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Food insecurity and associated factors among adult cancer patients in south Ethiopia: a cross-sectional study

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The incidence of cancer is increasing in Ethiopia, and it poses significant financial burden on households. However, data on the prevalence of household food insecurity and associated factors among adult cancer patients in Africa is scarce. This study aimed to determine the prevalence of food insecurity and identify factors associated with it among adult cancer patients in Southern Ethiopia. A facility-based cross-sectional study was conducted among 338 cancer patients from November 2023 to February 2024. Binary logistic regression model was built in RStudio. The prevalence of food insecurity among cancer patients in this study was 64.2% (95% CI: 58.96–69.16). An increase in age (AOR = 0.97 95% CI; (0.94, 0.99), being married (AOR = 0.37 95% CI; (0.19, 0.74), taking chemotherapy (AOR = 0.27 95% CI; (0.14, 0.51), and an increase in the number of chemotherapy cycles (AOR = 0.83 95% CI; (0.74, 0.92) were associated with lower odds of food insecurity. On the other hand, the odds of being food insecure was higher among participants with poorer performance status (AOR = 1.65 95% CI; (1.21, 2.32). Integrating brief food-insecurity screening into routine oncology visits can help identify patients at risk. Addressing food insecurity should be a core component of comprehensive cancer care in low-resource settings.

Keywords Adult cancer patients, Food insecurity, Ethiopia

Abbreviations

AOR	Adjusted Odds Ratio
CI	Confidence Interval
FANTA	Food and Nutrition Technical Assistance
HFIAS	Household Food Insecurity Access Scale
WSUCSH	Wolaita Sodo University Comprehensive Specialized Hospital

Food security exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and preferences for an active and healthy life[1]. Despite global progress, nearly 29% of the world's population (approximately 2.33 billion people) experience moderate or severe food insecurity, with the burden disproportionately affecting low- and middle-income countries (LMICs). In Africa, this prevalence rises to 58%[2], and more than half of Ethiopian households experience food insecurity[3]. A growing body of literature in cancer populations documents substantially higher prevalence of food insecurity than in the general population[4].

In Ethiopia, cancer is increasingly diagnosed and contributes to an estimated 5.8% of all deaths. Although population-based cancer data are available only for Addis Ababa, national estimates suggest approximately 60,960 new cancer cases and over 44,000 deaths annually[5]. Concurrently, access to comprehensive cancer care remains limited[6].

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Food insecurity is associated with lower consumption of fresh, nutrient-rich foods such as fruits, vegetables, and dairy, resulting in reduced intake of essential vitamins and minerals, including vitamin A, vitamin B6, calcium, magnesium, and zinc[7]. In cancer populations, food insecurity is associated with greater symptom burden, lower health-related quality of life (QoL), reduced treatment adherence, and increased mortality[4,8,9]. Furthermore, food insecurity may contribute to suboptimal treatment outcomes, including hospitalizations and adjustments to chemotherapy regimens[4].

Cancer patients are particularly vulnerable to nutritional threats due to multiple, interacting pathways[4]. Metabolic alterations associated with cancer (e.g., increased catabolism), treatment side effects such as nausea, taste alterations, mucositis, and fatigue, functional limitations, and financial toxicity (loss of income and rising out-of-pocket costs) can compromise both food access and dietary intake. These biological and socioeconomic factors create a feedback loop in which food insecurity exacerbates malnutrition, which in turn worsens treatment tolerance and clinical outcomes[4,9,10]. The predictors of food insecurity among cancer patients include sex[11], age[12], low economic level[13], having children < 18 years of age[13], and reduced health care utilization[14]. Existing interventions to mitigate food insecurity among cancer patients are limited in low-resource settings, and social protection mechanisms such as productive safety net program are not cancer-specific.

Despite the significant financial burden that a cancer diagnosis places on households, data on the prevalence of household food insecurity and associated factors among adult cancer patients in Ethiopia, and Africa at large, are scarce. Accordingly, this study aimed to determine the prevalence of food insecurity among adult cancer patients and to identify factors associated with food insecurity at Wolaita Sodo University Comprehensive Specialized Hospital, Southern Ethiopia.

