



# Relationship between Cancer Treatment Nutrition Related Side Effects and Nutrition Status among Adult Cancer Patients: A Case of Texas Cancer Center, Kenya

Elizabeth Oduor <sup>a\*</sup>, Alfred Owino Odongo <sup>a</sup>, Willy Kiboi <sup>b</sup>  
and Anselimo Makokha <sup>c</sup>

<sup>a</sup> Mount Kenya University, Kenya.

<sup>b</sup> Chuka University, Kenya.

<sup>c</sup> Jomo Kenyatta University of Agriculture and Technology, Kenya.

## **Authors' contributions**

*This work was carried out in collaboration among all authors. Author EO conceived and designed the study, data collection, data analyses and writing the manuscript. All authors read and approved the final manuscript.*

## **Article Information**

### **Open Peer Review History:**

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/120731>

**Original Research Article**

**Received: 02/06/2024**

**Accepted: 05/08/2024**

**Published: 09/08/2024**

## **ABSTRACT**

**Background:** Advancements in research and technology have expanded the array of available cancer treatment options. Nonetheless, these treatments may adversely impact the overall health of patients. The specific influence of each treatment option or their combined effects on cancer patients remains unclear in Kenya. Each person's medical history, diagnosis, and response to

\*Corresponding author: E-mail: [lizleahmuruka24@gmail.com](mailto:lizleahmuruka24@gmail.com);

treatment are unique; so, are they. There may be severe, minor, or no side effects. Various nutrition-related side effects of cancer are experienced by these patients, and they include diarrhea, vomiting, altered taste and odor, discomfort when eating, nausea, and appetite loss. These eventually influence the nutritional status and quality of life of these patients. Among the adverse effects of cancer treatment are dry mouth, vomiting, diarrhea, nausea, loss of appetite, fatigue, and constipation.

**Methods:** Employing an analytical cross-sectional study design, the research involved 384 participants selected through systematic sampling. Data collection utilized semi-structured questionnaires to obtain data on cancer treatment nutrition-related side effects. Quantitative data analysis was conducted using STATA version 17, incorporating descriptive statistics such as mean, mode, and percentages. Logistics regression (Crude odds ratio- COR) was done to explore any existing significant relationship between cancer treatment nutrition-related side effects and nutrition status, whereby a p-value of less than 0.05 depicted the existence of a significant association at a confidence interval of 95%.

**Results:** The study identified a prevalence of 34% (n=129) for nutrition-related side effects among the 384 respondents. Among these side effects, decreased appetite was the most prevalent main symptom (n=49, 38%), while nausea was the least experienced main symptom (n=14, 11%). A significant relationship (p=0.002) was established between nutrition-related side effects of cancer treatment and the nutrition status of the study respondents (COR=1.33; 95% CI=0.50,3.57).

**Conclusion:** Prompt management of nutrition-related side effects of cancer treatment is crucial to ensure optimal treatment outcomes and enhance the overall quality of life for cancer patients.

*Keywords: Cancer; patient; diarrhea; vomiting; radiotherapy; chemotherapy; immunotherapy.*

## 1. INTRODUCTION

Cancer can originate from any part of the body, and when abnormal cells proliferate uncontrollably, they disrupt the normal functioning of cells, impairing the body's optimal function [1]. Globally, cancer stands as the leading cause of death, claiming 10 million lives annually, with one in six deaths attributed to cancer [2]. In 2020, there were 18.1 million cancer cases worldwide, with 9.3 million occurring in men and 8.8 million in women. Africa reported 1.1 million new cancer cases and 711,429 cancer-related deaths, with a prevalence of 2.2 million cases. In Kenya, the cancer incidence rate is 47,887, resulting in 32,987 cancer-related deaths [2]. Cancer encompasses around 100 types, named after the tissue or organ of origin or based on the cells forming them [3].

