International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2024: 7.101

Nutritional Status and Risk Factors of Malnutrition Among Cancer Patients Receiving Chemotherapy at Tertiary Cancer Centre: A Cross-Sectional Study

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Abstract: ***Introduction: Cancer is a multifaceted ailment which requires several therapies and treatments, where nutrition plays one of the vital roles in managing it. The purpose of this study was to explore the complications among post-treatment cancer survivors who were not under palliative care. Methods: Hundred cancer patients were selected for the study. Participants who had completed active cancer treatment at least six months prior were recruited to complete a face-to-face survey by using a questionnaire. The survey assessed dietary habits, food choices, as well as clinical and nutritional status. Results: The cohort study (N = 100) predominantly consisted of male patients (66%), with most having suffered from lung (18.2%) and oesophageal (16.7%) cancers. Among female respondents, breast (26.5%) and ovarian (17.7%) cancers were most common. The mean age of the respondents was 54.74 ± 11.83 years. Conclusion: This study highlights that post-treatment cancer survivors, with varied cancer types and demographic profiles, face unique nutritional and clinical challenges. Understanding their dietary habits and nutritional status is essential for developing targeted interventions to support their long-term recovery and improve quality of life. These findings underscore the importance of integrating nutritional assessment and guidance into survivorship care plans for cancer survivors.***

Keywords: Cancer survivors, post-treatment, palliative, face-to-face, nutritional status, interventions, nutritional assessment

1. Introduction

Cancer is one of the most dreaded diseases affecting about of world's population and causes one in eight deaths across the world. The global cancer burden is expected to be 21.7 million new cases and 13 million deaths by 2030 (Ervik *et al.,* 2016). Globally, cancer is the second leading cause of premature death after cardiovascular diseases (Kocarnik *et al.,* 2022; Mahase, 2019) 1–3 but is projected to be the leading cause of death by the end of this century (Bray *et al.,* 2021). Another interesting fact is that the rates of cancer is maximum in high income countries (Torre *et al.,* 2016). According to Sung and colleagues, the global age-adjusted cancer mortality rate in 2020 was 43.0% greater among men than among women (120.8 vs.84.2 deaths per 100, 000). Similarly, the incidence rate was 19.0% greater among men than among women (222.0 vs.186 cases per 100, 000) (Sung *et al*, 2021). These disparities could arise from men's lower participation in cancer prevention activities; underuse of available prevention, screening, and treatment options; increased exposure to cancer risk factors; and biologic differences (Lui *et al.,* 2023; Dai *et al.,* 2022).8, 9 Malnutrition screening is very important for minimizing the risks of side-effects of the treatment. Nutrition education and dietary advice to the patient and family members and other related interventions to relieve symptoms preventing adequate food intake, as well as a variety of intensive interventions like enteral and parenteral supplies of nutrition (Ottery, 1995).

Hence the present study was intended with the following objectives:

1) To identify the prevalence and risk factors among cancer patients.
2) To provide protective measures in improving nutritional status of cancer patients.

2. Materials and Methods

Study area: The entire study was carried out in the hospitalized patients of Barpeta Cancer Centre, Barpeta, Assam. The study was done for the period of three months.

Selection of the sample: The samples were selected as per the willingness of the respondents. Consent forms were given to the samples that were willing to take part in the study. Ethical approval for this study was taken.

Sample size: At the beginning of the study 112 samples were selected as per the consent of the respondents. But for various reasons ultimately 100 respondents remained till the end of the study. So, out of the total sample size of hundred, 66 were males and the rest were females. Age of the respondents ranged from 11 to 80 years. Body mass index (BMI) of the samples was also calculated. Risk of malnutrition along with different types of symptoms that arises after chemotherapy was also incorporated in the study. Apart from these the educational qualification, occupation, marital status, dietary pattern, habit of chewing tobacco and betel nuts or smoking etc. of the samples were also recorded.

Data collection method: The data of the samples were collected by using a pre-tested interview schedule. The form was piloted with 3 academics where they felt the interview schedule was clear and complete.

Study period: This cross-sectional study was carried out in Barpeta Cancer Centre, Barpeta, Assam from July, 2024 to October, 2024. Nutritional status, the need for nutritional intervention and NIS were assessed through the pre-tested questionnaire.