Methods

Study setting and period

The study was conducted at Wolaita Sodo University Comprehensive Specialized Hospital (WSUCSH), located in Wolaita Sodo, Southern Ethiopia. Established in 1913, WSUCSH is the only hospital in South Ethiopia region that provides oncology care. The hospital serves as a teaching hospital in addition to providing curative and rehabilitation services. The hospital serves approximately 2 million people in Wolaita zone and neighboring zones. It has around 170 inpatient beds across major departments and an oncology center where 618 cancer patients were on follow-up during the study period (November 2023 to February 2024).

Study design and population

A facility-based cross-sectional study was conducted from November 2023 to February 2024 at the WSUCSH oncology center. The study included all adult (≥ 18 years) confirmed cancer patients attending the oncology center during the study period. Critically ill patients who were unable to respond to the questionnaire were excluded. Eligible participants were consecutively recruited until the calculated sample size was achieved.

Sample size determination and sampling procedure

The original sample size was calculated for the parent study based on the prevalence of undernutrition among adult cancer patients. The present analysis represents a secondary analysis examining food insecurity and associated factors using all available participants (n = 338). Although the sample size was not originally determined for this outcome, the adequacy of the sample for multivariable regression analysis was evaluated using established methodological recommendations. Specifically, assuming a food insecurity prevalence of approximately 53.65%[15], the expected number of food insecurity cases (~ 172) exceeds the commonly recommended threshold of 10 outcome events per predictor variable[16], supporting model stability and reliable estimation of associations. Therefore, the available sample size was considered adequate for the current analyses. All eligible adult cancer patients that come to WSUCSH oncology center during the study period were recruited consecutively until the sample size is achieved.

Outcome variable

Food insecurity was assessed using the Household Food Insecurity Access Scale (HFIAS) developed by the Food and Nutrition Technical Assistance (FANTA) project[17]. The HFIAS comprises nine occurrence questions that capture the experience of food insecurity in the past 30 days, the household (1) worried about not having enough food; (2) was unable to eat preferred foods; (3) ate a limited variety of foods; (4) ate foods they did not want to eat; (5) ate smaller meals than needed; (6) ate fewer meals in a day; (7) had no food of any kind in the household; (8) went to sleep hungry; and (9) went a whole day and night without eating. For each item, respondents first indicate whether the condition occurred (Yes/No). If "Yes," frequency-of-occurrence is recorded as: rarely (once or twice), sometimes (3–10 times), or often (> 10 times) in the 30-day period. Each item is scored 0–3 (0 = never, 1 = rarely, 2 = sometimes, 3 = often) and summed to produce a total HFIAS score ranging from 0 to 27, where higher scores indicate greater food-access insecurity.

Additionally, households were categorized as food secure, mildly food insecure, moderately food insecure, or severely food insecure based on the standard FANTA algorithm, which classifies respondents according to the pattern and severity of affirmative responses rather than the summed score alone[17].

Exposure variables

The following covariates were assessed as potential factors associated with household food insecurity. Socio-demographic and economic factors included age, sex, place of residence, educational attainment, marital status, occupation, household income, and household size. Clinical and cancer-related factors included cancer type, stage, duration since diagnosis (months), receiving chemotherapy, number of chemotherapy cycles received, performance status, and presence of co-morbidities. Lifestyle and psychosocial factors included alcohol

use, cigarette smoking, and khat chewing. We have used the Eastern Cooperative Oncology Group (ECOG) Performance Status Scale to assess patient's performance status. It describes a patient's level of functioning in terms of their ability to care for themselves, daily activity, and physical ability. It is graded from zero for fully active to five for dead.

Data collection and quality assurance

Data were collected using a structured interviewer-administered questionnaire programmed in KoboToolbox[18,19]. Socio-demographic and clinical data were extracted from patients' medical charts using a predesigned abstraction form to ensure consistency. Household food insecurity was assessed using the HFIAS[17]. Data were collected by trained health professionals with prior experience in survey administration. Before data collection, all data collectors and supervisors participated in a two-day training covering the study objectives, questionnaire content, Kobo data collection procedures, participant recruitment, ethical considerations, and interviewing techniques.