Treatment options for cancer, including surgery, radiotherapy, chemotherapy, immunotherapy, targeted therapy, hormone therapy, and stem cell transplant, vary depending on the cancer stage and type [4]. These treatments, along with cancer itself, can induce both short-term and long-term side effects affecting the nutritional status of cancer patients. Side effects may include weight gain, weight loss, anemia, loss of appetite, fatigue, hair loss, and diarrhea, among others [5]. Consequently, cancer patients are

among the most undernourished populations. Changes in appetite signals may lead to appetite loss in cancer patients [6]. Body composition assessment can detect malnutrition, with a significant percentage of cancer patients exhibiting minimal lean body mass, indicative of malnutrition. Considering the limited information on cancer treatment-related variables, this study aimed to evaluate the prevalence of cancer treatment-related nutrition side effects of adult cancer patients attending the Texas Cancer Center.

## 2. METHODS

### 2.1 Study Site

The research was conducted at the Texas Cancer Center, chosen based on the study population's characteristics and objectives. Located in Nairobi County on Mbagathi Way, Nairobi West, the facility offers comprehensive cancer services, and it boasts a multidisciplinary team providing holistic patient care.

### 2.2 Research Design

An analytical cross-sectional study design was employed to explore the prevalence of nutrition-related side effects of cancer treatment in cancer patients.

### 2.3 Target Population

The target population comprised cancer patients, while the accessible population was adults (aged 18 and above) with stage I, II, III, and IV cancer, seeking treatment at the Texas Cancer Center. This sample aimed to assess nutrition-related side effects of patients undergoing cancer treatment.

**Inclusion Criteria:** All adult outpatients and inpatients diagnosed with cancer at the Texas Cancer Center who consented to participate were included in the study.

**Exclusion Criteria:** Critically ill patients and those meeting the inclusion criteria but unable to participate due to other commitments were excluded from the study.

### 2.4 Sample Size

The sample size was determined using Cochran's formula for an infinite population, resulting in 384 participants. Purposive sampling was used to select the study site, while systematic random sampling was employed to select participants based on a predetermined interval of every 2 participants. This was established following the number of patients who attend Texas Cancer Center monthly (900 patients), the number of patients who visit the facility daily (30 patients), and the expected duration of data collection (30 days).

### 2.5 Data Collection Instruments

Data collection utilized a semi-structured questionnaire to collect data on the main nutrition-related side effects of cancer treatment among cancer patients.

### 2.6 Data Collection Procedures

The participants were asked if they had experienced any side effects that may have affected their food intake and practices since the start of treatment. The side effects that were assessed were reduced appetite, vomiting, diarrhea, and nausea. The duration of when the participant experienced these nutrition-related side effects, and where they sought treatment if they did was also captured.

### 2.7 Validity and Reliability of Data Collection Tools

Data collection tools were pre-tested and validated by a panel of experts, while reliability was assessed through the test-retest method.

### 2.8 Data Analysis and Presentation

The questionnaires were reviewed to assess if the nutrition-related side effects data was well completed (reduced appetite, nausea, diarrhea, and vomiting). Data analysis involved descriptive statistics, using STATA version 17. Findings were presented through tables and graphs.

## 3. RESULTS

### 3.1 The Response Rate of the Respondents

This study obtained a complete response from all expected participants, amounting to 384 individuals, representing a 100% response rate. This met the minimum sample size requirement without requiring adjustments to compensate for non-responses.

