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Malnutrition in hospitalized cancer patients in Hiwa Hospital: Prevalence and its related risk factors

*Dashne Jamal Jalal[1], Taha O. A. Mahwi[1]

1. Clinical science branch of clinical nutrition university of Sulaimani Iraq.

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ABSTRACT

Introduction:
Malnutrition is a significant but under-researched complication among patients with cancer in resource-limited settings such as Iraq, where decades of instability have likely worsened nutritional challenges. This study aimed to determine the prevalence and risk factors of malnutrition among hospitalized cancer patients at Hiwa Hospital in Sulaimani, Iraq.

Materials and Methods:
A hospital-based, cross-sectional study was conducted from October 2024 to March 2025, enrolling 350 adult inpatients with cancer using stratified random sampling. Data were collected through structured interviews, clinical records reviews, and standardized anthropometric measurements. Nutritional status was assessed using the Malnutrition Universal Screening Tool (MUST) and Patient-Generated Subjective Global Assessment (PG-SGA).

Results:
The mean age of the participants was 56.5 ± 16.0 years, and 176 (50.3%) were female. The majority were Kurdish 315 (90%) and unemployed 275 (78.6%), with 150 (42.9%) having no formal education. Chemotherapy was the most common treatment 215 (61.4%). According to the PG-SGA, 114 (32.6%) patients were well-nourished, 138 (39.4%) had moderate malnutrition, and 98 (28%) were severely malnourished. MUST identified 127 (36.3%) patients at low risk, 96 (27.4%) at medium risk, and 127 (36.3%) at high risk of malnutrition. Significant associations were found between malnutrition and lower educational level ($P \leq 0.001$) and marital status ($P \leq 0.001$), while age was an essential predictor of malnutrition severity (OR = 0.067, $P \leq 0.001$).

Conclusion:
Malnutrition is highly prevalent among hospitalized cancer patients in Iraq, with socioeconomic and clinical factors contributing significantly to its prevalence. Routine nutritional screening and early intervention are urgently needed in resource-limited settings.

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*Corresponding author: *E-mail: dashnejalal12@gmail.com*

Introduction

Cancer remains a leading global health concern, characterized by uncontrolled cell proliferation with high morbidity and mortality potential. In 2022, nearly 20 million new cancer cases and 9.7 million cancer-related deaths were reported worldwide, with projections indicating a rise to 35 million annual diagnoses by 2050 (1).

In Iraq, cancer incidence has increased over recent decades, reaching an age-standardized rate of 158.94 per 100,000 in 2022, with regional disparities reflecting the influence of environmental, lifestyle, and healthcare access factors (6).

Cancer etiology is multifactorial, involving genetic mutations, epigenetic alterations, and environmental exposures. Mutations in proto-oncogenes and tumor suppressor genes, such as KRAS, MYC, TP53, and BRCA1/2, disrupt cell cycle regulation and DNA repair mechanisms. (7,8).

Epigenetic modifications, including DNA methylation and histone acetylation, contribute to oncogenesis and are often influenced by environmental factors (9). Modifiable risk factors, such as tobacco use, obesity, air pollution, and alcohol consumption, significantly elevate cancer risk by promoting inflammation, metabolic dysregulation, and DNA damage (10). Additionally, viral infections and aging processes increase susceptibility to malignancies through chronic inflammation and genomic instability (11).

Malnutrition is a frequent and severe comorbidity among patients with cancer, resulting from reduced nutrient intake, metabolic alterations, and treatment-related toxicities (12).

It affects up to 80% of patients with advanced cancer, leading to poor treatment tolerance, prolonged hospitalization, and increased mortality (13). The pathogenesis of cancer-related malnutrition involves tumor-induced hypermetabolism, cytokine-mediated catabolism, and the adverse effects of chemotherapy or radiotherapy (14,15).