Data analysis: The obtained data were statistically by using SPSS for Windows. BMI was calculated using the World Health Organization calculation (weight in kg divided by height in m^2). Associations between variables were explored using chi-square tests for categorical data. $p < 0.05$ was considered statistically significant.

3. Results and Discussions

3.1 Background Information

a) Age and gender: Hundred cancer survivors who were receiving chemotherapy were selected for taking part in the present study on the basis of their consent. Most of the patients were under the age group of 51-60 years (33%), followed by 41-50 years (24%), 61-70 yrs (22%), less than 40 years of age and remaining (9%) were under the age group of 71-80 years (Table 1). Most of the respondents were males (66%) in the current study. While comparing the gender of the respondents separately, it was observed that highest number (41.2%) of females suffered from cancer in the age of 41-50 years followed by patients under the age group of 51-60 years. In case of males. it was seen in 51-60 years (33.3%), following that the patients of 61-70 years (30.3%) of age. Table1 also shows the percentage of cancer sufferers were seen more in females less than 40 years of age as compared to males. The gender distribution is consistent with global cancer incidence patterns, where men have a higher incidence and mortality rate than women (Sung *et al*., 2021; Kocarnik *et al*., 2022). Torre *et al. (*2016) The global cancer burden is higher in men than women, both in terms of incidence and mortality. This is attributed to differences in exposure to risk factors (such as tobacco use), access to screening and treatment and biological factors.

Table 1: Gender wise percent distribution of age of the respondents

Age (Years)	N*	Gender	
		Female (N (%))	Male (N (%))
<40	12	6 (17.6)	6 (9.1)
41-50	24	14 (41.2)	10 (15.2)
51-60	33	11 (32.4)	22 (33.3)
61-70	22	2 (5.9)	20 (30.3)
71-80	9	1 (2.9)	8 (12.1)

*Total number of respondents

b) Education: Fig.1 depicts the percent distribution of educational qualification of the respondents. From the Fig.1 it can be seen that most of the respondents were illiterate (51%). Thirty two percent of the respondents were primary school passed, followed by 12% of secondary school passed and only 5% were graduates. In the present study, it was seen that percentage wise more females were illiterate (52.9%) as compared to males (50%). The order of percent distribution of educational qualification in both the genders was same. Socioeconomic and educational disparities are well-documented contributors to cancer morbidity and mortality which was similar to the present study (Frederiksen *et al*., 2010; Ward *et al*., 2004).

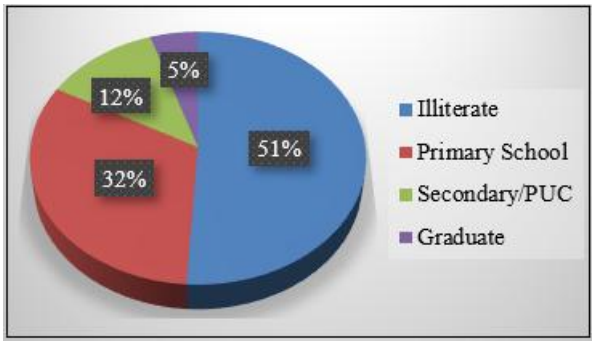

Figure 1: Percent distribution of educational qualification of the respondents

c) Occupation: The occupation of the respondents of the present study was quite diverse. Most of the females were home makers (94.1%) whereas most of the males were farmers (45.5%) (Table 2). In case of female responders only 3% were service holders. Among the male respondents 15.2% were businessmen, 13.6% were service holders, 12.1% were labourers and, 7.6% people were unemployed and rest 1.5% were retired employee and student. The monthly income source of the employed respondents was less than Rs.10, 000/-.