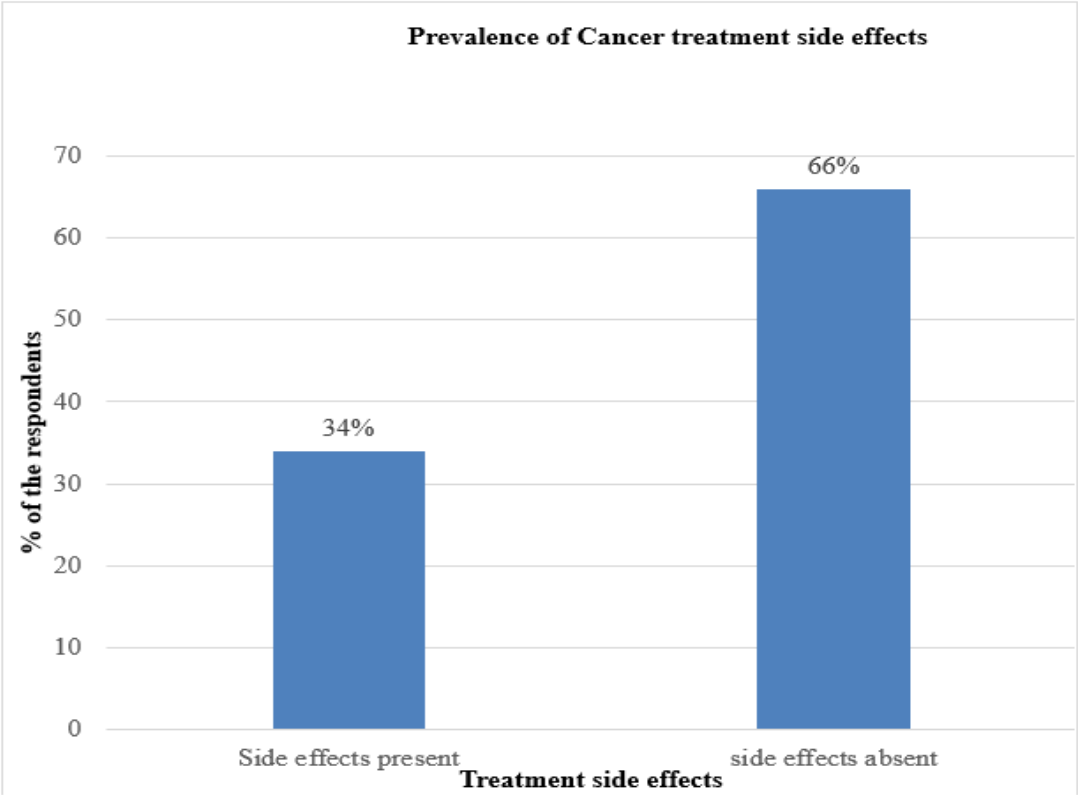
### 3.2 Prevalence of Cancer Treatment Nutrition-Related Side Effects of the Respondents

Of the 384 respondents who participated in the study, a third of them 34% (n=129) experienced nutrition-related side effects following the start of cancer treatment. Among this group of respondents, 68 (53%) received treatment at Texas Cancer Centre, 60 (47%) participants sought treatment from public health facilities, whereas only 1 of the participants did not seek treatment after experiencing nutrition-related side effects of cancer treatment. Reduced appetite was the most common of the main symptoms as it was experienced by 38% (n=49). The least experienced side effect of cancer treatment was nausea which accounted for 11% (n=14) of the study population.

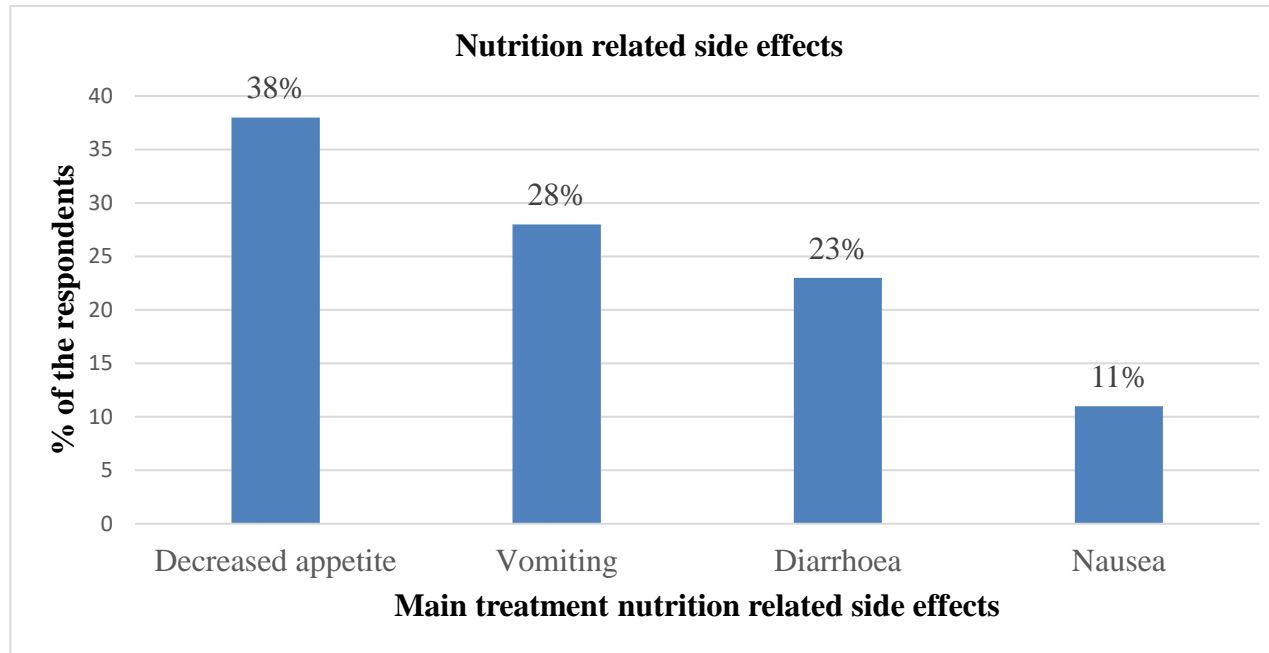
The main side effects of the respondents were further classified into decreased appetite, vomiting, diarrhea, and nausea as shown in Fig. 2.