Real-time data validation was performed within KoboToolbox to flag missing or out-of-range responses. The questionnaire was pretested on 5% of the sample among cancer patients at Hawassa University Comprehensive Specialized Hospital cancer treatment center, and we did not include them in the main study. Based on the pretest findings, minor modifications were made to improve clarity and flow. Regular field supervision, spot checks, and feedback sessions were conducted throughout the data collection period to ensure adherence to study protocols and data integrity.

Statistical analysis

Descriptive statistics, including frequencies, percentages, means, standard deviations, medians, and interquartile ranges, were computed to summarize socio-demographic, clinical, and food insecurity characteristics of the study participants. We have checked the linearity of quantitative continuous variables. The prevalence and distribution of food insecurity levels were described across key participant characteristics.

To identify factors associated with food insecurity, a binary logistic regression model was employed. Initially, we aimed to conduct ordinal regression analysis. However, because of very few count for moderate (14) and severe (1) food insecurity categories, we were unable to use ordinal regression. Thus, we dichotomized food insecurity into food secure and food insecure for regression analysis.

Data were analyzed using RStudio version 2025.09.1 + 401. Model selection was guided by the Akaike Information Criterion (AIC), with the model showing the lowest AIC value considered the best fitting model. Variables were selected based on prior evidence and clinical relevance to food insecurity among cancer patients, and we had 14 variables in the multivariable regression model. Multicollinearity among explanatory variables was checked using the Variance Inflation Factor, with a score less than 10 indicating acceptable levels. The Hosmer-Lemeshow goodness-of-fit test was applied to assess the fitness of the model, with a p-value = 0.063, indicating adequate model fit. The pseudo-R^2 statistics was conducted to assess the model explanatory power. The fitted model demonstrated good explanatory power (McFadden $R^2 = 0.21$; Cox & Snell $R^2 = 0.24$; Nagelkerke $R^2 = 0.33$). This indicates a considerable improvement in fit compared with the null model. Interaction terms were evaluated but not retained due to lack of significance, and due to minimal missing data, analyses were conducted using complete cases. Results were expressed as adjusted odds ratios (AORs) with corresponding 95% confidence intervals (CIs), and statistical significance was declared at a p-value < 0.05.

Ethical considerations

This study was conducted in accordance with the principles of the Decalaration of Helsinki. Ethical approval for the study was obtained from the Institutional Review Board of Wolaita Sodo University (ref: wsu41/40/231). Permission to conduct the study was also secured from the relevant hospital department. Informed consent was obtained from all participants prior to data collection. To ensure confidentiality, all collected data were anonymized using unique identification numbers, and no personally identifying information was recorded or reported.

Results

A total of 338 participants were included in the study. The median age was 43.5(+/−16), and just over half resided in rural areas (51.2%). Regarding education, 35.2% had no formal schooling. Almost half of the participants (45.6%) were not engaged in work outside the home. Most lived in larger households, with 63.6% having five or more members. (Table 1)

Table 2 shows the clinical and behavioral characteristics. Among the 338 participants, the vast majority did not consume alcohol (93.5%), did not chew khat (98.5%), and did not smoke cigarettes (99.7%). Nearly half had been diagnosed less than six months ago (45.8%). Most participants had advanced disease, with 37.6% at stage IV. Regarding treatment, 58.6% were currently receiving chemotherapy.

According to Fig. 1, the most common cancer types were breast tumors (37.0%), digestive tumors (16.9), and hematolymphoid tumors (13.9%).

Household responses to individual HFIAS items are presented in Table 3. More than half of the study participants (52.1%) worry that their household would not have enough food and 37.6% have to eat fewer meals in a day because there was not enough food.

The overall food insecurity categories derived from total HFIAS scores are shown in Fig. 2. Overall, 64.2% (95% CI: 58.96–69.16) of households were food insecure. About 59.8% of the households were mildly food insecure and 4.1% were moderately food insecure.

