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Malnutrition and Associated Factors among Adult Cancer Patients Receiving Chemotherapy at a Tertiary Hospital in Southwestern Nigeria: A Cross-sectional Study

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Abstract

Background: Malnutrition affects 20–80% of people living with cancer worldwide, with prevalence varying by cancer type, stage, and treatment. It may worsen during chemotherapy due to treatment-related symptoms, disease-associated inflammation, inadequate dietary intake, and socioeconomic constraints. However, evidence on malnutrition and its associated factors among Nigerian cancer patients receiving chemotherapy remains limited. The study assessed the prevalence of malnutrition and its associated factors among adult cancer patients receiving chemotherapy at a tertiary hospital in Southwestern Nigeria.

Methods

This cross-sectional study was conducted among a multistage sample of 147 adult cancer outpatients receiving chemotherapy at University College Hospital, Ibadan, from July to December 2025. Sociodemographic, clinical, anthropometric, dietary, lifestyle, and household food-security data were collected using an interviewer-administered questionnaire. Malnutrition was diagnosed using the Global Leadership Initiative on Malnutrition (GLIM) criteria. Diet quality was assessed using the Nigeria-adapted Diet Quality Questionnaire, and household food insecurity was assessed using the Household Food Insecurity Access Scale (Cronbach's alpha = 0.74). Data were analysed using descriptive statistics, chi-square tests, and binary logistic regression. Statistical significance was set at $p < 0.05$.

Results

Participants had a mean age of 56.0 ± 13.95 years, and 77.6% were women. Breast cancer was the most common diagnosis (48.3%), followed by cervical cancer (18.4%). Malnutrition affected 78.8% of participants, and 49.7% experienced household food insecurity. Nutritional status was significantly associated with disease severity, fever, infection, inflammation, acute illness or injury, fatigue, gastrointestinal symptoms, dysphagia, and alcohol use ($p < 0.05$). In the adjusted model, weight loss greater than 10% (OR = 4.52, 95% CI: 1.87–10.92; p<.001), recent fever (OR = 3.21, 95% CI: 1.45–7.10, p=.004), dysphagia (OR = 2.89, 95% CI: 1.13–7.42, p = .027), appetite loss (OR = 2.67, 95% CI: 1.24–5.76, p = .013), and unhealthy-food consumption (OR = 2.44, 95% CI: 1.12–5.31, p=.025) were associated with higher odds of malnutrition.

Conclusion

Malnutrition was highly prevalent among adult cancer patients receiving chemotherapy in this study. Clinical factors and unhealthy eating were independently associated with malnutrition. Adult cancer patients undergoing chemotherapy are likely to benefit from routine nutrition screening, assessment and individualised, symptom-tailored nutrition interventions.

INTRODUCTION

Cancer is a major public health problem worldwide, with more than 35 million new cases projected for 2025. [1, 2] LMICs bear a substantial burden, where delayed diagnosis, limited access to comprehensive care, and inadequate supportive services continue to undermine treatment outcomes and quality of life. [3] Although high-income countries report better cancer detection and survival outcomes, it is projected that more than 75% of cancer-related deaths will occur in LMICs over the next decade. [4] In Nigeria, the burden remains substantial, with 124,815 new cases reported in 2020 according to the Global Cancer Observatory. [5] The situation is characterised by late presentation, limited access to comprehensive cancer services, treatment costs, and inadequate supportive care, which may adversely affect treatment outcomes and quality of life. [5]

Chemotherapy is a cornerstone of cancer treatment and exerts its antineoplastic effect by using cytotoxic agents to interfere with cell division and DNA replication in rapidly proliferating malignant cells. [6]However, its non-selective action also affects normal rapidly dividing cells, particularly those of the gastrointestinal tract, resulting in adverse effects such as nausea, vomiting, anorexia, altered taste, diarrhoea, and oral mucositis. [7] These effects can reduce food intake and contribute to weight loss, muscle loss, functional decline, treatment toxicity, and poor quality of life. [8, 9] Cancer-associated inflammation may further increase energy and protein requirements while promoting tissue catabolism. [10, 11] Therefore, nutritional care becomes a vital component of cancer management, as nutritional deterioration may occur before treatment and worsen during chemotherapy.

Malnutrition, with reported prevalence ranging from 20% to 80% depending on tumour type, disease stage, and treatment status, [8, 9] is multifactorial. It may result from tumour-related metabolic changes, treatment effects, inadequate dietary intake, comorbidities, functional limitations, food insecurity, and socioeconomic constraints. [10, 11] It is associated with depletion of fat and lean body mass, reduced functional capacity, impaired quality of life, increased treatment toxicity, poor response to chemotherapy, and poorer survival outcomes. [11 – 15] Therefore, maintaining adequate nutritional status becomes important for optimising treatment response and clinical outcomes in cancer care. [16] However, a normal or high body mass index does not necessarily exclude malnutrition, particularly when substantial weight loss or muscle depletion is present. Nutritional assessment should therefore include weight history, body composition, food intake, disease burden, and inflammation, rather than relying on body mass index alone.

The Global Leadership Initiative on Malnutrition criteria provide a standardised approach to diagnosing malnutrition. Diagnosis requires at least one phenotypic criterion, such as weight loss, low body mass index, or reduced muscle mass, and at least one aetiological criterion, such as reduced food intake or assimilation, disease burden, or inflammation. The GLIM approach also permits grading of malnutrition severity according to phenotypic thresholds.