### 3.3 Nutrition Status of the Respondents

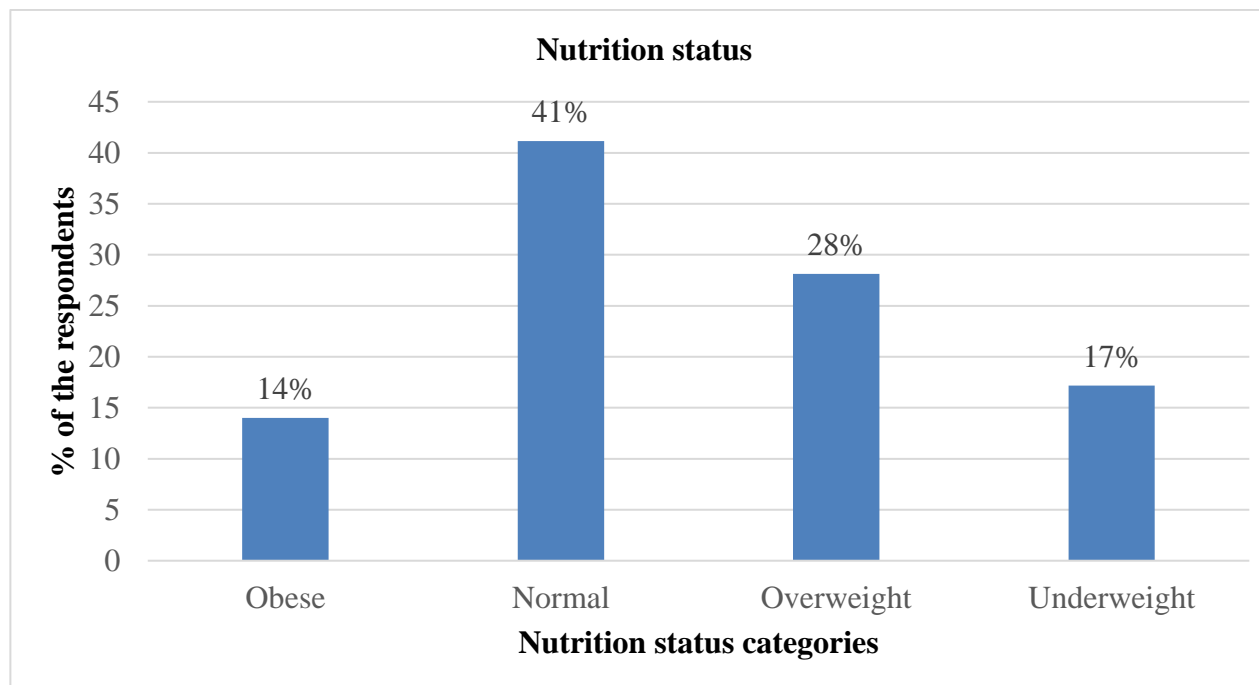
More than half the respondents 59% (n=227) were malnourished, with a significant proportion of this 28% (n= 108) being overweight. An average BMI of 25.0kg/m<sup>2</sup> ± 4.25SD was established.