Global studies report a high prevalence of malnutrition among hospitalized cancer patients, with rates ranging from 48% to 71%, and identify risk factors such as advanced disease stage, older age, and low socioeconomic status (16,17). Despite the recognized impact of malnutrition on cancer outcomes, there is a paucity of data from resource-limited settings such as Iraq, where decades of instability have likely exacerbated nutritional challenges among patients with cancer. Existing studies do not comprehensively assess the prevalence and risk factors of malnutrition in Iraqi oncology inpatients, particularly using combined anthropometric and clinical measures.

This gap highlights the need for context-specific research to inform targeted interventions.

The present study addresses this gap by investigating the prevalence of malnutrition and its associated risk factors among hospitalized cancer patients at Hiwa Hospital in Sulaimani, Iraq. The overall aim is to provide evidence-based insights to guide nutritional assessment and management in this vulnerable population group.

Materials and Methods

Study design and setting

This hospital-based analytical cross-sectional study was conducted at Hiwa Hospital, a tertiary oncology center in Sulaimani, Iraq. The study spanned six months, from October 2024 to March 2025.

Participants

The study population comprised adult cancer patients (aged ≥ 18 years) admitted to Hiwa Hospital's inpatient wards during the study period. Participants were selected using a stratified random sampling technique to ensure proportional representation across key strata, including cancer type and treatment modalities.

Eligible participants were adults (≥18 years) with confirmed histopathological cancer diagnoses, hospitalized for ≥48 hours to ensure clinical stabilization and accurate assessment. Only those willing to provide informed consent and with complete medical records, including treatment history and laboratory results, were included in the study.

The exclusion criteria comprised patients with cognitive impairment or inability to communicate, as verified by medical records or caregiver reports; pregnant or lactating women; individuals with non-cancer-related cachexia (such as HIV/AIDS or tuberculosis); those participating in other clinical trials

involving nutritional interventions; and patients with missing data on key variables.

Data Collection

Data collection followed a structured two-part protocol. First, demographic and clinical data were obtained using a pretested, interviewer-administered questionnaire capturing age, sex, occupation, educational background, cancer type, treatment history, and comorbidities. Second, trained dietitians performed standardized anthropometric and nutritional assessments on the participants. Body weight and height were measured using calibrated digital scales and stadiometers to calculate BMI, categorized as underweight (<18.5 kg/m^2), normal (18.5–24.9 kg/m^2), or overweight/obese (≥25 kg/m^2). Mid-upper arm circumference (MUAC) was measured at the midpoint between the acromion and olecranon, with values <23 cm indicating a malnutrition risk. Nutritional status was further evaluated using the Malnutrition Universal Screening Tool (MUST), which assigned risk scores based on BMI, unintentional weight loss, and acute disease effect, and the Patient-Generated Subjective Global Assessment (PG-SGA), with scores of ≥9 indicating severe malnutrition.

Ethical Considerations

Ethical approval was obtained from the Institutional Review Board of the College of Medicine, University of Sulaimani (reference number 3224; 2/12/24). Written informed consent was obtained from all participants or their legal proxies.

Confidentiality was maintained by anonymizing the data and storing it in password-protected files accessible only to the research team. Participants were informed of their right to withdraw at any stage without affecting their treatment.

Statistical Analysis

Data were analyzed using SPSS version 28.0 and RStudio software. Descriptive statistics were used to summarize the demographic and clinical characteristics. Associations between categorical variables were assessed using chi-square tests, and independent t-tests or ANOVA were used for continuous variables. Logistic regression was used to identify independent risk factors for malnutrition, adjusting for potential confounders.

The diagnostic accuracies of MUST and PG-SGA were evaluated using sensitivity, specificity, and AUC-ROC curves. Correlation analyses were performed to explore the relationships between nutritional markers and clinical outcomes. A p-value <0.05 was considered statistically significant, and missing data (<5%) were addressed using multiple imputation.

Results

The demographic characteristics of the 350 patients with cancer are presented in Table 1. The mean age of the participants was 56.51 ± 15.959 years. Slightly more than half of the participants were female (176, 50.3%), and 174 (49.7%) were male. The majority of patients were of Kurdish ethnicity (315, 90%), while 35 (10%) were Arab patients. Regarding marital status, 241 (68.9%) were married, 51 (14.6%) were single, 56 (16%) were widowed, and 2 (0.6%) were divorced.

