Research article

Validation of a Nutrition Alert Form (NAF) against Patient-Generated Subjective Global Assessment (PG-SGA) in Patients with Locally Advanced Head and Neck Squamous Cell Carcinoma

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ABSTRACT

Malnutrition is an under-recognized problem among oncological patients. However, there are no nutritional assessment tools that are easy to use and provide accurate results in time-limited settings. This study aimed to validate a Nutrition Alert Form (NAF) versus the Patient-Generated Subjective Global Assessment (PG-SGA) among patients with locally advanced head and neck squamous cell carcinoma (LA-HNSCC), as well as to determine the relationships between nutritional status and clinical outcomes. We prospectively enrolled 110 LA-HNSCC patients (77.3% males) who underwent chemoradiotherapy in the nutrition clinic at our institution. Nutritional status was assessed using both PG-SGA and NAF at the same timepoints. Body composition was determined by multifrequency bioelectrical impedance analysis. A total of 92.7% and 91.8% of patients were malnourished according to PG-SGA and NAF, respectively. NAF had a sensitivity of 97% and specificity of 75% versus PG-SGA. The agreement between the two assessment tools was moderate but significant (kappa = 0.59, $P < 0.001$). Dietitians completed NAF significantly faster than PG-SGA (3.6±1.3 vs. 16.4±3.3 min, $P < 0.001$). The NAF score correlated highly with the PG-SGA score ($r = 0.80$, $P < 0.001$). The NAF score and PG-SGA score were negatively associated with fat mass and skeletal muscle mass ($P < 0.03$ for all parameters). The NAF score correlated significantly with the PG-SGA score in terms of assessing nutritional status among oncological patients with high sensitivity and specificity. Given the simplicity and convenience of NAF compared to PG-SGA, the NAF tool should be an alternative nutrition assessment tool among oncological patients during routine clinical practice, particularly in time-limited settings.

Key words: Cancer, Nutrition screening, Nutrition assessment, Malnutrition, Head and Neck cancer

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บทความวิจัย

การศึกษาภาวะโภชนาการโดยใช้แบบประเมิน Nutrition Alert Form (NAF) เปรียบเทียบกับ Patient-Generated Subjective Global Assessment (PG-SGA) ในผู้ป่วยโรคมะเร็งศีรษะและลำคอชนิดเซลล์ Squamous

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บทคัดย่อ

ภาวะทุพโภชนาการเป็นปัญหาที่พบมากในผู้ป่วยโรคมะเร็ง ในประเทศไทยยังไม่มีเครื่องมือเฉพาะในการประเมินภาวะโภชนาการที่ใช้งานง่าย ไม่ต้องใช้เวลามากและให้ผลลัพธ์เป็นที่น่าพอใจในผู้ป่วยกลุ่มนี้ จึงนำมาสู่วัตถุประสงค์ของการศึกษานี้ เพื่อศึกษาการใช้แบบประเมินภาวะโภชนาการ Nutrition Alert Form (NAF) เปรียบเทียบกับแบบประเมิน Patient-Generated Subjective Global Assessment (PG-SGA) นอกจากนั้นยังศึกษาความสัมพันธ์ของภาวะโภชนาการโดยการใช้แบบประเมินและตัวชี้วัดทางโภชนาการอื่นๆ เช่น ตัวชี้วัดทางชีวเคมี ข้อมูลองค์ประกอบร่างกาย กับผลลัพธ์ในทางคลินิก โดยทำการศึกษาในผู้ป่วยโรคมะเร็งศีรษะและลำคอชนิดเซลล์ Squamous ที่เข้ามารับการรักษาที่คลินิกผู้ป่วยนอกโรงพยาบาลรามาธิบดี กรุงเทพฯ จำนวน 110 ราย (เพศชาย 77.3%) จากผลการศึกษาพบว่า ผู้ป่วย 92.7% และ 91.8% มีภาวะทุพโภชนาการจากการใช้แบบประเมิน PG-SGA และ NAF ตามลำดับ เมื่อใช้แบบประเมิน PG-SGA เป็นมาตรฐาน พบว่า NAF มีความไว 97% และความจำเพาะ 75% เมื่อศึกษาความสอดคล้องระหว่างเครื่องมือ พบว่า มีความสอดคล้องปานกลาง (kappa = 0.59, $P < 0.001$) เมื่อประเมินเวลาที่ใช้ในการตอบแบบประเมินพบว่า NAF ใช้เวลาเฉลี่ย 3.6 ± 1.3 นาที ในขณะที่ PG-SGA ใช้เวลาเฉลี่ย 16.4 ± 3.3 นาทีต่อครั้ง ($P < 0.001$) เมื่อศึกษาความสัมพันธ์ของแบบประเมินและตัวชี้วัดทางโภชนาการ พบว่า ค่าคะแนนของแบบประเมิน NAF มีความสัมพันธ์เชิงบวกเท่ากับ 0.80 กับค่าคะแนนจากแบบประเมิน PG-SGA อย่างมีนัยสำคัญทางสถิติ ($r = 0.80$, $P < 0.001$) รวมถึงมีความสัมพันธ์เชิงลบกับตัวชี้วัดจากการวัดองค์ประกอบร่างกายอย่างมีนัยสำคัญทางสถิติอีกด้วย ($P < 0.03$ ทุกตัวชี้วัด) กล่าวโดยสรุป แบบประเมิน NAF มีความไวและความจำเพาะในการประเมินภาวะโภชนาการในผู้ป่วยกลุ่มโรคนี้ เนื่องจากผู้ใช้ไม่จำเป็นต้องมีความรู้ ความเชี่ยวชาญเฉพาะด้าน นอกจากนั้นยังใช้เวลาไม่นานจึงมีความเหมาะสมที่จะนำไปใช้ในทางปฏิบัติ