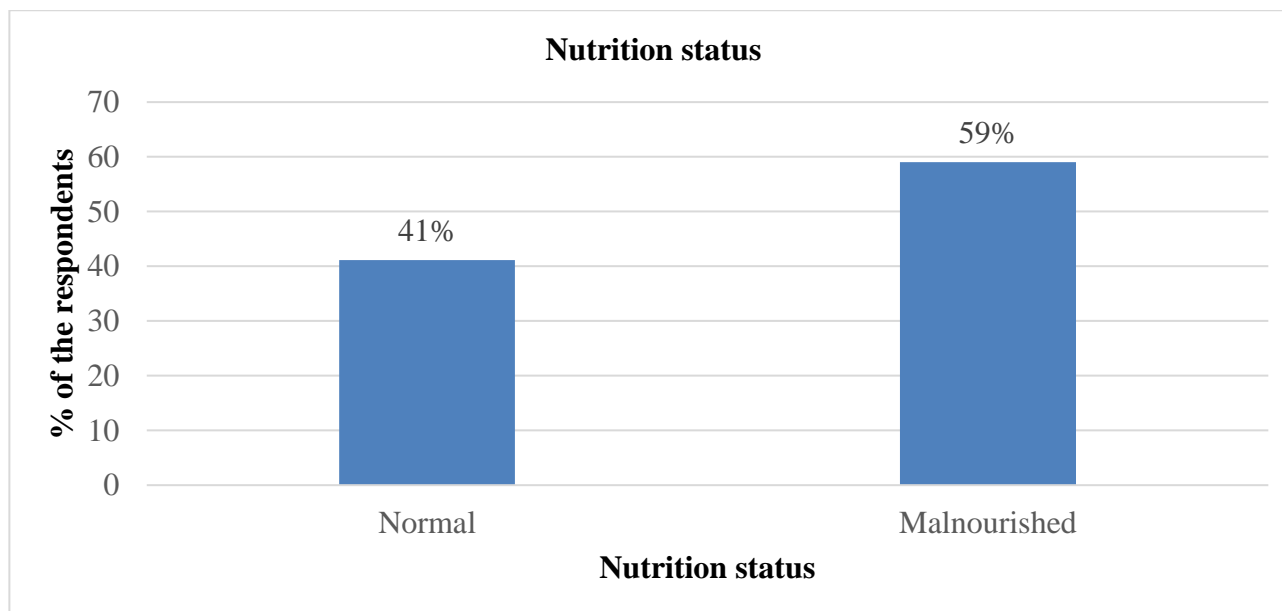
**Fig. 1. Nutrition-related side effects of cancer treatment**



**Fig. 2. Prevalence of main treatment nutrition-related side effects of the respondents**



**Fig. 3. Nutrition status categories of the respondents**



**Fig. 4. Nutrition status of the respondents**

**Table 1. Relationship between nutrition status and nutrition-related side effects of cancer treatment**

Variables	Malnutrition		COR(95 % CI)	P value
	Yes	No		
<b>Main Treatment side effects</b>				
Reduced appetite	137	14	1.00	
Vomiting	68	121	1.20(0.48,3.03)	0.696
Diarrhea	17	13	1.33(0.50,3.57)	0.002
Nausea	5	9	0.93(0.30,2.86)	0.903

In broader classifications, of the 384 study participants, 41% (n=157) of the participants had a normal nutrition status while 59% (n=227) of the participants were malnourished (Fig. 4).

### 3.4 Relationship between Nutrition Status and Cancer Treatment Nutrition-Related Side Effects

A significant relationship (p=0.002) was obtained between diarrhea and the nutrition status of the study respondents (COR=1.33; 95% CI=0.50,3.57).

Reduced appetite has no p-value (as guided by Dr David) because this was the reference point hence cannot have a p-value.

## 4. DISCUSSION

### 4.1 Prevalence of Cancer Treatment Nutrition-Related Side Effects of the Respondents

The results of this study depicted a lower prevalence rate of nutrition-related side effects of cancer treatment in comparison to the pooled prevalence rate obtained by Agbejule in 2021, which showed that, despite the prevalence of nutrition-related side effects of cancer varying between 14% to 100%, the average pool was around 52% among cancer patients in Nigeria. This study's rate was also lower when compared to Kawakita et al. [7] study that found the prevalence of nutrition-related side effects being 53.1% following a total dose of opioid prescribed and taken during cancer treatment. Moreover, in another study done among three hundred and sixty-nine respondents, the prevalence of self-reported oral side effects of cancer treatment was 89.70% [8]. The high prevalence rates reported by Wong could have been attributed to the fact that oral side effects cover a multitude of side effects inclusive of those that are nutrition-related. The high rates could also have been a