Food insecurity and poor diet quality may further compromise nutrition among cancer patients. [17, 18] Food-insecure households may have limited access to sufficient and diverse foods, while treatment-

related symptoms such as dry mouth, constipation, altered taste, and early satiety may reduce the ability to consume or tolerate available foods. [19, 20] Although a previous Nigerian study [21] has documented nutrition-related problems among cancer patients, evidence integrating GLIM-based assessment with clinical, dietary, and household food-security factors remains limited. This study therefore assessed the prevalence of malnutrition and examined its associated sociodemographic, clinical, lifestyle, dietary, and food-security factors among adult cancer patients receiving chemotherapy at a tertiary hospital in Southwestern Nigeria.

METHODS

Study Design and Setting

A hospital-based cross-sectional study was conducted from July to December 2025 at the Radiation Oncology Department and the Surgical Outpatients Clinic of University College Hospital, Ibadan, Oyo State, Nigeria. The hospital is a tertiary referral centre serving patients from Ibadan and other parts of Southwestern Nigeria.

Sample size Determination.

The initial sample size was calculated using Cochran's formula based on an assumed malnutrition prevalence of 45%. [15] A finite-population correction [22] was subsequently applied using the estimated monthly clinic population, and a 10% allowance was included for attrition. The minimum calculated sample was 145 participants. However, 147 eligible participants were recruited and included in the final analysis.

Sampling Technique

A multi-stage sampling technique was employed to obtain a representative sample of Adult Cancer Patients.

Stage 1: Purposive selection of the University College Hospital because it is the only available Tertiary Healthcare Centre and teaching hospital that offers Chemotherapy to Cancer patients in the state.

Stage 2: Purposive selection of the Radiation Oncology Department and the Surgical Out-Patients Clinic at University College Hospital because these departments attend to patients diagnosed with cancer.

Stage 3: Simple random sampling of patients who attended the Surgical Out-Patients Clinic (SOP) and Radiation Oncology Department to ensure representativeness and generalizability and to prevent bias.

Eligibility Criteria

Participants were included if they:

- Were aged 18 years or older.
- Had a confirmed cancer diagnosis.
- Were receiving chemotherapy at the time of data collection.
- Provided written informed consent.

Patients were excluded if they:

- Were younger than 18 years.
- Were not receiving chemotherapy.
- Were admitted to the hospital during the data-collection period.
- Had a coexisting wasting condition, such as HIV infection.
- Declined participation.

Instruments for Data Collection

1. Malnutrition was diagnosed according to the Global Leadership Initiative on Malnutrition (GLIM) framework [23]. Participants were classified as malnourished when they met at least one phenotypic criterion and one aetiological criterion.

Phenotypic criteria included:

- Unintentional weight loss.
- Low body mass index.
- Reduced muscle mass or visible muscle wasting.

Aetiological criteria included:

- Reduced food intake or impaired assimilation.
- Disease burden or inflammation.

Body mass index was calculated as weight in kilograms divided by height in metres squared. Nutritional status was categorised as malnourished or not malnourished. Malnutrition severity was graded according to GLIM thresholds where sufficient phenotypic information was available. [24]

2. Diet quality was assessed using the 29-item Nigeria-adapted Diet Quality Questionnaire (DQQ), a standardised, closed-ended, list-based instrument developed by the Global Diet Quality Project for population-level monitoring of diet quality. [25 – 27] Participants reported whether they had consumed foods from specified food groups during the previous day and night. Responses were processed via the Diet Quality Questionnaire Data Portal.

The assessed indicators included:

- Consumption of all five recommended food groups.
- Consumption of individual food groups.
- Minimum dietary diversity for women.
- Dietary diversity score.
- NCD-Protect score.
- NCD-Risk score.
- Global Dietary Recommendations score.

Minimum dietary diversity for women was calculated only for women aged 15–49 years. For the broader study population, dietary diversity was represented by the dietary diversity score.

Additional study-specific indicators were calculated as follows:

- **Protective food consumption**: consumption of at least one whole grain, pulse, nut or seed, vegetable, or fruit.
- **Unhealthy food consumption**: consumption of at least one soft drink, sweet food, salty or fried snack, deep-fried food, processed meat, or fast food/instant noodles.
- **Healthy diet pattern**: consumption of at least one protective food and no reported consumption of any predefined unhealthy food.
- **Multiple sugary foods or beverages**: consumption of at least two predefined sugary food or beverage categories.
- **Multiple salty or ultra-processed foods**: consumption of at least two predefined salty or ultra-processed food categories.

These study-specific indicators were exploratory and were not treated as validated clinical measures of overall diet quality.

3. Household food insecurity was assessed using the Household Food Insecurity Access Scale (HFIAS), [28] which has been validated for Sub-Saharan African populations. [29] The scale measures household experiences of food insecurity during the previous four weeks. Scores range from 0 to 27, with higher scores indicating greater food insecurity. Households were classified as food secure, mildly food insecure, moderately food insecure, or severely food insecure using the standard HFIAS classification algorithm.

Data Collection Procedure

Data were collected using an interviewer-administered semi-structured questionnaire. The questionnaire was pilot-tested among adult cancer patients receiving chemotherapy at a private oncology hospital in Ibadan, and a reliability test of the Household Food Insecurity Access Scale (HFIAS) yielded Cronbach's alpha = 0.74. The questionnaire consists of four major sections:

Section A: This section included questions on socio-demographic characteristics of the patients such as age, gender, marital status, income level, educational level, occupation, religion, LGA of residence, etc., as well as lifestyle practices and most recent packed cell volume (PCV) information of the patients.

Section B: This section had questions on symptoms experienced by cancer patients, as well as information on their nutritional status to determine the prevalence of malnutrition using the Global Leadership Initiative on Malnutrition (GLIM).