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Introduction

Head and neck cancers are common among developing countries and are particularly prevalent in Asia[1]. The World Health Organization reported that the worldwide incidence of head and neck cancers has been over 550,000 cases/year, with approximately 300,000 patients dying each year[2,3]. Squamous cell carcinoma is the most common histological subtype. The majority of head and neck squamous cell carcinoma (HNSCC) patients typically present with locally advanced (LA) disease for which surgery and/or chemoradiotherapy (CRT) are the mainstays of treatment[4]. Malnutrition is a significant problem among HNSCC patients because the tumors originate in the proximal alimentary tract. In addition, the main treatments of surgery and/or CRT usually affect appetite and swallowing functions in patients, resulting in decreased oral intake. Approximately 30-50% of patients have malnutrition at the time of diagnosis and the prevalence of malnutrition increases to around 80% during treatment[5]. Malnutrition is associated with many adverse outcomes including impaired immune system, impaired tolerance to anticancer treatment, reduced quality of life, increased healthcare costs, morbidity, and mortality[6-8]. Moreover, the nutritional status of HNSCC patients is associated with treatment outcomes[9-11]. Well-nourished patients tolerate CRT better and show better treatment efficacy[12]. Consequently, appropriate nutritional care for oncological patients is critical to improve their treatment outcomes and quality of life and reduce the mortality rate[13]. Early nutrition screening and assessment to detect patients with malnutrition at the time of diagnosis is recommended for all oncological patients[14,15].

Patient-Generated Subjective Global Assessment (PG-SGA) is a reliable nutritional assessment tool with high sensitivity and specificity to identify patients with malnutrition. It is used as a standard cancer-specific nutrition assessment tool and is recommended by the Oncology Nutrition Dietetic Practice Group, American Dietetic Association. However, it is time-consuming and users require training to complete the clinical assessment[16-18]. Moreover, due to the tool's complexity, only a few oncological patients are evaluated for nutritional status, particularly in countries with limited resources. The Nutrition Alert Form (NAF) is a simple nutrition assessment tool that was developed by Komindr et al. and is widely used in Thailand. It has been validated among hospitalized patients and shown to be accurate, easy to use, and concise, without any requirement for nutrition expertise[19]. NAF has been recommended as a nutritional assessment tool for general patients, particularly hospitalized patients, by the Society of Parenteral and Enteral Nutrition of Thailand (https://www.spent.or.th/).

To date, there have been no nutrition assessment tools that are easy to use and provide accurate results for identification of malnourished HNSCC patients in time-limited settings. The primary objectives of this study were to validate NAF versus PG-SGA among patients with LA-HNSCC who had undergone surgery and/or CRT or RT only, as well as to determine the relationships between baseline nutritional status and clinical outcomes as a secondary outcome.