Table 4 shows the factors associated with food insecurity among cancer patients. An increase in age (AOR = 0.97 95% CI; (0.94, 0.99), being married (AOR = 0.37 95% CI; (0.19, 0.74), taking chemotherapy (AOR = 0.27 95%

Variable ($n = 338$)	Median +/- SD or N (%)
Age	43.5+/−16
Sex	
Female	236 (69.8)
Male	102 (30.2)
Residence	
Rural	173 (51.2)
Urban	165 (48.8)
Marital status	
Married	268 (79.3)
Widowed	36 (10.6)
Single	26 (7.7)
Divorced/Separated	8 (2.4)
Education	
No formal education	119 (35.2)
Primary education	102 (46.6)
Secondary education completed	58 (26.5)
Higher	59 (26.9)
Spouse education	
No formal education	83 (31.0)
Primary education	60 (32.4)
Secondary education completed	67 (36.2)
Higher	58 (31.4)
Occupation	
Not working outside the home	154 (45.6)
Employed worker	59 (17.4)
Merchant	56 (16.6)
Farmer	45 (13.3)
Others*	24 (7.1)
Household size	
< 5	123 (36.4)
≥ 5	215 (63.6)
Monthly income (ETB)	
< 3000	109 (32.2)
3000–4999	83 (24.6)
5000–9999	96 (28.4)
≥ 10,000	50 (14.8)

Table 1. Sociodemographic characteristics of study participants. *driver, evangelist, daily laborer, student; ETB: Ethiopian birr.

CI; (0.14, 0.51), and an increase in the number of chemotherapy cycles (AOR = 0.83 95% CI; (0.74, 0.92) were associated with lower odds of food insecurity. On the other hand, the odds of being food insecure was higher among participants with poorer performance status (AOR = 1.65 95% CI; (1.21, 2.32).

Discussion

This study revealed a high burden of household food insecurity (64.2%) among cancer patients in South Ethiopia, indicating that food insecurity is a major yet often overlooked challenge in oncology settings. Several significant predictors including younger age, unmarried status, ongoing chemotherapy, higher chemotherapy cycles, and poor performance status highlight the combined social and clinical vulnerabilities faced by this population.

Given the scarcity of published data on household food insecurity among adult cancer patients in low- and middle-income countries, our observed prevalence (64.2%) represents an important new contribution. Studies from high- and middle-income settings report food insecurity rates ranging from 17% to 55% among cancer patients, supporting the notion that cancer can exacerbate difficulties in food access[20]. Our estimate also exceeds the pooled national prevalence of household food insecurity in the general Ethiopian population (51.5%)[21].

Although few studies directly assess food insecurity among cancer patients in Africa, nutritional indicators further support this vulnerability. A meta-analysis from Africa reported a 32.8% prevalence of undernutrition among cancer patients[22], while another meta-analysis conducted in Ethiopia found an even higher burden (49.2%)[23]. Together, this evidence suggests that cancer patients in similar settings face substantial nutritional and food access challenges, which reinforces the significance of our findings. There are limited oncology facilities in

Variable ($n = 338$)	N (%)
Drinking alcohol	
Yes	22 (6.5)
No	316 (93.5)
Chewing Khat	
Yes	5 (1.5)
No	333 (98.5)
Smoking cigarette	
Yes	1 (0.3)
No	333 (99.7)
Duration of illness since diagnosis (in months)	
< 6	155 (45.8)
6–11	79 (23.4)
≥ 12	104 (30.8)
Stage of the cancer	
Stage I	44 (13.0)
Stage II	48 (14.2)
Stage III	103 (30.5)
Stage IV	127 (37.6)
Unknown	16 (4.7)
Taking chemotherapy	
Did not start	69 (20.4)
Currently taking	198 (58.6)
Completed	71 (21.0)
Cycles of chemotherapy taken (n = 269)	
< 4	141 (52.4)
4–6	61 (22.7)
> 6	67 (24.9)
Has comorbidities	
Yes	38 (11.2)
No	300 (88.8)
Performance status	
Fully active	94 (27.8)
Restricted in physically strenuous activity	162 (47.9)
Ambulatory and capable of all self-care	49 (14.5)
Capable of only limited self-care	21 (6.2)
Completely disabled	12 (3.6)

Table 2. Lifestyle, clinical characteristics, and performance status of the study participants.

Ethiopia, high out-of-pocket expenditures, and minimal nutrition services in routine cancer care. Thus, patients in Ethiopia bear the direct and indirect costs of treatment unlike high-income countries. These limitations exacerbate cancer patients' and their households' vulnerability to food insecurity.