Table 2: Gender wise percent distribution of occupation among respondents

Types of occupation	N (Total number of respondents)	Gender	
		Female (N (%))	Male (N (%))
Business	10	0 (0.0)	10 (15.2)
Driver	2	0 (0.0)	2 (3.0)
Farmer	30	0 (0.0)	30 (45.5)
Unemployed	37	32 (94.1)	5 (7.6)
Labour	8	0 (0.0)	8 (12.1)
Retired employee	1	0 (0.0)	1 (1.5)
Service	11	2 (3.0)	9 (13.6)
Student	1	0 (0.0)	1 (1.5)

d) Religion: The present study showed that most of the samples were Islams (57%) and rest were Hindus. The religious distribution in cancer studies is typically a reflection of the local population demographics rather than a direct risk factor for cancer.

e) Marital status: Most of the samples were married (96%), only 3% were unmarried and rest (1%) was widowed.

f) Language spoken: Most of the respondents used to speak in Bengali (63%) followed by Assamese (32%) and Bodo (5%). The gender wise percent distribution followed the similar pattern as the total participants. The language distribution among patients in Assam is consistent with the linguistic demographics of the region, where Bengali and Assamese are widely spoken (Census of India, 2011).

g) Addictive habits: The present study revealed that most of the male respondents were suffering from lung (16.7%) and oesophaseal (12.1%) cancers while female responders were largely suffered by cancer of breast (26.5%) and gall

bladder (14.7%). Among the samples 55% respondents had the habit of chewing tobacco whereas rest had the habits of both smoking and chewing tobacco. About 52.9% females had the habit of smoking and chewing tobacco where as in case of males, higher percentage of cancer (59.1%) was seen in those who had the habit of only chewing tobacco. Chewing tobacco and smoking are considered as risk factors for various kinds of cancers including oral, neck, esophageal, pancreatic, lung cancers etc. Similarly, studies done by Choi *et al*. (2013) and Yang *et al*., (2016) revealed a significant association ($p < 0.05$) between tobacco use and cancer type, supporting the role of tobacco as a major risk factor.

h) Dietary habits: All the respondents of the present study were non–vegetarians. Studies showed that high ingestion of red and processed meat also increases the risk of esophageal adenocarcinoma (Choi *et al.,* 2013; Andrici and Eslick, 2015; Yang *et al.,* 2016). In the present study all the respondents were non-vegetarian, however, due to limited financial resources, regular intake of animal protein was rare. This dietary pattern, combined with high tobacco use, may contribute to the observed cancer types. So, in this case we might assume that tobacco chewing and smoking were the main causes of cancer. Moreover, central obesity and gastroesophageal reflux disease are two crucial risk factors toward development of esophageal adenocarcinoma (Cook *et al.,* 2014; Corley *et al.,* 2008;). On the other hand, healthy dietary habits such as more consumption of foods rich in omega-3 fatty acids, fibre, polyunsaturated fatty acids and low intake of trans fats etc. could be a shield against some types of esophageal cancer (Kubo *et al.,* 2009). Superfluous consumption of alcohol and hot food and beverages enhances the risk of esophageal squamous cell carcinoma to many folds. Torre *et al.* (2016) too opined that in developing countries, cancers related to infection (like cervical and liver cancer) are more common. In developed countries, cancers associated with lifestyle factors (such as lung, breast and colorectal) predominate. While some high-income countries have seen declines in certain cancer rates (e. g. lung cancer in men due to reduced smoking), the overall global burden is rising due to population growth and aging.

3.2 Health indicators of the respondents

a) BMI: Table 3 shows the percentage of the BMI of the respondents. It can be seen that most of the patients were having normal weight, 17% patients were severely underweight, 15% were severely underweight and 13% were fall under underweight category. Only 6% of the respondents were overweight.

Table 3: Gender wise percent distribution of Body Mass Index (BMI) among respondents

Categories	N (Total number of respondents)	Gender	
		Female (N (%))	Male (N (%))
Very severely underweight	15	5 (14.7)	10 (15.2)
Severely underweight	17	2 (5.9)	15 (22.7)
Underweight	13	6 (17.6)	7 (10.6)
Normal	49	20 (58.8)	29 (43.9)
Overweight	6	1 (2.9)	5 (7.6)

b) Malnutrition: Among them most of the patients (62%) were at risk of malnutrition, out of which 64.75% were females and 60.6% were males (Table 5). Thirty percent of the total patients were malnourished which further can influence treatment outcomes, delay wound healing, worsen muscle function and increased the chance of post operative complications. It is estimated that 40 to 80% of all cancer patients will be malnourished during the course of the disease. (Ravasco, 2019). Among the malnourished patients, 23.5% and 33.3% were females and males respectively (Table 5). Malnutrition ensues from an inflammatory state that promotes anorexia and consequently, weight loss. It is highly prevalent in cancer patients (Dewys *et al.,* 1980) as 15 to 40% of patients report weight loss at diagnosis (Wigmore *et al.,* 1997). Additionally, the incidence of malnutrition increases as the disease progresses until it affects 80% of patients (Rosania *et al.,* 2016*;* Gupta *et al.,* 2006). Malnutrition adversely affects the evolution of cancer patients, increasing the incidence of infections, length of hospital stays and risk of death (Chow *et al.,* 2016).