Section C: This section included the Dietary Quality Questionnaire (DQQ) and Household Food Insecurity Access Scale (HFIAS) to obtain data on respondents' Food security and dietary quality, respectively. Data were collected in private, one-on-one interactions to ensure confidentiality, with each session lasting about 10–15 minutes.

Data Analysis

Data were analysed using IBM SPSS Statistics version 27. Continuous variables were summarised using means and standard deviations. Categorical variables were presented as frequencies and percentages.

Chi-square tests were used to examine associations between nutritional status and categorical sociodemographic, clinical, lifestyle, dietary, and food-security variables. Binary logistic regression was used to examine factors associated with malnutrition. Variables were selected based on clinical relevance and findings from the bivariate analysis. Statistical significance was set at $p < 0.05$. Results were reported as odds ratios with 95% confidence intervals, including adjusted associations.

RESULTS

Table 1 shows the sociodemographic characteristics of 147 respondents. The mean age of the study participants was 56.01 ± 13.95; most were female (77.6%) and married (76.9%). About half (49.7%) of the respondents had tertiary education as their highest level of education; most (84.4%) respondents were of Yoruba ethnicity and resided in urban areas (83.0%). Also,45.6% were traders; about one third (29.9%) earned less than 70,000 naira, while 14.3% were retirees. About 83.7% of respondents did not consume alcohol, and the majority (99.3%) did not smoke.

Table 1
Socio-demographic and Lifestyle- related Characteristics of the Respondents

Variable	Frequency (n = 147)	Percentage (%)
Age (Mean = 56.01 ± 13.95)		
Young Adults (18–39)	14	9.5
Middle-Aged Adults (40–59)	70	47.6
Older Adults (60–79)	59	40.1
Very Old Adults (80 and above)	4	2.7
Gender		
Male	33	22.4
Female	114	77.6
Ethnicity		
Yoruba	124	84.4
Igbo	15	10.2
Hausa	2	1.4
Others	6	4.0
Marital Status		
Married	113	76.9
Single	12	8.2
Divorced	18	12.2
Widowed	4	2.7
Educational status		
No formal education	13	8.8
Primary	20	13.6
Secondary	40	27.2
Tertiary	73	49.7
No response	1	0.7
Primary occupation		
Artisan	10	6.8

Variable	Frequency (n = 147)	Percentage (%)
Age (Mean = 56.01 ± 13.95)		
Businessman	4	2.7
Retired worker	21	14.3
Self employed	11	7.5
Teaching	8	5.4
Student	1	0.7
Civil servant	17	11.6
Traders	67	45.6
Others	8	5.4
Average Monthly Income		
< 70 000	44	29.9
70,000–100,000	33	22.4
100,000–150 000	31	21.1
150,000–200,000	15	10.2
> 200,000	22	15.0
No response	2	1.4
Residence		
Rural	25	17.0
Urban	122	83.0
Alcohol consumption		
Yes	24	16.3
No	123	83.7
Cigarette smoking		
Yes	1	0.7
No	146	99.3

Table 2 shows the clinical and treatment-related characteristics of respondents. Breast cancer (48.3%) is the most prevalent among the respondents, followed by cervical cancer (18.4%). About one-third (37.4%)

of the respondents were midway through chemotherapy treatment at the time of response, while 28.6% were in their first cycle.

Most respondents did not report fever (66.0%) or infection (87.8%) in the previous month. Also, 72.8% reported no inflammation, and 85.0% had no acute illness or injury during that period. About 47.6% of patients reported loss of appetite. Forty-nine per cent of respondents experienced moderate disease severity. Gastrointestinal symptoms such as nausea, vomiting or diarrhoea were reported by 43.5% of the respondents, while visible muscle wasting was observed in 33.3%.

Table 2
Clinical and Treatment-related Characteristics of Adult Cancer Patients Receiving Chemotherapy

Variable	Frequency (n = 147)	Percentage (%)
Type of Cancer		
Breast	71	48.3
Cervical	27	18.4
Gastrointestinal	16	10.9
Thoracic	5	3.4
Urological and Reproductive	10	6.8
Bone	10	6.8
Thyroid	2	1.4
Lymphoid	1	0.7
Others	5	3.4
Cycle of chemotherapy		
First	42	28.6
Midway	55	37.4
Final	22	15.0
Completed	28	19.0
Experience of Fever in the past one month		
Yes	48	32.7
No	97	66.0
No response	2	1.3
Experience of infection in the past one month		
Yes	17	11.6
No	129	87.8
No response	1	0.6
Experience of inflammation in the past one month		
Yes	37	25.2
No	107	72.8

Variable	Frequency (n = 147)	Percentage (%)
Type of Cancer		
No response	3	2.0
Experience of any acute illness or injury		
Yes	19	12.9
No	125	85.0
No response	3	2.0
Loss of Appetite		
Yes	70	47.6
No	76	51.7
No response	1	0.7
Severity of disease		
Mild	41	27.9
Moderate	72	49.0
Severe	34	23.1
Nausea, vomiting or diarrhoea		
Yes	64	43.5
No	83	56.5
Visible muscle wasting		
Yes	49	33.3
No	97	66.0
No response	1	0.7

Table 3 shows the respondents' nutritional status based on their Body Mass Index and weight loss. A little less than half (48.3%) were within the normal weight range, 28.6% were overweight, 13.6% were obese, and 6.1% were underweight based on BMI. In terms of weight loss, 45.6% of respondents did not experience weight loss, 8.2% lost < 5% of their normal weight, 41.5% lost between 5–10% of their normal weight, and 3.4% lost > 10% of their normal weight.