Material and Method

Participants and study design

This prospective cohort study was conducted at Ramathibodi Hospital, Mahidol University, Bangkok, Thailand, between January 2018 and January 2019.The study was approved by the Ethics Committee for Research, Faculty of Medicine, Ramathibodi Hospital, Mahidol University (Protocol number:ID11-60-31). The study was explained in detail to participants and they were given the opportunity to ask any questions. All participants voluntarily signed and dated an informed consent form. The inclusion criteria were age >18 years, consent for participation in the study, and ability to communicate and answer the questions. Individuals with metastasis or unstable medical conditions were excluded. All patients received nutrition counseling before treatment and at every follow-up visit during treatment at the nutrition clinic. Sample size calculation was based on the assumption that the prevalence of malnutrition risk in this population was around 40%[20] and that NAF had >90% sensitivity to detect patients at risk of malnutrition. The minimum sample size for this study was 88 patients.

Data collection

Nutritional assessment

All participants were interviewed by two well-trained dietitians and assessed for nutrition status by PG-SGA and NAF. PG-SGA was developed in 1994 as a modification of SGA so as to be more specific for oncological patients, and its details were described elsewhere[21]. Permission to use the PG-SGA© was received from Pt-Global (http://pt-global.org). It consists of two sections: 1) a medical history (weight change, food intake, symptoms related to eating problems, activity) that was originally designed to be completed by patients using a checkbox format, and 2) a physical examination performed by health professionals, such as a physician, nurse, or dietitian. In this study, both PG-SGA sections were completed by dietitians. The PG-SGA score provides a global rating of patient nutritional status. A higher score indicates a greater risk of malnutrition, while a score ≥ 9 indicates a critical need for nutrition support[16]. Nutritional statuses of patients were classified into three groups: well-nourished (PG-SGA A or NAF A), moderately or suspected of being malnourished (PG-SGA B or NAF B), and severely malnourished (PG-SGA C or NAF C).

NAF was modified from the original SGA and consists of eight sections: weight, height and body mass index (BMI), body build, weight change, dietary intake change, gastrointestinal symptoms, functional capacity, and co-morbid diseases. Serum albumin level and total lymphocyte count (TLC) were added to provide alternative options when body weight could not be measured. NAF excluded physical examinations, such as fat loss, muscle wasting, and edema, because practitioners would require further training and experience. NAF classified patients into three categories: well-nourished (NAF A; score 0-5), moderately or suspected of being malnourished (NAF B; score 6-10), and severely malnourished (NAF C; score ≥ 11). The details of PG-SGA and NAF have been described previously elsewhere[19,22].

Clinical outcomes

We collected data on patient characteristics, treatment modality, complications, and outcomes. The following clinical data were collected: age, sex, tumor site, tumor stage, treatment, co-morbid diseases, height, weight, BMI, and body composition. BMI was calculated as weight (kg)/height (m)^2 and classified according to the Asia-Pacific criteria: underweight, < 18.5 kg/m^2; normal weight, 18.5-22.9 kg/m^2; overweight, 23.0-24.9 kg/m^2; obese, ≥25.0 kg/m^2. Body composition was determined after at least 8 h of fasting using multifrequency bioelectrical impedance analysis with eight tactile electrodes (InBody 770; Biospace, Seoul, Korea). Blood samples for assessment of albumin and TLC were obtained before treatment initiation. TLC was derived by multiplying the percentage of lymphocytes by white blood cell count. All patients received nutrition counseling and the nutrition requirement goal was at least 30–35 kcal/kg/day with 1.2-1.5 g/kg/day protein intake[23].

The clinical outcome in this study was treatment interruption and defined as: 1) reduction in dose of chemotherapy, 2) delay or stoppage of chemotherapy, 3) one break in radiation therapy (physician- or patient-initiated treatment interruption), and 4) unplanned hospital admission[24].

Statistical analysis

Statistical analyses were performed using Statistical Package for Social Science version 19 software (SPSS, IBM Corporation, Chicago, IL, USA). Mean and standard deviation were presented for continuous variables. Proportion and chi-square test were used for categorical variables. Validation of NAF was defined as its ability to identify patients who were malnourished compared to PG-SGA. Nutritional status classified by NAF and PG-SGA was dichotomized into malnourished (NAF B, C or PG-SGA B, C) and well-nourished (NAF A or PG-SGA A). Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated. Cohen's kappa test was used as a measure of agreement between tools. Pearson correlation coefficient was used to assess the correlations between either the PG-SGA score or NAF score and other nutrition parameters. Logistic regression was used to determine predictive factors of treatment interruption (chemotherapy, radiotherapy and hospital admission). All tests were two-sided and $P < 0.05$ was considered statistically significant.