This study revealed that certain socio-demographic variables were predictors of food insecurity among cancer patients. It was found in this study that as age increases, the odds of food insecurity decreases. Several prior studies confirmed that younger people with cancer are more likely to become food insecure compared to their older counter parts[12,24–26]. This might be because younger patients diagnosed with cancer are limited from working because of the illness, their income decreases, and they have fewer opportunities to accumulate wealth[27]. This finding reflects not only individual characteristics but also systemic inequalities in accessing care.

The current study documented that being married reduces the odds of food insecurity by 63%. Another study also reported that food insecurity was higher among unmarried[28]. Although there is scarcity of direct studies that explored being married with food insecurity among cancer patients, broader literature shows that having a partner is associated with better economic and social resources, which reduces the odds of food insecurity[29]. Having a marriage may lead to shared economic resources, dual income, larger household social capital and support networks, and thus reduced food insecurity compared to being single[30,31].

This study found that receiving chemotherapy and completing more chemotherapy cycles were associated with food insecure. This finding contrasts with previous studies reporting that food insecurity is associated with treatment delay, or make changes to their treatment because of their financial constraints[14,28]. One possible explanation is that, in Ethiopian context, patients who receive chemotherapy or complete multiple chemotherapy cycles are a subgroup with better financial or social resources and support. However, the cross-sectional design