Table 3
Frequency and Percentage Distribution of the Respondents' Nutritional Status based on BMI and Weight Loss

Variable	Frequency (n = 147)	Percentage (%)
BMI Category		
Underweight	9	6.1
Normal weight	71	48.3
Overweight	42	28.6
Obese	20	13.6
Weight loss		
No	67	45.6
< 5%	12	8.2
5–10%	61	41.5
> 10%	5	3.4

Figure 1

Prevalence of Malnutrition among **A**dult Cancer Patients Receiving Chemotherapy is presented in Fig. 1.

[Insert Fig. 1 **here]**

Figure 2

The Distribution of Respondents and their Food Insecurity Levels among Adult Cancer Patients Receiving Chemotherapy is presented in Fig. 2.

[Insert Fig. 2 **here]**

Table 4 (a) shows that, on average, respondents consumed about 5.2 of the 10 MDD-W/DDS food groups (DDS ≈ 5.24), and 63.6% of women of reproductive age met the MDD-W threshold (≥ 5 food groups). The mean GDR score was ≈ 10.98 (on a 0–18 scale), indicating moderate alignment with global dietary recommendations overall.

Consumption of starchy staples and animal-source foods was nearly universal (98.6% and 93.2%, respectively), while vegetable consumption was relatively high (75.5%) but fruit consumption was lower (47.6%). Only 21.1% of respondents consumed all five recommended food groups (All-5), suggesting that many diets lacked at least one key group despite high staple and animal-source food intake.

The mean NCD-Protect score (3.15) was substantially higher than the mean NCD-Risk score (1.17), yielding a positive GDR score. Nonetheless, notable proportions reported intake of items to limit: about 25% consumed salty or fried snacks, 22% consumed deep-fried foods, and 18% consumed soft drinks or sweet foods in the previous day.

Rural respondents had slightly lower DDS (5.20 vs 5.25) than urban respondents, and a marginally lower GDR score (10.84 vs 11.01). Rural participants reported higher consumption of starchy staples and animal-source foods but lower consumption of pulses, nuts/seeds, and whole grains, and higher intake of salty/fried snacks and deep-fried foods.

Women had slightly higher NCD-Risk (1.27 vs 0.82) and lower NCD-Protect (3.19 vs 3.00) than men, resulting in a slightly lower GDR score (10.92 vs 11.18). Men had higher DDS (5.39 vs 5.19) and higher All-5 (0.24 vs 0.20), but women reported higher overall fruit and vegetable consumption.

Table 4 (b) shows respondents' diet quality using fixed indicators and the distribution of the additional DQQ-derived indicators overall and by residence and sex. Overall, 57.8% of respondents consumed at least one whole grain, pulse, nut or seed, with higher prevalence in urban (62.3%) than rural (36.0%) residents. Multiple unhealthy items were less common: 23.1% reported more than one sugary food or beverage and 6.1% reported more than one salty ultra-processed food.

The proportion with any protective food consumption (PFC) was 22.4%, while 27.2% reported any unhealthy food consumption (UFC). A healthy diet pattern (protective foods without any unhealthy items) was observed in 18.4% of respondents. Fast food or instant noodles were consumed by 6.1% overall, with higher reported intake among urban (7.4%) than rural (0.0%) residents, and among women (7.0%) than men (3.0%).

By residence, urban respondents had slightly higher PFC (23.8% vs 16.0%) and similar UFC (27.0% vs 28.0%) compared with rural respondents, resulting in a higher prevalence of a healthy diet pattern (19.7% vs 12.0%). By sex, women had slightly higher UFC (29.8% vs 18.2%) and lower PFC (21.9% vs 24.2%) than men, and a similar prevalence of a healthy diet pattern (18.4% vs 18.2%). Overall, the UFC score (29.8%) was higher than the PFC score (21.9%) in females, while the PFC score (24.2%) was higher than the UFC score (18.2%) among men.

Table 4
(a): Diet quality of Respondents

Indicator	value	Urban	Rural	female	Male
All-5	0.211	0.221	0.16	0.202	0.242
At least one vegetable	0.755	0.754	0.76	0.763	0.727
At least one fruit	0.476	0.467	0.52	0.491	0.424
At least one pulse, nut or seed	0.544	0.582	0.36	0.544	0.546
At least one animal-source food	0.932	0.926	0.96	0.930	0.940
At least one starchy staple	0.986	0.984	1	0.991	0.970
MDD-W	0.636	0.618	0.7	0.636	NaN
Dietary Diversity Score (DDS)	5.238	5.246	5.2	5.193	5.394
Zero vegetable or fruit consumption	0.150	0.156	0.12	0.149	0.152
At least one vegetable or fruit	0.850	0.844	0.88	0.851	0.848
Pulse consumption	0.415	0.443	0.28	0.404	0.455
Nuts or seeds consumption	0.211	0.221	0.16	0.211	0.212
Whole grain consumption	0.095	0.090	0.12	0.105	0.061
Processed meat consumption	0.054	0.066	0	0.061	0.030
Salty or fried snack consumption	0.252	0.238	0.32	0.263	0.212
Deep fried food	0.225	0.205	0.32	0.237	0.182
Sweet foods consumption	0.177	0.189	0.12	0.202	0.091
Soft drinks (sodas, energy drinks, sports drinks)	0.177	0.180	0.16	0.193	0.121
NCD-Protect	3.150	3.172	3.04	3.193	3
NCD-Risk	1.170	1.164	1.2	1.272	0.820
GDR Score	10.980	11.008	10.84	10.921	11.182

Note: *All-5 and individual food group indicators are proportions. MDD-W is the proportion of women of reproductive age (15–49 years) meeting minimum dietary diversity (≥ 5 of 10 food groups). DDS, NCD-Protect, NCD-Risk, and GDR Score are means*