Results

A total of 110 patients (85 men; 77.3%) were enrolled in the study. Mean age was 56.0±10.7 years, mean weight was 59.9±12.9 kg, and mean BMI was 22.0±3.9 kg/m^2. The study included patients with various stages, tumor sites, and times of assessment for nutritional status. Thirty-nine patients (35.5%) were diagnosed with nasopharynx cancer. Most patients were diagnosed with stage IVA and IVB (69.1%). Eighty-one patients (73.6%) were assessed for nutritional status before treatment initiation and the others were assessed for nutritional status during and after CRT treatment. **Table 1** shows patient characteristics. Primary prophylactic percutaneous endoscopic gastrostomy (PEG) was performed for enteral nutrition support during oncological treatment in most patients (83.6%). The majority of patients received definitive CRT (82.7%) as their main treatment.

Nutritional status

Overall, 92.7% and 91.8% of patients were malnourished according to PG-SGA and NAF, respectively. In comparing PG-SGA and NAF in terms of nutritional status assessment, PG-SGA classified 8 patients (7.3%) as well-nourished, 73 patients (66.4%) as moderately malnourished, and 29 patients (26.3%) as severely malnourished, while NAF classified 9 patients (8.2%) as normal to mildly malnourished, 56 patients (50.9%) as moderately malnourished, and 45 patients (40.9%) as severely malnourished. Malnourished patients were significantly older and had lower body weight than well-nourished patients. Data are given in **Table 2**.

Validity and reliability of NAF

Using PG-SGA as a reference, NAF had a sensitivity of 97.0% and specificity of 75.0%. The agreement between the two assessment tools was significant (kappa=0.59, P<0.001). The PPV of NAF was 98.0% and the NPV was 66.7%. Data are shown in **Table 3**.

Examination of the agreement between the dietitians (examiners) for NAF was 90% (kappa=0.84, P=0.002) and that for PG-SGA was 70% (kappa=0.54, P=0.006). Moreover, NAF required less time to complete than PG-SGA. The mean time for dietitians to complete PG-SGA and NAF was 16.4±3.3 min and 3.6±1.3 min, respectively (P<0.001).

Before treatment initiation, using PG-SGA as a reference and using albumin instead of weight, NAF had a sensitivity of 94.6%, specificity of 71.4%, and kappa value of 0.66 (P<0.001). When TLC was used instead of weight, NAF had a sensitivity of 95.9%, specificity of 57.1%, and kappa value of 0.67 (P<0.001). The data are shown in **Table 3**.

Correlations between baseline nutritional status, nutritional markers, and clinical outcomes

Malnourished patients, classified by either PG-SGA or NAF, had significantly lower pre-treatment albumin levels than well-nourished patients. NAF score was positively correlated with PG-SGA score (r=0.80, P<0.001). Albumin was the only biochemical marker that showed a negative correlation for PG-SGA score (r= -0.45, P<0.001) and NAF score (r= -0.46, P<0.001). Fat mass (FM) and skeletal muscle mass (SMM) were negatively associated with PG-SGA score and NAF score (P<0.03 for all parameters). The data are shown in Table 4. Unfortunately, we were unable to demonstrate an association between baseline nutritional status, classified by either PG-SGA or NAF, and any treatment interruption or unplanned hospitalization.

Table 1. Patient characteristics

Parameters	N =110
Age (years)	56.0±10.7
Gender	
Male	85 (77.3)
Tumor site	
Nasopharynx	39 (35.5)
Oral cavity	21 (19.1)
Oropharynx	18 (16.4)
Hypopharynx	16 (14.5)
Larynx	15 (13.6)
Unknown primary	1 (0.9)
Tumor stage	
II	12 (10.9)
III	22 (20.0)
IVA–IVB	76 (69.1)
Co-morbid diseases	
Hypertension	28 (25.4)
Type 2 diabetes	5 (4.5)
Chronic kidney disease	4 (3.6)
Chronic liver disease	7 (6.3)
Chronic lung disease	9 (8.1)
Cardiovascular disease	3 (2.7)
Treatment	
Definitive chemoradiotherapy	91 (82.7)
Surgery and chemoradiotherapy	14 (12.8)
Surgery and radiotherapy	2 (1.8)
Radiation therapy alone	3 (2.7)