Types of cancer of the respondents: Table 4 depicting the gender wise percent distribution of various types of cancers the respondents. It was evident from the Table 4 that most of the male responders were suffering from lung cancer (18.2%), on the contrary 26.5% of the answerers were breast cancer patients. Oesophaseal (16.7%), larynx (10.6%) and tongue (9.1%) cancers were also observed high in case of male respondents as compared to other types of cancers. This distribution mirrors national and global cancer statistics (Torre *et al*., 2016). He reported that globally, the most common cancers in men are lung, prostate and colorectal, while in women, breast, colorectal and lung cancers predominate and they noted that cancer incidence and mortality rates are highest in high-income countries. Though, relatively rare, one male respondent was also gotten in the study who was suffering from breast cancer. According to Review of Surveillance, Epidemiology and End Result (SEER) data, male breast cancer incidence rose by 40% from 1975 to 2015, exceeding that of women by 25% (Ries *et al.,* 2005). The ratio of male breast carcinoma to female is 1: 1000 cases. Incidence is relatively low in men because of presence of less amount of breast tissue. It is also because of the difference in their hormonal environment when compared to female (Ambareen *et al.,* 2024). In case of females, mostly suffering from ovarian (17.7%) and gall bladder (14.7%) cancers.

Table 4: Gender wise percent distribution of cancer types among respondents

Diagnosis of Cancer	Gender		Total
	Female count (% within gender)	Male count (% within gender)	
Lung	1 (2.9%)	12 (18.2%)	13 (13%)
Oesophagus	2 (5.9%)	11 (16.7%)	12 (12%)
Breast	9 (26.5%)	1 (1.5%)	10 (10%)
Larynx	0	7 (10.6%)	7 (7%)
PFS (Progression free survival)	1 (2.9%)	6 (9.1%)	7 (7%)
Tongue	0	6 (9.1%)	6 (6%)
Pharynx	1 (2.9%)	5 (7.6%)	6 (6%)
Ovary	6 (17.7%)	0	6 (6%)
Gall Bladder	5 (14.7%)	1 (1.5%)	6 (6%)

Stomach	3 (8.8%)	1 (1.5%)	4 (4%)
Colon	1 (2.9%)	2 (3.0%)	3 (3%)
Bone marrow	3 (8.8%)	0	3 (3%)
Liver	0	2 (3.0%)	2 (2%)
Pancreas	0	2 (3.0%)	2 (2%)
NHL (non-Hodgkin's lymphoma)	1 (2.9%)	1 (1.5%)	2 (2%)
Sarcoma	0	1 (1.5%)	1 (1%)
Spindle Cell Tumour	0	1 (1.5%)	1 (1%)
Germ Cell Tumour	0	1 (1.5%)	1 (1%)
Tonsil	0	1 (1.5%)	1 (1%)
Multiple Myeloma	0	1 (1.5%)	1 (1%)
Periampullary	0	1 (1.5%)	1 (1%)
Rectum	0	1 (1.5%)	1 (1%)
Hard Palate	1 (2.9%)	0	1 (1%)
Alveoli	0	1 (1.5%)	1 (1%)
Lymphoma	0	1 (1.5%)	1 (1%)
Total	**34**	**66**	**100 (100%)**