Table 4
(b): Diet Quality of Respondents

Indicator	value	Urban	Rural	female	Male
At least one whole grain, pulse, nut or seed	0.578	0.623	0.36	0.579	0.576
More than one sugary food or beverage	0.231	0.221	0.28	0.246	0.182
More than one salty ultra-processed food	0.061	0.066	0.04	0.070	0.030
Protective Food Consumption (PFC)	0.225	0.238	0.16	0.220	0.242
Unhealthy Food Consumption (UFC)	0.272	0.271	0.28	0.298	0.182
Healthy Diet Pattern	0.184	0.197	0.12	0.184	0.182
Fast food or instant noodles	0.061	0.074	0	0.070	0.030

Table 5 shows the association between nutritional status and clinical, treatment-related and lifestyle-related determinants of malnutrition. The Disease severity ($p = 0.000^*$), experience of fever in the past month ($p = 0.000^*$), infection in the past month ($p = 0.023^*$), inflammation in the past month ($p = 0.000^*$), injury or illness (0.016^*), difficulty in swallowing ($p = 0.044^*$), nausea, vomiting and diarrhoea that limits activities ($p = 0.000^*$), fatigue and weakness ($p = 0.000^*$) and alcohol intake (0.001^*) were significantly associated with nutritional status.

However, nutritional status was not significantly associated with cancer type, stage of chemotherapy, socio-demographic characteristics (including gender, age, marital status, educational status, occupation, monthly income, and residential area), or other determinants of malnutrition such as food security, access, and diet quality.

Table 5
Association between Clinical, Treatment, Lifestyle-related determinants of Malnutrition and Nutritional status of Respondents

Clinical and Treatment-related Variables	χ^2	**P-value**
Cancer type	7.607	0.473
Stage of chemotherapy	7.513	0.057
Severity of disease	17.354	0.000*
Experience of fever in the past month	15.138	0.000*
Experience of infection in the past month	5.187	0.023*
Experience of inflammation in the past month	13.104	0.000*
Experience of acute illness or injury	5.760	0.016*
Fatigue and weakness that limit activities	12.428	0.000*
Nausea, vomiting or diarrhoea in the past week	Not reported	0.000*
Difficulty swallowing	4.042	0.044*
Lifestyle-related		
Alcohol Intake	10.554	0.001*

P-values with an asterisk (*) are statistically significant (dup: abstract ?)

Table 6 presents the results of the multivariable binary logistic regression analysis examining factors associated with malnutrition among adult cancer patients receiving chemotherapy. Patients with more than 10% weight loss had significantly higher odds of malnutrition (OR = 4.52, 95% CI: 1.87–10.92, p<.001). Recent fever was also significantly associated with malnutrition (OR = 3.21, 95% CI: 1.45–7.10, p=.004); patients who reported fever had 3.21 times higher odds of malnutrition. Difficulty swallowing was associated with approximately threefold higher odds of malnutrition (OR = 2.89, 95% CI: 1.13–7.42, p = .027). Similarly, patients who reported loss of appetite had significantly higher odds of malnutrition (OR = 2.67, 95% CI: 1.24–5.76, p = .013). A UFC score greater than 27% was also significantly associated with malnutrition (OR = 2.44, 95% CI: 1.12–5.31, p=.025). Failure to meet the minimum dietary diversity for women (MDD-W) was associated with increased odds of malnutrition among the female respondents; however, this association was not statistically significant (OR = 2.05, 95% CI: 0.91–4.62, p=.081). Age, sex, educational status, average monthly income, household food insecurity, current smoking and weekly alcohol use were not significantly associated with malnutrition in the adjusted model.

Table 6
Multivariable Binary Logistic Regression Predicting Malnutrition among Adult Cancer Patients Receiving Chemotherapy

Predictor (Yes = 1 vs. No = 0)	B	OR	95% CI	p-value
Socio-demographic				
Age > 56 years	0.45	1.57	0.72–3.42	.261
Female gender	-0.32	0.73	0.32–1.65	.452
Low Education (≤ secondary)	0.28	1.32	0.59–2.95	.498
Low income (<₦70K/month)	0.61	1.84	0.82–4.12	.139
Clinical Factors				
Weight loss > 10%	1.51	4.52	1.87–10.92	*<.001 **
Recent fever	1.17	3.21	**1.45–7.10 **	*.004 **
Difficulty swallowing	1.06	2.89	**1.13–7.42 **	*.027 **
Appetite loss	0.98	2.67	**1.24–5.76 **	*.013 **
Diet Quality				
UFC score > 27% (unhealthy foods)	0.89	2.44	**1.12–5.31 **	*.025 **
MDD-W not met (< 5 groups)	0.72	2.05	0.91–4.62	.081
HFIAS				
Food insecure (any level, 49.7%)	0.19	1.21	0.55–2.69	.632
Lifestyle				
Current smoker	0.41	1.51	0.62–3.67	.372
Alcohol use (weekly)	0.28	1.32	0.55–3.18	.534

P-values with an asterisk (*) are statistically significant

DISCUSSION

This study determined the prevalence of malnutrition using GLIM criteria and examined its associations with sociodemographic, clinical, lifestyle, dietary and food-security factors among adult cancer patients receiving chemotherapy at a tertiary hospital in Southwestern Nigeria. The findings demonstrate a high burden of malnutrition in this population and indicate that, after adjustment, clinical and nutrition-impact factors were more strongly associated with malnutrition than sociodemographic, lifestyle or household food-security characteristics.