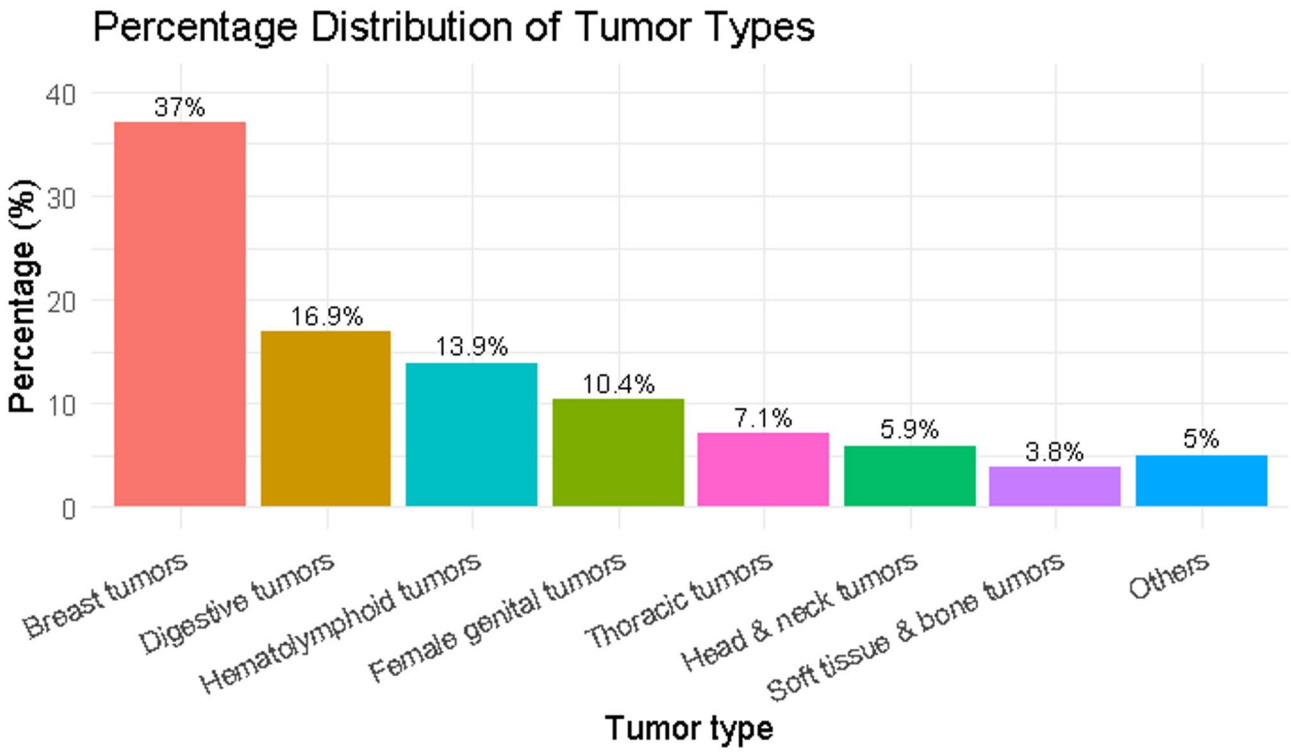


Fig. 1. The distribution of the type of cancer among the study participants. The distribution of the type of cancer among the study participants. The bar chart shows the distribution of the type of cancer among the study participants. The distribution was presented in percentage. Red bars= breast tumors, brown=digestive tumors, dark blue=hematolymphoid tumors, dark green= female genital tumors, pink=thoracic tumors, green= head and neck tumors, purple= soft tissue and bone tumors, and light blue= other tumor types.

Variable ($n=338$)	Category	*N* (%)
Worry about food	Yes	176 (52.1)
	No	162 (47.9)
Unable to eat preferred foods	Yes	175 (51.8)
	No	163 (48.2)
Eat just a few kinds of foods	Yes	190 (56.2)
	No	148 (43.8)
Eat foods they really do not want eat	Yes	170 (50.3)
	No	168 (49.7)
Eat a smaller meal	Yes	151 (44.7)
	No	187 (55.3)
Eat fewer meals in a day	Yes	127 (37.6)
	No	211 (62.4)
No food of any kind in the household	Yes	44 (13.0)
	No	294 (87.0)
Go to sleep hungry	Yes	26 (7.7)
	No	312 (92.3)
Go a whole day and night without eating	Yes	19 (5.6)
	No	319 (94.4)

Table 3. Household's response to HFIAS questions among the study participants.

of the current study does not allow determination of the direction of association. It remains unclear whether patients who are less food insecure are more likely to initiate or complete more chemotherapy cycles or whether receiving or continuing chemotherapy contributes to improved food security. There is a need for a longitudinal study to clarify the temporal relationship between receiving chemotherapy and household food insecurity.