Employment status revealed that 275 (78.6%) were unemployed, 68 (19.4%) were employed, 6 (1.7%) were retired, and 1 (0.3%) fell into the "other" category.

Regarding educational attainment, the largest group had no formal education (150, 42.9%), followed by secondary school (83, 23.7%). At the time of evaluation, treatment patterns were dominated by chemotherapy (215; 61.4%), with additional modalities including palliative care (56; 16.0%), radiotherapy (35; 10.0%), and targeted therapy (20; 5.7%).

Immunotherapy, hormonal therapy, and surgery were administered to eight patients (2.3%) (Table 1).

Table 1. Demographic Information

Demographic Information		Frequency (Percent)
Age		56.51 ± 15.959
Sex	Male	174 (49.7%)
	Female	176 (50.3%)
Ethnicity	Kurdish	315 (90%)
	Arabic	35 (10%)
Marital status	Single	51 (14.6%)
	Married	241 (68.9%)
	Divorced	2 (0.6%)
	Widowed	56 (16%)
Employment status	Employed	68 (19.4%)
	Unemployed	275 (78.6%)
	Retired	6 (1.7%)
	Other	1 (0.3%)
Educational level	No formal education	150 (42.9%)
	Primary school	66 (18.9%)
	Secondary school	83 (23.7%)
	University	48 (13.7%)
	Postgraduate	3 (0.9%)
Current treatment	Chemotherapy	215 (61.4%)
	Radiation therapy	35 (10%)
	Immunotherapy	8 (2.3%)
	Target therapy	20 (5.7%)
	Hormonal therapy	8 (2.3%)
	Surgery	8 (2.3%)
	Palliative care	56 (16%)

The most common cancer types, in descending order, were lung cancer (34 patients, 9.7%), breast cancer (31, 8.9%), acute lymphoblastic leukemia (ALL) (22, 6.3%), colorectal cancer (21, 6%), and lymphoma (19, 5.4%).

Multiple myeloma (MM) was diagnosed in 18 (5.1%) patients, acute myeloid leukemia (AML) in 17 (4.9%), and non-Hodgkin lymphoma in 16 (4.6%). Additional details regarding the distribution of various cancer types are shown in Figure 1.