Among the female participants, breast cancer was the most common cancer diagnosis. This finding aligns with data from the African Cancer Registry Network, which identified breast cancer as the leading cancer affecting women in sub-Saharan Africa, including Nigeria. [30] However, this result describes the cancer profile of the study participants, and the distribution of cancer types at this tertiary hospital could have been influenced by referral patterns, sex, age, cancer stage and access to specialised care.

The chemotherapy stage distribution showed that about one-third of respondents were midway through chemotherapy. This distribution shows that nutritional assessment occurred at different phases of treatment, and prolonged exposure to treatment-related side effects may negatively affect food intake and nutritional status.

Participants were assessed at different stages of chemotherapy, with approximately one-third midway through treatment. A substantial proportion of participants reported clinical symptoms, including recent fever, inflammation, acute illness or injury and fatigue that limited daily activities. These symptoms may reflect the combined effects of disease burden, treatment-related toxicity, infection and systemic inflammation, and may significantly contribute to malnutrition through increased metabolic demands, reduced appetite, and accelerated protein catabolism. [24, 31] The significant bivariate associations observed between disease severity, fever, acute illness or injury, fatigue and nutritional status further strengthen the suggestion that patients with greater clinical burden are likely to be more vulnerable to malnutrition

Loss of appetite, nausea, vomiting and diarrhoea were common nutrition-impact symptoms among the participants. These symptoms may reduce the amount and variety of food consumed, impair nutrient absorption or increase nutrient losses. Previous research has similarly identified nutrition-impact symptoms as important factors contributing to reduced food intake and nutritional risk among patients with cancer. [20, 32] The distribution between those experiencing the symptoms and those not experiencing appetite losses suggests different tolerance levels to chemotherapy side effects.

More than three-quarters of the participants were classified as malnourished using the GLIM criteria. This finding indicates a considerable burden of malnutrition among adult cancer patients receiving chemotherapy in this cohort. The result is consistent with the broad variation in cancer-related malnutrition reported across different cancer types, treatment settings and patient populations. [33] The GLIM framework strengthens malnutrition assessment by requiring at least one phenotypic criterion, such as weight loss, low BMI, or reduced muscle mass, and at least one aetiological criterion, such as reduced food intake or inflammation. [24] The high prevalence observed in this study supports the need for routine nutritional screening and timely assessment of patients receiving chemotherapy.

Approximately half of the participants were classified as food insecure, indicating that household food insecurity was common in this study population. Cancer treatment may place considerable financial demands on households, while symptoms and treatment-related limitations may reduce patients' ability to work or obtain food. Food insecurity can also restrict access to adequate quantities and varieties of

nutrient-dense foods. Although household food insecurity was not significantly associated with malnutrition in the adjusted model, [34] reported that food-insecure cancer patients had significantly higher rates of malnutrition and lower treatment completion rates than food-secure patients. Food insecurity may influence nutritional status indirectly through dietary quality, treatment affordability, social support and access to nutrition care.

The dietary assessment indicated that approximately 6 in 10 participants met the defined minimum dietary-diversity threshold, 4 in 10 did not, and only 2 in 10 participants consumed foods from all five food groups assessed in the study, indicating generally poor dietary adequacy. This pattern suggests that meeting a minimum diversity threshold did not necessarily indicate an adequate or optimal diet. Patients may have consumed foods from the required number of groups but in insufficient quantities or with limited nutritional quality. The finding that unhealthy-food consumption scores greater than 27% were significantly associated with malnutrition in the adjusted model is important. Participants with this dietary pattern had 2.44 times the odds of malnutrition compared with those with lower scores. This implies that an unhealthy dietary pattern may displace nutrient-dense foods and provide inadequate protein, energy and micronutrients. However, the cross-sectional design prevents a causal interpretation. On the other hand, patients experiencing appetite loss, dysphagia, or gastrointestinal symptoms may also choose convenient, soft, processed or more palatable foods that are not nutrient-dense, creating a bidirectional relationship between symptoms, dietary quality, and malnutrition.

A significant association was found between disease severity and recent fever experience, recent acute illness or injury, fatigue limiting activities, and nutritional status. According to, [35] worsened cancer is associated with increased inflammation, altered metabolism, and muscle wasting, which contribute to the development of malnutrition and cachexia. As the disease becomes more severe, these changes intensify, increasing the risk of further deterioration in nutritional status.

The adjusted binary logistic regression identified five factors independently associated with malnutrition: weight loss greater than 10%, recent fever, difficulty swallowing, appetite loss, and an unhealthy-food consumption score greater than 27%. Participants who had experienced more than 10% weight loss had 4.52 times the odds of being malnourished compared with those who had not experienced this degree of weight loss. This finding is consistent with evidence that percentage weight loss is an important indicator of nutritional deterioration among patients with cancer [36], although weight loss is also one of the phenotypic criteria used to diagnose malnutrition under GLIM. The association could have partly reflected an overlap rather than a completely independent causal relationship.

Recent fever was also independently associated with malnutrition. Participants who reported fever had 3.21 times the odds of malnutrition compared with those who did not. Fever may indicate infection, inflammation or greater disease activity, all of which may increase metabolic demands and promote catabolism. When these processes occur alongside reduced food intake, they may accelerate weight loss and lean tissue loss. This finding highlights the importance of evaluating and managing potentially reversible causes of fever and inflammation as part of comprehensive oncology nutrition care.

Difficulty swallowing was associated with almost threefold higher odds of malnutrition. Dysphagia can limit the quantity, consistency and variety of foods consumed and may result in prolonged inadequate intake. Patients reporting dysphagia should therefore receive early assessment and appropriate intervention, including texture modification, energy- and protein-dense meals, swallowing evaluation and alternative feeding support when clinically indicated.