Complications of the respondents related to treatment of cancer: As a part of the cancer treatment, both radiation therapy and chemotherapy is given to the patients depending on the stage of cancer. The health condition of the patient plays a crucial part in the treatment of cancer sufferers. In the present study, forty seven percent responders were receiving chemotherapy whereas rest were under both chemo and radiation therapy treatment. Highest number of patients receiving chemotherapy (47%) and radiation therapy (53%) were under 41-60 years of age. Several symptoms are also associated with the chemo treatment which ultimately complicates the situation and many patients could not be able to continue the treatments further for the same. The symptoms can be dry mouth, diarrhea, constipation, anorexia (loss of appetite), nausea, vomiting, sore mouth/throat, dysphagia (swallowing difficulties), feeling of fullness after eating a small portion of meal etc. Even the consistency of food needed to be altered for ease in swallowing of the informants. Chow *et al.* (2016) found that many patients require changes in food consistency (e. g., soft or pureed diets) due to dysphagia or sore mouth/throat, and only a minority of patients make significant dietary changes after starting chemotherapy. Table.5 shows that most of the repliers were suffering from loss of appetite i. e. Anorexia (71%) followed by at risk of malnutrition (62%), constipation (34%), nausea (22%) and vomiting (9%). Two percent of the patients had swallowing difficulties (dysphagia) and felt heavy after taking a small meal whereas rest did not face any such issues. Similar finding was reported Rosania *et al.* (2016), which stated that gastrointestinal symptoms such as anorexia (loss of appetite), constipation, nausea and vomiting are common among cancer patients undergoing chemotherapy, and these symptoms significantly contribute to malnutrition and treatment discontinuation. Similarly, Dewys *et al.* (1980) and Gupta *et al.* (2006) both highlight that chemotherapy frequently leads to symptoms such as anorexia, nausea, and vomiting, which are major contributors to malnutrition and poor treatment adherence. While most studies agree on the high prevalence of these symptoms, some research suggests that proactive nutritional intervention and early symptom management can reduce their severity and improve treatment adherence (Arends *et al*., 2017).

Only 6 numbers (2 females and 4 males) of the respondents had changed their food habit after chemotherapy. They started taking more of vegetarian foods and also changed the consistency of foods. Likewise, Ravasco (2019) observed that despite high rates of nutrition-impact symptoms, only a small proportion of patients proactively change their diet, often due to lack of counselling or awareness. Ottery (1995) emphasizes the importance of nutrition education and intervention to manage symptoms and prevent malnutrition during cancer treatment.

Table 5: Gender wise percent distribution of complications faced by patients after receiving chemotherapy

Complications	Presence/absence of symptoms	N (Total number of respondents)	Gender	
			Female (N (%))	Male (N (%))
At risk of malnutrition	Yes	62	22 (64.7)	40 (60.6)
	No	38	12 (35.3)	26 (39.4)
Malnourishment	Yes	30	8 (23.5)	22 (33.3)
	No	70	26 (76.5)	44 (66.7)
Dry mouth	Yes	5	0 (0)	5 (7.6)
	No	95	34 (100)	61 (92.4)
Diarrhea	Yes	9	2 (5.9)	7 (10.6)
	No	91	32 (94.1)	59 (89.4)
Constipation	Yes	34	8 (23.5)	26 (39.4)
	No	66	26 (76.5)	40 (60.6)
Anorexia	Yes	71	26 (76.5)	45 (68.2)
	No	29	8 (23.5)	21 (31.8)
Nausea	Yes	22	8 (23.5)	14 (21.2)
	No	78	26 (76.5)	52 (78.8)
Vomiting	Yes	9	5 (14.7)	4 (6.1)
	No	91	29 (85.3)	62 (93.9)
Sore mouth/throat	Yes	1	0 (0)	1 (1.5)
	No	99	34 (100)	65 (98.5)
Dysphagia	Yes	2	2 (5.9)	0 (0)
	No	98	32 (94.1)	66 (100)
Feeling of fullness after having a small meal	Yes	2	2 (5.9)	0 (0)
	No	98	32 (94.1)	66 (100)
Changes of food	Yes	6	2 (5.9)	4 (6.1)
	No	94	32 (94.1)	62 (93.9)

Fig.2 is showing a clear picture of percent distribution of various symptoms after chemotherapy treatment.