result of the study population not being knowledgeable of the side effects that could be classified as oral, thus reporting additional side effects as well, since the data collection technique was through self-report. In a study done using 98 respondents receiving chemotherapy, 41% reported at least mild anticipatory nausea, while for 24% this was a moderate to severe problem [9]. In a study by Persson et al. [10]. 71% of the study population who were undergoing chemotherapy experienced vomiting. These side effects among the study participants could be attributed to the rapidly dividing cells in the digestive system, including the cells in the lining of the stomach and intestines, which results in nausea, vomiting, diarrhea, and loss of appetite. Worsening disease prognosis and disease progression also compromise the food intake thus leading to more nutritional complications [11].

Decreased appetite could be a more common main symptom than nausea in this study due to cancer affecting the body's metabolism and appetite-regulating mechanisms, leading to a decreased desire to eat. Additionally, cancer treatments such as chemotherapy and radiation therapy can cause gastrointestinal side effects like nausea, vomiting, and changes in taste perception, which can further contribute to decreased appetite. However, nausea may be managed more effectively with anti-nausea medications, whereas addressing decreased appetite can be more challenging as it involves addressing the underlying causes and may require multiple approaches including dietary modifications, nutritional support, and supportive care interventions. Moreover, psychological factors such as anxiety, depression, and the emotional burden of a cancer diagnosis can also impact appetite [12]. This study depicts the possibility of having lower prevalence rates of nutrition-related side effects among cancer patients receiving treatment. This could be a result of the early introduction of antiemetics to



prevent the worsening of some of the nutrition-related side effects such as vomiting. Seeking treatment on the onset of these side effects could therefore be a good precautionary measure.

#### **4.2 Relationship between Nutrition Status and Cancer Treatment Nutrition-Related Side Effects**

Logistics regression established that cancer treatment nutrition-related side effects had a significant relationship ( $p=0.002$ ) with the nutrition status of the study respondents ( $COR=1.33$ ;  $95\% CI=0.50,3.57$ ). Similarly, Wei et al. [13] found that most cancer patients experienced colitis and diarrhea as a result of being on cancer treatment. These effects began six weeks after the commencement of treatment and continued up until four months following the end of treatment [13-15]. This eventually contributed to poorer nutrition status among the respondents of that study. Moreover, in a study carried out in 2018 by Brown et al, nutrition-related side effects like vomiting and diarrhea in cancer patients stemmed from the inflammatory state of the body that subsequently led to weight loss. In a study by Mattox [16-18], he emphasizes the importance of nutrition assessment before the start of treatment in cancer patients to prevent the decline in quality of life, which results from malnutrition which could have been preventable. However, these results differed from those obtained by Marx et al. [19,20] in a study to determine the association between nutrition status and chemotherapy-induced nutrition adverse events among gastric cancer patients where he found that there was no association between these two variables.

Nutrition-related side effects of cancer represent a significant challenge for cancer patients, arising from both the aggressive nature of treatments like chemotherapy, radiation therapy, and surgery and the metabolic alterations induced by the disease itself [21]. These side effects encompass a spectrum of symptoms that profoundly affect patients' ability to maintain adequate nutrition and overall well-being. Loss of appetite, a common occurrence among cancer patients, can result in decreased food intake and nutrient deficiencies. Similarly, taste changes, often described as metallic or bitter sensations, can diminish the pleasure of eating and further reduce dietary diversity. Nausea and vomiting, prevalent side effects of chemotherapy, can disrupt meal consumption and lead to malnutrition if not managed effectively. Mouth

sores and difficulty swallowing, frequently encountered with head and neck cancers or as a consequence of radiation therapy, present formidable barriers to adequate nutrition, causing pain and discomfort during eating. Gastrointestinal disturbances such as diarrhea or constipation can impair nutrient absorption and exacerbate nutritional deficits [22, 23]. Moreover, cancer-related fatigue, a pervasive symptom experienced by many patients, can sap energy levels and diminish the motivation to prepare and consume meals, contributing to malnutrition risk. By addressing these challenges through a combination of dietary counselling, symptom management strategies, nutritional supplementation, and psychosocial support, healthcare providers can strive to mitigate malnutrition risk, optimize treatment outcomes, and improve the quality of life for individuals navigating the complex terrain of cancer therapy.

