

Total Scores*

*Interpretation

☐ *Scores of 0-5* (NAF = A : Normal-Mild malnutrition)
No risk of malnutrition, nurse should rescreen the patient again within 7 days.

☐ *Scores of 6-10* (NAF = B : Moderate malnutrition) *Please inform attending doctor and dietitian/nutritionist immediately.*
Moderate risk of malnutrition. Patient should be assessed by dietitian/nutritionist and received nutrition therapy by attending doctor **within 3 days.**

☐ *Scores of 11 and more* (NAF = C : Severe malnutrition) *Please inform attending doctor and dietitian/nutritionist immediately.*
Severe risk of malnutrition. Patient should be assessed by dietitian/nutritionist and received nutrition therapy by attending doctor **within 24 hours.**

Screened by.....D/M/Y.....Time.....

Nutrition Alert Form : Developed by Prof. Surat Komindr, MD, Division of Nutrition and Biochemical Medicine, Department of Medicine, Ramathibodi Hospital

Original Article

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應用於泰國病人的簡易營養不良篩檢工具

營養不良在醫院裡經常沒被發現。目前，沒有滿意的營養篩檢工具以確認營養的風險。大部分診斷營養不良的工具是依據體重及身高當標準，但是很多病人沒有體重記錄，且某些工具是費時的。本文敘述發展一個完整的營養篩檢表單(營養警訊單，NAF)且測試其效度。NAF 是修訂自主觀整體評估(SGA)原始版加入兩項標準生化值測量。評量症狀的嚴重性及生化值的改變。NAF 的效度測試是由有經驗的臨床營養學者(醫師)評估 210 名在 Ramathibodi 醫院住院的泰國病人。交叉驗證是由營養師及護士執行於另 90 名病人。多數時候，護士可以在 5 分鐘內完成病人的營養篩檢。四分之一的病人在入院時無法秤體重。由於它們的高敏感度、特異度及準確性，5 分和 11 分被當作不同營養不良程度的切點，6 至 10 分被定義為中度營養不良。營養師及護士之間的診斷一致性，在“正常至輕度營養不良”、“中度營養不良”及“重度營養不良”分別為 85%、70%及 72%。應用於住院的泰國病人的營養不良篩檢，NAF 優點是易使用、簡要、不需要營養專長，且不論是否有體重資料都可以使用。

關鍵字：營養篩檢工具、營養不良、營養評估、盛行率、營養不良風險