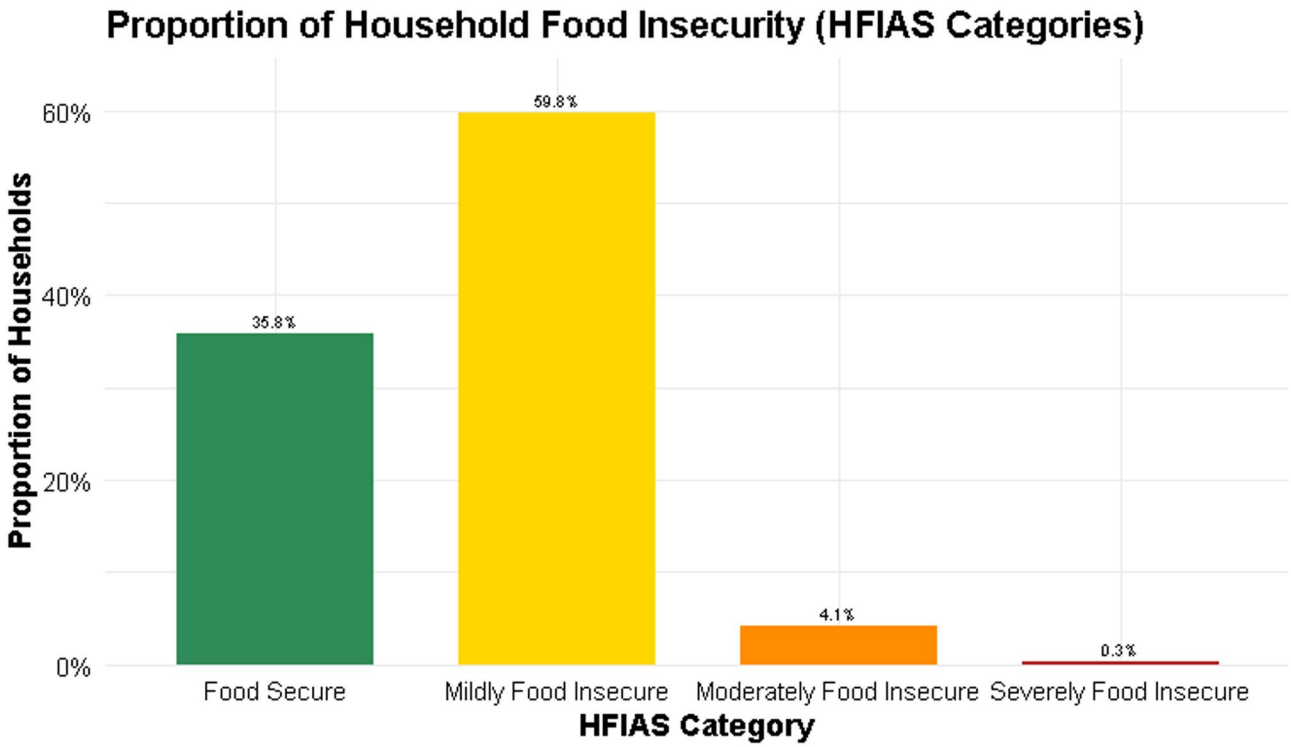


Fig. 2. Household food insecurity access prevalence of the study participants. The prevalence of household food insecurity among the study participants in South Ethiopia. The bar chart depicts the prevalence of household food insecurity (secure, mild, moderate, and severe) among the study participants. Food insecurity was assessed using household food insecurity access scale tool. Green bar indicates food security, yellow= mild food insecurity, orange= moderate food insecurity, and red= severe food insecurity.

Variable ($n=338$)	Food security status		AOR (95% CI)	*p* Value
	Secure	Insecure		
Age in years			0.97(0.94, 0.99)	< 0.01
Marital status				
Currently married	90	178	0.37(0.19, 0.74)	< 0.01
Currently not married	31	39	1	
Taking chemotherapy				
Yes	41	99	0.27(0.14, 0.51)	< 0.001
No	80	118	1	
Number of chemotherapy cycles			0.83(0.74, 0.92)	< 0.001
Performance status			1.65(1.21, 2.32)	< 0.01

Table 4. Factors associated with food insecurity among cancer patients in South Ethiopia, 2024.

Consistent with another study, this study reported that study participants with poorer performance status had increased odds of food insecurity[32]. Although direct studies on food insecurity and performance status are limited, Evidence from other chronic disease populations depict that poorer performance status might have reduced their ability to engage in income-generating activities or maintain their employment. Poorer functional status is also associated with increased medical and caregiver costs, and might divert household resources away from food[33,34].

Our study utilized a cross-sectional design, and it did not identify whether the food insecurity was due to the financial burden arising from the burden of cancer care, making the direction of causality ambiguous. Moreover, food insecurity was assessed at a single point before, during, or after taking chemotherapy, and it may not reflect persistent food insecurity. Patients early in treatment may have family support or savings that can mask food insecurity temporarily.

Conclusion

Food insecurity is highly prevalent among cancer patients in South Ethiopia, and is associated with age, treatment status, marital status, functional limitations, and number of chemotherapy cycles. Thus, oncology services in Ethiopia should utilize context specific strategies to address food insecurity effectively. A brief food-insecurity screening should be integrated into routine oncology visits, with particular attention to younger, unmarried, and functionally limited patients. Targeted support such as connecting patients to productive safety net programs, and guidance on available services, especially for those unable to afford care should be implemented. Addressing food insecurity should be a core component of comprehensive cancer care in low-resource settings. Moreover, longitudinal studies with repeated food insecurity assessment are needed to clarify causal inference between food insecurity and receiving chemotherapy.

Data availability

The datasets analyzed for this study are available with the corresponding author, which can be accessed on reasonable request.

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Author contributions
SKD conceived the study, designed the protocol, coordinated data collection, analyzed the data, interpreted the findings, and drafted the manuscript. DN conceived the study, designed the protocol, coordinated data collection, analyzed the data, interpreted the findings, and drafted the manuscript. All authors read and approved the final version of the manuscript. DTH contributed to the design, data collection, analysis, and interpretation of the findings, and proofread the manuscript. ALM contributed to the design, analysis and interpretation of the findings, and proofread the manuscript. ADK contributed to the design, data collection, analysis, and interpretation of the findings, and proofread the manuscript.

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Competing interests
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