This relationship was adjusted against the economic and sociodemographic factors.

## **5. CONCLUSIONS AND RECOMMENDATIONS**

### **5.1 Conclusion**

The prevalence of nutrition-related side effects was 34% among the study participants, with decreased appetite being the most common main symptom. A significant relationship was also established between nutrition related side effects of cancer treatment and nutrition status.

### **5.2 Recommendations**

Investigating drug-nutrient interactions is essential to understand how cancer treatment drugs affect nutrition status. Interventional studies are needed to gauge the effectiveness of weekly nutritional assessments in identifying patients at risk of malnutrition. Moreover, assessing healthcare professionals' knowledge regarding nutritional deficiencies and basic nutrition assessment of cancer patients warrants further research.

## **DISCLAIMER (ARTIFICIAL INTELLIGENCE)**

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

## CONSENT AND ETHICAL APPROVAL

Ethical approval was obtained from the Mount Kenya Institutional, Scientific, and Ethical Review Committee (MKU/ISERC/2685), and permissions were sought from the Texas Cancer Center and NACOSTI (Reference number: 247263). Informed consent was obtained from participants, confidentiality was maintained, and participants had the right to withdraw from the study. The research adhered to ethical guidelines.

## ACKNOWLEDGEMENT

I would like to acknowledge my family for their great support. I wish to thank my supervisors Dr. Alfred Owino Odongo and Dr. Willy Kiboi for their valuable input and guidance on this research thesis. I would also like to thank the study participants and the management at Texas Cancer Center for allowing me to carry out this study in the facility. Special appreciation goes to my parents (Mr & Mrs Oduor), siblings (Fredrick, Victor, Loreto, and Jenipher), Niece (Nia Keira) and husband Engineer Collins Pepelah for all his unwavering moral support and understanding during my study period. Above all, I am grateful to the almighty God.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. American Cancer Society. (2015, December 8). from What Is Cancer: Available:<https://www.cancer.org/cancer/cancer-basics/what-is-cancer.html> Accessed on: October 14, 2017,
2. WHO. International Agency for Research on Cancer; 2020.
3. National Cancer Institute. Understanding Cancer; 2015. Accessed on: October 17, 2017, Available:<http://www.cancer.gov/about-cancer/understanding>
4. National Cancer Institute. Types of Cancer Treatment: 2017. Accessed on: October 14, 2017. Available:<https://www.cancer.gov/about-cancer/treatment/types>
5. Cancer Reaserch UK. Hormone Therapy: 2017. Accessed on: October 17, 2017. Available:[www.cancerresearchuk.org/about-cancer/cancer-in-general/treatment/hormone-therapy](http://www.cancerresearchuk.org/about-cancer/cancer-in-general/treatment/hormone-therapy)
6. Maasberg S, Knappe-Drzikova B, Vonderbeck D, Jann H, Weylandt KH, Grieser C, Pascher A, Schefold JC, Pavel M, Wiedenmann B, Sturm A, Pape UF. Malnutrition predicts clinical outcome in patients with neuroendocrine neoplasias. *Neuroendocrinology*. 2017;104:11–25
7. Kawakita D, Hyland AJ, Murphy G, Pinto L, Peres LC, Wallace L, Olshan AF. Smokeless tobacco use and the risk of head and neck cancer: pooled analysis of US studies in the Inhance consortium. *American Journal of Epidemiology*. 2016;184(10):703-716.
8. Wong HM. Oral complications and management strategies for patients undergoing cancer therapy. *Sci World J*; 2014. Available:<https://doi.org/10.1155/2014/581795>
9. Gupta D, Lis CG. Pretreatment serum albumin as a predictor of cancer survival: a systematic review of the epidemiological literature. *Nutrition Journal*. 2017;16(1):60
10. Persson C, Glimelius B. The relevance of weight loss for survival and quality of life in patients with advanced gastrointestinal cancer treated with palliative chemotherapy. *Anticancer research*. 2002; 22(6B):3661-3668
11. Zaloga GP, Parenter Enteral Nutr. 2018 ;42(2):296-307. DOI: 10.1177/0148607116676593 Epub 2017 Dec 20.
12. Tubert J, Packel L, Hunter LA, Mfaume R, Njau P, Ramadhani AA, Liu JX, McCoy SI. *AIDS Res Ther*. 2021;18(1):21. DOI: 10.1186/s12981-021-00343-1 PMID: 33902623
13. Wei D, Heus P, van de Wetering FT, et al. Probiotics for the prevention or treatment of chemotherapy- or radiotherapy-related diarrhoea in people with cancer. *Cochrane Database Syst Rev*. 2018;8:CD008831
14. Agbejule OA, Hart NH, Ekberg S, Koczwara B, Ladwa R, Simonsen C. Bridging the research to practice gap: A systematic scoping review of implementation of interventions for cancer-related fatigue management.