Data are presented as mean ± standard deviation or number (%)

Table 2. Characteristics of patients according to nutritional status classified by NAF

Variables	Total population (n=110)	Nutritional status		P - value
		Well-nourished (class A)	Malnourished (class B + C)	
Age (years)	56.0±10.7	48.9±10.0	56.7±10.6	0.03*
Gender				0.97
Male	85 (77.3)	7 (77.8)	78 (77.2)	
BW (kg)	59.9±12.9	68.5±11.7	58.4±12.2	0.02*
BMI (kg/m^2)	22.0±3.9	24.1±2.6	21.8±3.9	0.09
Tumor site				
Non-NPC	71 (64.5)	2 (22.2)	69 (68.3)	0.009**
NPC	39 (35.5)	7 (77.8)	32 (31.7)	
Tumor stage				0.01*
II	12 (10.9)	3 (33.3)	9 (8.9)	
III	22 (20.0)	4 (44.4)	18 (17.8)	
IVA–IVB	76 (69.1)	2 (22.3)	74 (73.3)	
Albumin (g/L)	35.0±4.3	38.2±2.1	34.6±4.3	0.001**
TLC (cells/mm^3)	1,758.5±612.7	1,928.3±775.6	1,737.2±592.5	0.38
PG-SGA score	11.7±6.5	2.8±1.2	12.5±6.2	<0.001***
FM (kg)	16.1±8.1	18.4±4.0	15.9±8.3	0.57
FM (%)	25.2±8.6	26.9±5.7	25.9±8.9	0.69
SMM (kg)	24.6±4.8	27.8±4.3	24.4±4.8	0.17
SMM (%)	40.6±4.7	40.6±3.5	40.6±4.8	0.97

Data are presented as mean ± standard deviation or number (%), Mean values of parameters were compared by an independent-sample *t*-test and the chi-square test for categorical variables.

Albumin and TLC were analyzed in 81 patients which were enrolled before treatment initiation.

NPC: nasopharynx cancer; TLC: total lymphocyte count; PG-SGA: Patient-Generated Subjective Global Assessment; NAF: Nutrition Alert Form; FM: fat mass; SMM: skeletal muscle mass.

Significance in shown by *P < 0.05, **P < 0.01, ***P < 0.001.

Table 3. Diagnostic value of NAF compared with PG-SGA

	PG-SGA					
	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Κ-value	P-value
NAF(BW)	97.0	75.0	98.0	66.7	0.59	<0.001
NAF (Alb)	94.6	71.4	97.2	55.5	0.66	<0.001
NAF(TLC)	95.9	57.1	95.9	57.1	0.67	<0.001

NAF (Alb) and NAF(TLC) were analyzed in 81 patients which were enrolled before treatment initiation.

PG-SGA: Patient-Generated Subjective Global Assessment; NAF: Nutrition Alert Form; PPV: positive predictive value; NPV: negative predictive value; Κ-value: Cohen's kappa coefficient value; Alb: albumin; TLC: total lymphocyte count.

Table 4. Relationships between PG-SGA score, NAF score, and other nutrition parameters

Nutritional parameters	PG-SGA score		NAF score	
	r†	*p*-value	r†	P - value
NAF score	0.80	<0.001***	1	-
Albumin (g/L)	-0.45	<0.001***	-0.46	<0.001***
TLC (cells/mm^3)	-0.08	0.44	-0.23	0.05
FM (kg)	-0.54	<0.001***	-0.39	0.004**
SMM (kg)	-0.37	0.002**	-0.30	0.02*

†Pearson correlation test.

Albumin and TLC were analyzed in 81 patients which were enrolled before treatment initiation.

PG-SGA: Patient-Generated Subjective Global Assessment; NAF: Nutrition Alert Form; TLC: total lymphocyte count; FM: fat mass; SMM: skeletal muscle mass.

Significance in shown by *P < 0.05, **P < 0.01, ***P < 0.001.

Discussion

In the present study, we demonstrated a high prevalence of malnutrition among HNSCC patients. Specifically, malnutrition was found among 92% of the participants. NAF had high sensitivity and specificity to diagnose malnutrition compared to PG- SGA. The agreement between the two assessment tools was significant. This is the first study designed to compare NAF with PG- SGA in HNSCC patients. NAF had high sensitivity and specificity compared to PG-SGA and was an appropriate score for classification of nutritional status. NAF provided reliability and simplicity because it required less time to complete, was easy to use, and did not require nutrition expertise compared to PG-SGA. When body weight was unavailable, the parameters of albumin and TLC were added to NAF. Our results showed good agreement between PG-SGA and NAF with and without use of albumin or TLC to replace body weight. Moreover, the overall NAF score was beneficial for follow- up of nutritional status during the course of treatment.