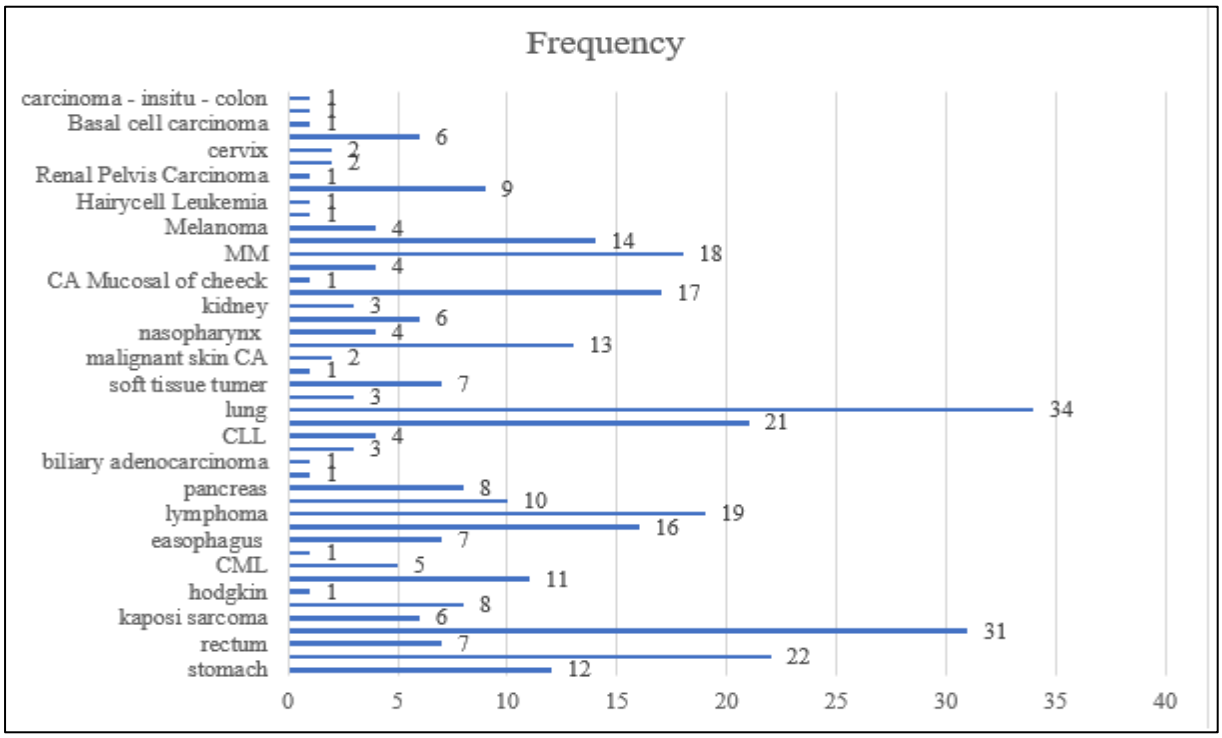

Figure 1. Type of cancer

The anthropometric measurements are summarized in Table 2. The mean height was 164.219 ± 9.799 cm, weight was 63.915 ± 14.512 kg, body mass index (BMI) was 23.754 ± 5.331 kg/m^2, and MUAC was 26.700 ± 6.305 cm. In the month preceding the assessment, 225 patients (64.3%) lost weight, 56 (16.0%) gained weight, and 69 (19.7%) reported no meaningful change. Among those who lost weight, the mean ± SD reduction was 3.191 ± 2.839 kg. Most patients (193, 85.7%) experienced modest losses (0.5–5 kg), while 24 (10.6%) lost 6–10 kg and 8 (3.7%) experienced losses exceeding 11 kg during the same period.

Table 2. Anthropometric Measurements

Anthropometric Measurements		Mean ± SD
Height (in cm)		164.219 ± 9.799
Weight (in kg)		63.915 ± 14.512
Body Mass Index (kg/m^2)		23.754 ± 5.331
MUAC in cm		26.700 ± 6.305
Weight change in the past month	Weight loss	225 (64.3%) *
	Weight gain	56 (16%)
	No change	69 (19.7%)
Mean weight loss (kg)		3.191 ± 2.839
Weight loss (kg)	0.5-5	193 (85.7%)
	6-10	24 (10.6%)
	≥ 11	8 (3.7%)
*Frequency (%)		

Nausea was the most common gastrointestinal symptom, observed in 83 (23.7%) patients. Concurrent symptoms included nausea with diarrhea in 39 (11.1%) patients, nausea with vomiting in 35 (10%), and constipation alone in 31 (8.9%) patients. Both nausea + vomiting + constipation and nausea + constipation were reported in 26 (7.4%) patients. Additional details on the distribution of gastrointestinal symptoms are presented in Figure 2.