- BMC Cancer. 2021;21 (Erratum in: BMC Cancer. 2021;21(1):882. PMID: 34261438; PMCID:PMC8278687): 809. Available:<https://doi.org/10.1186/s12885-021-08394-3>
15. Apprey C, Annan RA, Arthur FKN., Boateng SK, Animah, K. The assessment and prediction of malnutrition in children suffering from cancer in Ghana. *European Journal of Experimental Biology*. 2014;4 (4), 31-37
  16. Mattox TW, Cancer Cachexia: Cause, Diagnosis, and Treatment. *Nutr. Clin. Pract*. 2017;32:599–606.
  17. Brown JC, Caan BJ, Meyerhardt JA, Weltzien E, Xiao J, Feliciano EMC, Kroenke CH, Castillo A, Kwan ML, Prado CM. The deterioration of muscle mass and radiodensity is prognostic of poor survival in stage I–III colorectal cancer: A population-based cohort study (C-SCANS). *J. Cachex Sarcopenia Muscle*. 2018;9:664–672.
  18. Hijiya N, Panetta JC, Zhou Y, Kyzer EP, Howard SC, Jeha S, Relling MV. Body mass index does not influence pharmacokinetics or outcome of treatment in children with acute lymphoblastic leukemia. *Blood*. 2015;108 (13):3997-4002. DOI:10.1182/blood-2006-05-024414
  19. Marx W, Kiss N, McCarthy AL, McKavanagh D, Isenring L. Chemotherapy-induced nausea and vomiting: a narrative review to inform dietetics practice. *J Acad Nutr Diet*. 2016;116(5):819-27
  20. Maciel BJ, Pedrosa F, Coelho CP. Nutritional status and adequacy of enteral nutrition in pediatric cancer patients at a reference center in northeastern Brazil *Nutricionhospitalaria*. 2012;27(4):1099-105. DOI: 10.3305/nh.2012.27.4.5869
  21. Pedrazzoli P, Lasagna A, Corbella M, Bruno R. *Future Oncol*. 2021;17(2):123-126. DOI: 10.2217/fon-2020-0764. Epub 2020 Nov 27. PMID: 3324498
  22. Marissa J, Wigmore SJ, Plester CE, Ross JA, Fearon KCH, Wigmore S. Contribution of anorexia and hypermetabolism to weight loss in anicteric patients with pancreatic cancer. *BJS*. 2015;84:196–197
  23. Muscaritoli M, Lucia S, Farcomeni A, Lorusso V, Saracino V, Barone C, Plastino F, Gori S, Magarotto R, Carteni G, Chiurazzi B, Pavese I, Marchetti L, Zagonel V, Bergo E, Tonini G, Imperatori M, Iacono C, Maiorana L, Pinto C, Rubino D, Cavanna L, Di Cicilia R, Gamucci T, Quadrini S, Palazzo S, Minardi S, Merlano M, Colucci G, Marchetti P; PreMiO Study Group. *Oncotarget*. 2017;8(45):79884-79896. DOI:10.18632/oncotarget.20168 eCollection 2017 Oct 3. PMID: 29108370

**Disclaimer/Publisher's Note:** The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of the publisher and/or the editor(s). This publisher and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.

© Copyright (2024): Author(s). The licensee is the journal publisher. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

*Peer-review history:*

*The peer review history for this paper can be accessed here:*  
<https://www.sdiarticle5.com/review-history/120731>