Both nutritional assessment tools were able to identify patients at risk of malnutrition. However, NAF appeared more sensitive in terms of identifying patients with severe malnutrition than PG-SGA (40% of patients were severely malnourished according to NAF and only 26% according to PG-SGA). This finding may be explained by the different classifications of the two assessment tools. NAF classifies severity of malnutrition according to the basic disease stress conferring metabolic changes, while PG-SGA classifies patients by individual judgment according to physical examination and others.

The cross-validation between the two dietitians demonstrated that there was less disagreement between the examiners using NAF than with PG-SGA. Moreover, the dietitians required less time to complete NAF compared to PG-SGA. This implies that NAF is easy and more practical to use in time-limited settings, such as outpatient clinics. Given the simplicity of NAF, any healthcare personnel can assess nutritional status and notify the primary physician promptly to prescribe early nutrition intervention that will be of benefit to oncological patients.

Malnutrition is an independent predictor of treatment outcome among cancer patients[25-27]. Serum albumin is one of the makers for nutritional status that is used for non-critically ill patients. As expected, our study demonstrated that serum albumin negative correlated with PG-SGA score and NAF score. Low serum albumin concentrations have been associated with poor treatment outcomes and pre-treatment albumin level $\geq$ 4.0 g/dL can decrease mortality. Serum albumin is an independent prognostic indicator among patients with advanced head and neck cancer treated with concurrent chemoradiotherapy[28]. However, we could not demonstrate an association between baseline nutritional status, classified by either PG-SGA or NAF, and treatment interruption. This could be explained by the fact that all patients in the present study participated in an intensive nutrition support program before and during the course of treatment. Consequently, patients with malnutrition before treatment initiation may have had better nutritional statuses during the treatment course. Early nutrition intervention may lead to improved treatment tolerance and decreased treatment interruption. In this study, over 80% of patients had primary prophylactic PEG according to our institutional standard practice for LA-HNSCC patients undergoing CRT. The results may be different in other centers where prophylactic PEG is not considered a standard treatment[29]. Moreover, the sample size in our study was small; thus, it might be underpowered in terms of detecting the association.

It is interesting that our study revealed negative associations between NAF scores or PG-SGA scores and SMM. Consequently, patients with high NAF scores or PG-SGA scores may not only suffer from malnutrition, but also have sarcopenia. It has been demonstrated that sarcopenia and sarcopenic obesity have negative impacts on treatment outcomes among oncological patients[30,31]. In addition to routine weight measurement, body composition analysis can provide a precise diagnosis of sarcopenia and sarcopenic obesity. Assessment of body composition should be considered for routine use in clinical practice because of its potential to improve individual nutritional care plans.

We acknowledge several limitations in our study. First, it was a cross-sectional study and we did not include nutritional interventions in the analysis. Second, we were only able to assess nutritional status before treatment initiation among 73.6% of patients, while the remaining patients were assessed for nutritional status during and after CRT treatment. Despite these limitations, the study findings are important and highlight the clinical benefit of nutritional assessment and support among patients with LA-HNSCC. In a further study, we plan to determine changes in nutritional status before, during, and after treatment, as well as to assess whether baseline nutritional status according to NAF can predict clinical outcomes, such as quality of life and survival rate from various cancers. A long-term follow-up would be beneficial for understanding the associations between nutrition parameters and treatment outcomes as well as survival of cancer patients.

Conclusions

Prevalence of malnutrition was extremely high in HNSCC patients. NAF had high sensitivity and specificity for assessing nutritional status among oncological patients. NAF should be considered for routine use in clinical practice, because it requires less time to complete, is concise, and does not require nutrition expertise compared to PG-SGA. Our study findings highlight the clinical benefits of nutritional assessment and support among patients with HNSCC. All oncological patients should be assessed for nutritional status and receive nutritional support to improve their treatment outcomes.

Statement of authorship

The authors declare that they have no conflict of interests. All authors critically revised the manuscript and gave final approval for it to submitted for publication.

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