Appetite loss was another independent factor associated with malnutrition. Participants who reported appetite loss had 2.67 times the odds of malnutrition compared with those without appetite loss. Persistent appetite loss can result in inadequate energy and protein intake and may contribute to involuntary weight loss and cancer cachexia. This finding supports including appetite assessment in routine chemotherapy follow-up rather than treating it as an unavoidable or minor side effect.

In contrast, age, female sex, low educational status, low income, inadequate minimum dietary diversity, household food insecurity, current smoking and alcohol use were not statistically significantly associated with malnutrition in the adjusted model. These findings suggest that, in this sample, clinical and nutrition-impact factors were more closely associated with GLIM-defined malnutrition than the measured sociodemographic, lifestyle and household food-security variables. However, further studies may be needed to examine their indirect effects and potential interactions with cancer type, treatment stage, household resources and social support.

Overall, the findings indicate that malnutrition among adult cancer patients receiving chemotherapy at a tertiary hospital in Southwestern Nigeria was associated predominantly with weight loss, fever, dysphagia, appetite loss and poor dietary quality. The results support a care model that combines regular nutritional assessment with early management of nutrition-impact symptoms and attention to patients' dietary intake.

Conclusion

Malnutrition was highly prevalent among adult cancer patients receiving chemotherapy in this study. Household food insecurity was common, and dietary diversity was limited. Malnutrition was mainly associated with clinical symptoms and unhealthy eating, particularly substantial weight loss, fever, dysphagia and appetite loss, rather than with sociodemographic characteristics. Routine screening, repeated assessment using the GLIM criteria, individualised dietary counselling, symptom-directed dietary modification, dysphagia management and food-security support should be integrated throughout chemotherapy and oncology care.

Limitations

The participant sample tilted toward older age groups due to higher clinic attendance among elderly cancer patients. However, despite this limitation, research integrity was maintained.

Abbreviations

BMI
Body Mass Index
DNA
Deoxyribonucleic Acid
DQQ
Diet Quality Questionnaire
FPC
Finite Population Correction
GLIM
Global Leadership Initiative on Malnutrition
HFIAS
Household Food Insecurity Access Scale
LMICs
Low–and Middle–Income Countries
PEM
Protein Energy Malnutrition
SOP
Surgical Out–patients Ward
UCH
University College Hospital
WHO
World Health Organisation

Declarations

Ethical Approval

Ethical approval was obtained from the University of Ibadan/University College Hospital (UI/UCH) Ethics Committee with the Assigned Number: UI/EC/25/0814.

The Chairman, Medical Advisory Committee's (CMAC) permission was also obtained from the University College Hospital (UCH) Hospital Services Department.

Informed Consent

Informed consent, written in English and interpreted to participants in the local language, was provided by the participants before data were collected

Conflicts of Interest

The authors declared no conflicts of interest.

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Authors' Contributions

BOA and AEO conceived and planned the research study. AEO and IBA collected and analysed the data. AEO and BOA interpreted the data and produced the results. AMF and FOS supervised and coordinated data collection. AEO, BOA and BAO wrote and edited the manuscript. All authors read, commented on and approved the final manuscript.

Data Availability

The datasets generated and analysed during this study are available from the corresponding author on reasonable request.

Declaration of generative AI and AI-assisting technologies in the writing process

During the preparation and writing of this work, the authors used ChatGPT 5.5 for language editing and grammar refinement. No content generation or data interpretation was performed by AI. All intellectual contributions are original and solely attributable to the authors. After using the tool, the authors reviewed and reworked the content as required and take full responsibility for the research work.