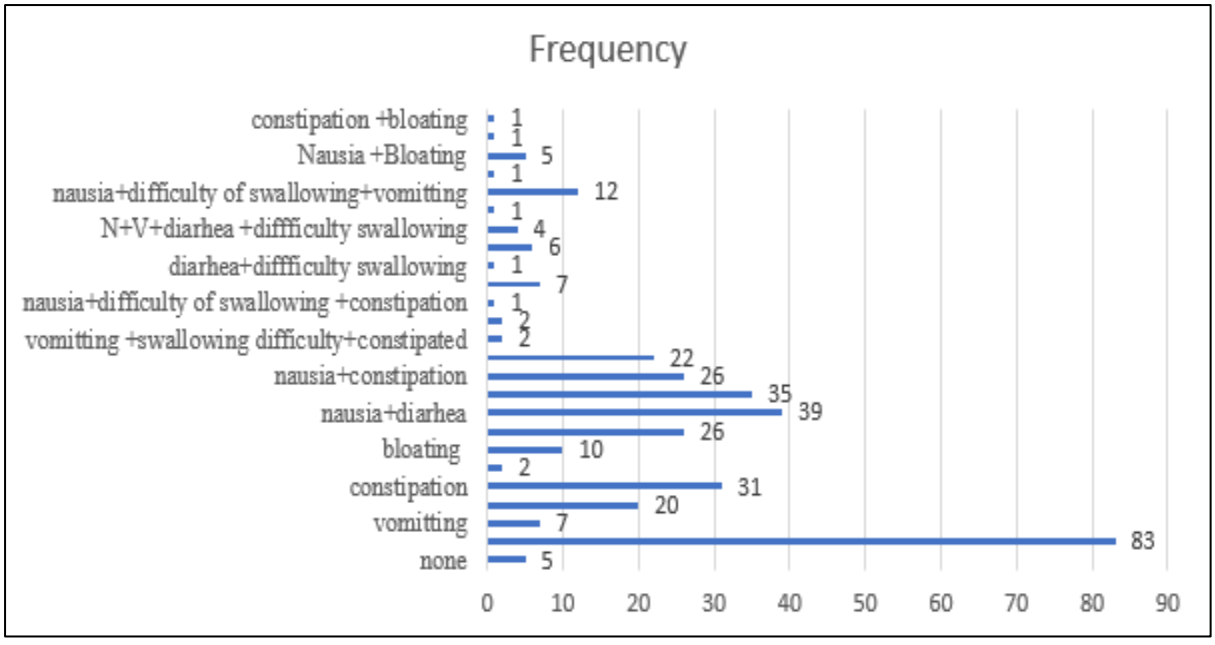

Figure 2. Gastrointestinal problems.

Cancer-related risk factors are listed in Table 3. Regarding smoking status, 65 (18.6%) patients were current smokers, 117 (33.4%) were ex-smokers, and 168 (48%) had never smoked. Alcohol consumption patterns showed that 2 (0.6%) patients consumed alcohol daily, 79 (22.6%) occasionally, and 269 (76.9%) never

consumed alcohol. Thyroid disorders were the most prevalent comorbidity, affecting 79 patients (22.6%), followed by hypertension in 64 (18.3%), diabetes mellitus in 26 (7.4%), and coexisting diabetes and hypertension in 21 (6.0%). Heart disease was documented in eight patients (2.3%). Notably, the majority (212, 60.5%) had no recorded comorbidities. In this cohort, the mean PG-SGA score was 13.10 ± 5.760. According to the PG-SGA classification, 114 patients (32.6%) were well nourished, 138 (39.4%) had suspected or moderate malnutrition, and 98 (28.0%) were severely malnourished. According to the MUST, 127 patients (36.3%) were at low risk, 96 (27.4%) at medium risk, and 127 (36.3%) at high risk of malnutrition.

Table 3. Risk Factors for Cancer

Risk Factors		**Frequency (Percent)**
Smoking status	Current smoker	65 (18.6%)
	Ex-smoker	117 (33.4%)
	Never smoked	168 (48%)
Alcohol consumption	Daily	2 (0.6%)
	Occasionally	79 (22.6%)
	Never	269 (76.9%)
Comorbidities	DM	26 (7.4%)
	HTN	64 (18.3%)
	Heart disease	8 (2.3%)
	Chronic kidney disease	6 (1.7%)
	Respiratory disease	1 (0.3%)
	Thyroid	79 (22.6%)
	None	212 (60.5%)
	HTN + DM	21 (6%)
	HTN + DM + HRT disease	4 (1.1%)
	HTN + heart disease	2 (0.6%)
	CVA	1 (0.3%)
	HTN + Respiratory	1 (0.3%)
	DM + heart disease	1 (0.3%)
	heart disease + HTN	2 (0.6%)
	HTN + Hypothyroid	1 (0.3%)
Mean ± SD PG-SGA score		13.10 ± 5.760
PG-SGA category	Well nourished	114 (32.6%)
	Suspected or moderate malnutrition	138 (39.4%)
	Severe malnutrition	98 (28%)
MUST score	Low risk	127 (36.3%)
	Medium risk	96 (27.4%)
	High risk	127 (36.3%)

A statistically significant association was observed between marital status and the PG-SGA category ($P \leq 0.001$), with the majority of patients across all marital subgroups classified as either suspected of, moderately malnourished, or severely malnourished. Similarly, educational attainment was significantly associated with the PG-SGA category ($P \leq 0.001$), with lower educational levels linked to a higher likelihood of malnutrition. No other variables demonstrated a statistically significant relationship with the PG-SGA category (Table 4).