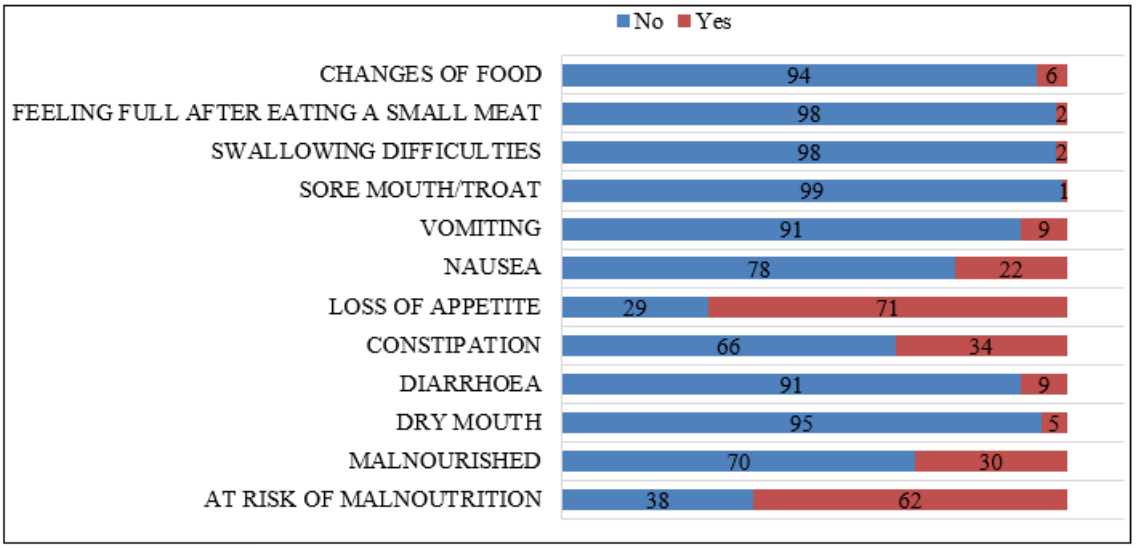

Figure 2: Percent distribution of symptoms after chemotherapy treatment

Comparison of various parameters of cancer patients with gender: The analysis of the association between age and gender among cancer patients was conducted using a chi-square test of independence. The resulting p-value of age with gender was 0.003, which is substantially lower than the conventional significance threshold of 0.05. This indicates that the null hypothesis—asserting no association between age and gender in this population—can be rejected. Thus, the observed distribution of age categories differs significantly by gender among cancer patients and this difference is unlikely to be attributable to random variation alone. This finding underscores the importance of considering both demographic variables when analysing cancer epidemiology. In support of this finding a pan-cancer analysis published in "Molecular Oncology" in the year 2022 found that gender remained a significant factor influencing cancer-specific survival even after adjusting for demographic, clinical and treatment factors. Female patients generally had better survival than males in most cancer types and the gender disparity was statistically significant (He *et al.,* 2022). Another study done in US population-level data found significant age and sex differences in cancer incidence and survival. For most cancer types and age groups, males had higher incidence and worse survival than females, with notable exceptions in certain age groups and cancer types. The study emphasizes the importance of considering both age and sex in cancer epidemiology and outcomes, and reports statistically significant differences ($p < 0.001$) in many comparisons (Selvaraj *et al.,* 2025).

A statistically significant association ($p < 0.001$) was observed between gender and occupation among cancer patients. The literature consistently demonstrates that cancer incidence and risk profiles vary not only by gender but also by occupational categories, with certain occupations conferring higher risks for one gender over the other. Studies have identified elevated risks for specific cancers among women in certain occupations, such as rubber workers (bladder cancer), carpenters (pleural cancer), construction workers (lung cancer), and bar staff (lung cancer) (Rix *et al.,* 1997; Carpenter and Roman, 1999). Professional women, including teachers, nurses, and clerks, also show higher incidences of breast and uterine cancers compared to other occupational groups (Rix *et al.,* 1997). On the other hand, males generally have a higher overall cancer incidence compared to females, particularly in older age groups and in occupations with high exposure to carcinogens (e. g., mining, metalworking, construction) (Sritharan *et al.,* 2023; Selvaraj *et al.,* 2025). However, some studies indicate that females in traditionally male-dominated, high-risk occupations (e. g. construction, transport, chemical processing etc.) may experience equal or even higher relative risks for certain cancers, such as lung cancer, compared to their male counterparts (Sritharan *et al.,* 2023). The significant p-value (<0.001) supports the assertion that gender and occupation interact to influence cancer risk profiles. These findings are corroborated by large-scale epidemiological studies, which highlight both biological and exposure-related factors contributing to these disparities.