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Figures

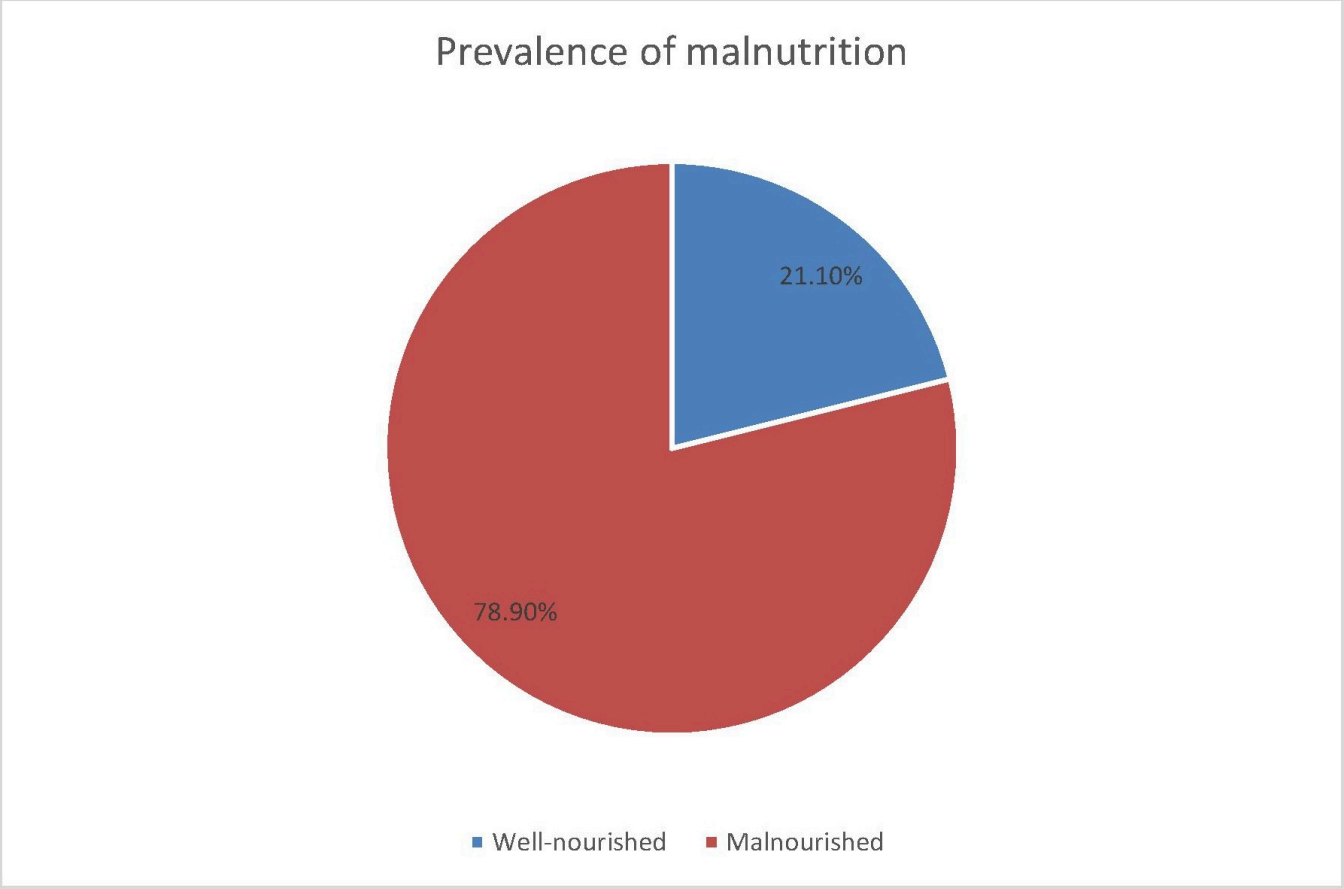


Figure 1

shows the prevalence of malnutrition among the respondents. 78.8% of respondents were malnourished, while about 21.1% were well-nourished. This indicates a 78.8% malnutrition prevalence among respondents.

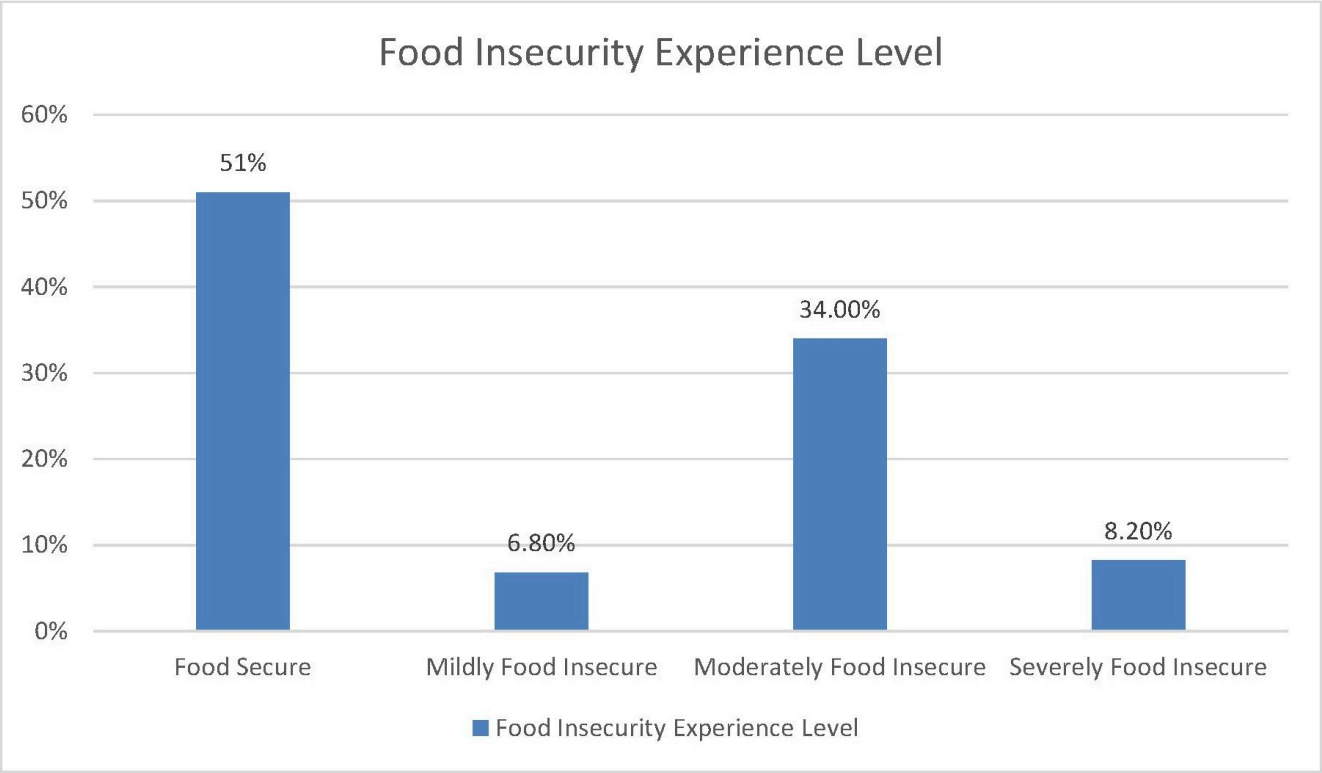


Figure 2

shows the distribution of respondents by food insecurity level: 51.0% were food secure, 6.8% were mildly food insecure, 34.0% were moderately food insecure, and 8.2% were severely food insecure. Overall, 49.0% of adult cancer patients receiving chemotherapy in this study experienced household food insecurity, with most affected households classified as moderately food insecure.