Table 4. Correlation of PG-SGA category with patient cancer and sociodemographic factors

Characteristics		PG-SGA category			P-value*
		Well nourished	Suspected or moderate malnutrition	Severe malnutrition	
Sex	Male	60 (52.6%)	69 (50%)	45 (45.9%)	0.620
	Female	54 (47.7%)	69 (50%)	53 (54.1%)	
Ethnicity	Kurdish	102 (89.5%)	125 (90.6%)	88 (89.8%)	0.955
	Arabic	12 (10.5%)	13 (9.4%)	10 (10.2%)	
Marital status	Single	12 (19.3%)	17 (12.3%)	12 (12.2%)	0.001
	Married	87 (76.3%)	90 (65.2%)	64 (65.3%)	
	Divorced	0	2 (1.4%)	0	
	Widowed	5 (4.4%)	29 (21%)	22 (22.4%)	
Educational level	No formal education	24 (21.1%)	75 (54.3%)	51 (52%)	0.001
	Primary school	24 (21.1%)	17 (12.3%)	25 (25.5%)	
	Secondary school	40 (35.1%)	31 (22.5%)	12 (12.2%)	
	University	25 (21.9%)	13 (9.4%)	10 (10.2%)	
	Postgraduate	1 (0.9%)	2 (1.4%)	0	
Employment status	Employed	30 (26.3%)	23 (16.7%)	15 (15.3%)	0.140
	Unemployed	82 (71.9%)	110 (79.9%)	83 (74.7%)	
	Retired	2 (1.8%)	4 (2.9%)	0	
	Other	0	1 (0.7%)	0	
*P-value based on chi-square and Fisher's exact test					

No statistically significant association was found between the MUST score and the demographic variables assessed, indicating no meaningful differences in malnutrition risk across the studied subgroups (Table 5).

Table 5. Correlation of MUST scores in patients with cancer and sociodemographic factors

Characteristics		MUST score			P-value*
		Low risk	Moderate risk	High risk	
Sex	Male	60 (47.2%)	51 (53.1%)	63 (49.6%)	0.685
	Female	67 (52.8%)	45 (46.9%)	64 (50.4%)	
Ethnicity	Kurdish	114 (89.8%)	88 (91.7%)	113 (89%)	0.798
	Arabic	13 (10.2%)	8 (8.3%)	14 (11%)	
Marital status	Single	15 (11.8%)	15 (15.6%)	21 (16.5%)	0.434
	Married	94 (74%)	67 (69.8%)	80 (63%)	
	Divorced	1 (0.8%)	1 (1%)	0	
	Widowed	17 (13.4%)	13 (13.5%)	26 (20.5%)	
Educational level	No formal education	50 (39.4%)	38 (39.6%)	62 (48.8%)	0.23.
	Primary school	20 (15.7%)	20 (20.8%)	26 (20.5%)	
	Secondary school	37 (29.1%)	26 (27.1%)	20 (15.7%)	
	University	18 (14.2%)	11 (11.5%)	19 (15%)	
	Postgraduate	2 (1.6%)	1 (1.1%)	0	
Employment status	Employed	30 (23.6%)	17 (17.7%)	21 (16.5%)	0.140
	Unemployed	95 (74.8%)	75 (78.1%)	105 (82.7%)	
	Retired	2 (1.6%)	3 (3.1%)	1 (0.8%)	
	Other	0	1 (1%)	0	
*P-value based on chi-square and Fisher's exact test					

Patient age was identified as a significant predictor of the PG-SGA category, with increasing age associated with higher PG-SGA scores and greater severity of malnutrition (OR = 0.067, P ≤ 0.001, 95% CI: 0.030–0.105). Older age was associated with

more advanced malnutrition at presentation; however, there was no statistically significant relationship between age and MUST scores (Table 6).