The study showed a highly significant association ($p < 0.001$) was also observed between gender and marital status among cancer patients. Research consistently finds that marital status is an independent prognostic factor for cancer survival, with gender-specific effects. Married individuals, regardless of gender, experience better overall and cancer-specific survival compared to unmarried counterparts. The protective effect of marriage is attributed to psychosocial support, improved treatment adherence, and earlier stage at diagnosis (Zhu and Lei, 2023; Krajc *et al.,* 2023). The survival benefit of marriage is more pronounced in males than females. Unmarried men, including those who are widowed, divorced, or never married, have a significantly higher hazard of death and are more likely to present with late-stage disease compared to unmarried women (Simpson *et al.,* 2019; Krajc *et al.,* 2023). However, both genders benefit from being married, and the association remains significant after adjusting for confounders (Zhu and Lei, 2023; Krajc *et al.,* 2023).

The various symptoms of cancer patients undergoing treatment was also compared with the gender to find

relationship among male and female cancer patients using a chi-square test of independence. The analysis of gender and swelling difficulty yielded a p-value of 0.047, indicating a statistically significant association between gender and the presence of swallowing difficulties at the conventional alpha level of 0.05. This suggests that the prevalence of dysphagia differs between genders in the studied cancer patient cohort, and the observed difference is unlikely to be due to random chance. These findings are consistent with some published literature. A study by Son *et al.* (2015) found that gender was significantly related to aspiration incidence—a severe form of swallowing dysfunction—in tongue cancer patients, although this association was not observed across all head and neck cancer types. Other reviews highlight that swallowing dysfunction is a common and clinically relevant complication in cancer patients, with prevalence and severity potentially influenced by demographic factors, tumour site, and treatment modality (Raber-Durlacher *et al.,* 2012; Matko *et al.,* 2025). However, the literature also notes considerable heterogeneity in findings, and some studies have not found a consistent association between gender and swallowing difficulties across all cancer types (Raber-Durlacher *et al.,* 2012; Son *et al.,* 2015).

The association between gender and the symptom of early satiety (feeling full after eating a small meal) among cancer patients was evaluated using a chi-square test. The analysis yielded a p-value of 0.047, indicating a statistically significant association at the conventional alpha level of 0.05. This finding suggests that the prevalence of early satiety differs between male and female cancer patients in this cohort, and that this difference is unlikely to be due to random variation alone. Similarly, a population-based study by Arends *et al*. (2017) highlighted that gender can influence the manifestation and reporting of cancer-related symptoms such as appetite loss and early satiety, though the underlying mechanisms may be multifactorial.

A comparison of constipation prevalence among cancer patients by gender revealed a statistically significant association, with a p-value of 0.043. This indicates that the likelihood of constipation differs between male and female cancer patients at a level that is unlikely to be due to chance alone ($p < 0.05$). Research shows that constipation is common among cancer patients, with prevalence rates ranging from 31% to over 80%, depending on the population and treatment context (Lisboa *et al.,* 2021; Pehlivan and Nural, 2022). Studies have found that female patients, particularly those undergoing chemotherapy, are more likely to experience constipation compared to males (Lisboa *et al.,* 2021; Chen *et al.,* 2021). Some studies have identified gender as an independent risk factor for constipation, even after adjusting for other variables such as age, treatment type, and comorbidities (Chen *et al.,* 2021). However, Danish registry data linked constipation to short-term GI cancer risks (SIR = 5.0), particularly ovarian cancer (SIR = 7.3), but did not explicitly analyse gender differences (Sundboll *et al*., 2019). The marginal significance ($p = 0.043$) in your study aligns with weaker evidence for gender-specific constipation patterns in oncology.