Table 6. Effect of age on PG-SGA category and MUST score in patients with cancer

Variable	OR	P-value*, CI95%
PG-SGA category		
Age	0.067	P≤0.001, CI95%: 0.030-0.105
MUST score		
Age	0.003	P≤0.289, CI95%: -0.003-0.009
*P-value based on Linear regression		

Discussion

This study aimed to determine the prevalence of malnutrition and its associated risk factors among hospitalized cancer patients at Hiwa Hospital. The findings revealed that malnutrition is a primary concern in this population, with most patients experiencing significant weight loss, appetite changes, and gastrointestinal symptoms, such as nausea, vomiting, and dry mouth. Most patients did not receive formal nutritional support, and malnutrition was highly prevalent according to both the PG-SGA and MUST assessment tools. Socioeconomic vulnerability, advanced age, and lower educational attainment were identified as significant risk factors for poor nutritional status.

The present study revealed a high prevalence of malnutrition, with nearly two-thirds of patients classified as malnourished or at risk according to both the PG-SGA and MUST tools. The most frequent clinical manifestations include significant weight loss, gastrointestinal symptoms such as nausea and vomiting, and reduced appetite. These results are consistent with studies from other LMICs, such as those by Shadmand Foumani Moghadam et al. (2021) in Iran (18) and Mohsin et al. (2024) in Bangladesh (19), which also reported high rates of malnutrition among hospitalized cancer patients. The similarity in the findings may be attributed to shared challenges in these regions, including late cancer diagnosis, limited access to nutritional support, and socioeconomic constraints.

In contrast, studies from high-income countries, such as Marshall et al. (2019) in Australia, reported lower malnutrition rates (20). This discrepancy likely reflects differences in healthcare infrastructure, routine nutritional screening, and the availability of specialized nutritional interventions. The lack of systematic nutritional care in resource-limited settings, as observed in our study, may contribute to the high burden of malnutrition.

The present study also identified significant associations between malnutrition and both educational level and marital status. Patients with lower educational attainment were more likely to be malnourished, a finding echoed by Liu et al. (2024) in China, who highlighted the role of socioeconomic vulnerability in nutritional outcomes (21). However, the association with marital status was less consistent with the previous literature, as some studies did not find a significant relationship (22, 23). This inconsistency may be due to cultural or social differences in family support and caregiving responsibilities.

No significant association was found between malnutrition and sex, which is in line with some studies (24). But contrasts with others reporting higher malnutrition rates in males (25,26). Regional dietary patterns, cancer type, and social factors may influence these differences. Age was found to be a significant predictor of malnutrition severity, aligning with studies by Zhang et al. (2025) (27) and Dogan et al. (2025) (28), which reported increased malnutrition risk with advancing age. However, Ng'weshemi et al. (2025) did not observe this association, suggesting that the impact of age may vary depending on population characteristics and cancer type. (29).

Limitations

The cross-sectional design of this study limits the ability to establish causality between risk factors and malnutrition. Additionally, the lack of detailed cancer staging and treatment protocol data may

have influenced the assessment of the risk factors. The findings may not be generalizable to non-hospitalized cancer patients.

Conclusions

In conclusion, this study demonstrated a high prevalence of malnutrition among hospitalized cancer patients at Hiwa Hospital, with socioeconomic factors such as low educational attainment and unemployment, as well as clinical factors such as advanced age and treatment-related side effects, contributing significantly to poor nutritional status. To address this critical issue, routine nutritional screening using validated tools should be implemented for all patients with cancer upon admission, followed by timely and individualized nutritional interventions. Additionally, increasing awareness and training among healthcare providers, as well as integrating proactive management of common nutrition-impact symptoms, are essential steps to improve clinical outcomes and quality of life for cancer patients in resource-limited settings. Conflict of interest: All authors declare no conflicts of interest.

Data availability: Data from this study can be obtained from the corresponding author upon reasonable request.

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