A statistically significant association was observed between gender and cancer treatment modalities among patients ($p = 0.034$). This result indicates that the distribution or outcomes of cancer treatment differ between male and female patients to a degree unlikely to be due to chance alone. Recent research supports the finding that gender significantly influences cancer treatment outcomes and approaches. Numerous large-scale studies and meta-analyses have demonstrated that males and females often respond differently to various cancer therapies, including chemotherapy, immunotherapy and targeted treatments (Vera *et al.,* 2023). Some studies also report that males may experience fewer side effects from specific treatments, while females may have higher rates of certain toxicities (Rakshith *et al.,* 2023). A large-scale analyses of oncology clinical trials reveal that females often experience better survival outcomes and treatment responses compared to males. In a systematic review of 288 clinical trials with sex-specific outcome analyses, 42% reported significantly better survival or response for females, while only 16% favored males. The remaining trials found no significant difference. Notably, targeted therapies (such as EGFR inhibitors in non-small cell lung cancer and rituximab in non-Hodgkin's lymphoma) and chemotherapy regimens have shown more favorable results in females (Kammula *et al.,* 2024). The statistically significant difference ($p = 0.034$) observed between gender and cancer treatment in current study is strongly supported by current evidence. Multiple high-quality studies and meta-analyses confirm that gender influences both the efficacy and toxicity of cancer therapies, with a trend toward improved outcomes for females in many cancer types and treatment regimens (Vera *et al.,* 2023; Rakshith *et al.,* 2023; Kammula *et al.,* 2024).

However, not all studies have found consistent gender differences and some suggest that other factors, such as cancer type, stage and treatment regimen, may also play significant roles in symptom prevalence and severity.

4. Future Scope of Research

The present study opens several avenues for future research to further improve the nutritional management of cancer patients. Future research should focus on large-scale, multicentric studies across diverse populations to validate and expand upon these findings. Longitudinal studies are needed to assess the long-term impact of nutritional interventions on treatment outcomes and survival rates among cancer patients. Additionally, exploring the effectiveness of tailored nutrition education and counselling programmes for patients and their families could be valuable in preventing and managing malnutrition. Additionally, examining the benefits of early and routine nutritional screening at different stages of cancer treatment could yield valuable insights. Understanding the psychosocial factors that influence dietary habits and nutritional status in cancer patients remains an important area for exploration. Community-based awareness and prevention programmes addressing modifiable risk factors, such as tobacco use and unhealthy diets, also warrant further evaluation. Finally, the integration of multidisciplinary approaches—including the involvement of dietitians, psychologists and social workers—may offer a more holistic strategy for addressing malnutrition in comprehensive cancer care.

5. Limitations of the Study

- The study was conducted at a single tertiary cancer centre, which may limit the generalizability of the findings to other regions or populations.
- The sample size was relatively small (100 respondents), reducing the statistical power and representativeness of the results.
- Participants were selected based on their willingness to participate, introducing potential selection bias as those who declined may have different characteristics or nutritional statuses.
- The cross-sectional design only captures data at one point in time, making it impossible to assess changes over time or establish causal relationships between risk factors and malnutrition.
- Data were collected using a pre-tested interview schedule, relying on self-reported information, which may be subject to recall bias or social desirability bias.
- The study was conducted over a limited period of three months (July to October, 2024), which may not account for seasonal variations in dietary habits or nutritional status.
- The assessment of nutritional status was primarily based on BMI and questionnaire responses, lacking more comprehensive nutritional evaluation tools such as biochemical markers or detailed dietary intake analysis.
- The study did not include a control group (such as non-cancer patients or cancer patients not receiving chemotherapy), which limits the ability to attribute findings specifically to the cancer treatment or disease status.
- Other potentially influential factors, such as psychological status, detailed socioeconomic variables, or comorbidities, were not explored in depth.

6. Conclusion

This study highlights a high prevalence of malnutrition and risk of malnutrition among cancer patients receiving chemotherapy at a tertiary care centre in Assam. The findings reveal that undernutrition and its associated complications are common, particularly among those with low socioeconomic status, poor dietary habits and addictive behaviors such as tobacco use. The study underscores the critical need for early nutritional assessment and intervention as an integral part of cancer management. Addressing malnutrition can improve treatment outcomes, reduce complications, and enhance the overall quality of life for cancer patients. Furthermore, the results emphasize the importance of adopting preventive strategies, including healthy lifestyle choices and dietary patterns, to reduce the risk of cancer and its adverse effects.

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